ANATOMY

NEET PG - 2018

Handwritten Note

MBBS HELP

http://mbbshelp.com

WhatsApp: +1 (402) 235-1397

Name: _____

Subject: Anatomy

This page left intentionally

ANATOMY

SUPERIOR EXTREMITY

The Pectoral Region

Pectoralis Major

Origin ⇒ Medial 2/3rd of the clavicle;
Manubrium & Body of sternum;
2nd – 6th costal cartilage;
External oblique aponeurosis;

Insertion ⇒ Lateral lip of Bicipital groove of Humerus

Action ⇒ Adduction
Flexion
Medial Rotation of the shoulder joint

N. Supply ⇒ Medial & Lateral Pectoral Nerve (Composite / Hybrid Muc

Blood supply ⇒ Superior thoracic A.
Lateral thoracic A.
Thoracoacromial A.
} → Branches of Axillary A.
Perforating branches of Internal thoracic A
Anterior Intercostal A.

Cruciate Muscle
⇓
Muscle fibre cross in letter "X"
eg ⇒ Pectoralis Major;
Sternocleidomastoid;
Masseter.

Q. M/c muscle to be congenitally absent
⇓
Pectoralis Major (Poland Syndrome)
(Sternocostal part).

eg ⇒ Pectoralis Major
Flexor Pollicis Brevis → Superficial head
↳ supplied
→ Deep head Medi
↳ supplied by deep br of ulnar
Flexor digitorum profundus
Brachialis

http://mbbshelp.com whatsApp +1(402) 235-1397

Lesser tubercle of Humerus ⇒ "Subscapularis" Muscle attaches

⇓

Medial Rotation @ Shoulder joint

Greater tubercle of Humerus ⇒

① Supraspinatus ⇒ Abduction (0° to 15°)

② Infraspinatus ⇒ } Lateral Rotation

③ Teres Minor ⇒ }

④ Coracohumeral Ligament

QQ

Forgotten Muscle of Rotator cuff ⇒ Subscapularis

Lateral lip of Bicipital groove ⇒ Pectoralis Major

Medial lip of Bicipital groove ⇒ Teres Major Attaches

Floor of
In the V Bicipital groove ⇒ · Latissimus dorsi

· Long head of biceps brachii & the synovial sheath of shoulder joint

· Ascending branch of Anterior circumflex humeral artery

Rotator cuff ⇒ Subscapularis

Infraspinatus

Teres Minor

Supraspinatus (M/C muscle to be damaged in Rotator cuff)

http://mbbshelp.com WhatsApp +1 (402) 235-1397

DELTOID

- Anterior fibres / Clavicular fibres ⇓ Flexion & Medial Rotation @ shoulder joint
- Acromian fibres / Middle fibres ⇓ Abduction from 15-90°
- Posterior fibres ⇓ Extension & Lateral Rotation @ shoulder joint

- Axillary Nerve Supplies — Deltoid
  Teres Minor
  - gives some cutaneous branch
    Upper Lateral cutaneous N. of Arm
    ↳ "Regimen batch sign"

Abduction @ shoulder joint

0°-15° / initiation of Abduction ⇒ Supra spinatus
15°-90° ⇒ Acromial fibres of deltoid
90° or above / overhead Abduction ⇒ Serratus Anterior
Trapezius (Lower fibres)
Lateral Rotation of Scapula

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

SERRATUS ANTERIOR (Boxer Muscle)

Origin – Arises from the Lateral aspect of upper 8 Ribs as digitation.

Insertion – Costal aspect Medial border of the Scapula

Action – ~~Protraction of Scapula~~
↳ it Means "Abduction"

N. Supply – ~~Long Thoracic Nerve~~ / N. to Serratus Anterior

Q. ~~Winging of Scapula~~ is d/t Palalysis of :⇒

Serratus Anterior (on attempting Movement)
Trapezius (@ Rest)

Q. ~~Retraction of Scapula~~ is done by :⇒

Rhomboides Minor
Rhomboides Major
Middle fibres of Trapezius.

(a, b, c) Q. True about Abduction @ shoulder joint –

a. Musculotendinous cuff Stabilizes Shoulder joint
b. Supraspinatus Initiates Abduction
c. Serratus Anterior & Trapezius also help in Abduction
d. Multipennate deltoid clavicular fiber is Main Abductor
e. Axillary N. injury that No effect on Abduction

http://mbbshelp.com +1 (402) 235-1397

Structure lying in Delto-pectoral groove

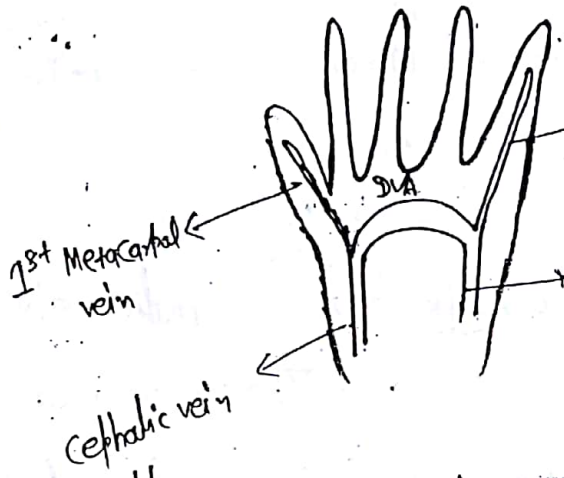
⇓

Cephalic vein

Structure lying in the ilio-psoas groove ⇒ Femoral Nerve

Structure lying in the Tracheo-esophageal groove ⇒ Recurrent Laryngeal Nerve

Cephalic vein



DVA ⇒ Dorsal venous Ar.

⇓

Formed by joining of Lateral end of dorsal venous arch with the 1st Metacarpal vein

- Lies in the Roof of Anatomical Snuff box.
- Lies in delto-pectoral groove
- Pierces the clavi-pe
- Drains into the Axill

Basilic vein

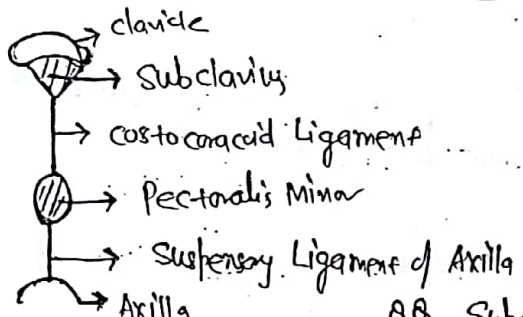
- Formed by joining of Medial end of dorso-venous arch & the 5th Metacarpal vein.
- It join & Vene comitans (of a vein) around the brachial artery & form axillary vein.

http://mbbshelp.com

V.V.Q. Clavi-pectoral fascia

- begins from the clavicle & inserted into the Axilla;
- encloses 2 Muscle — Subclavius
  Pectoralis Minor
- Part of fascia b/w Subclavius & Pectoralis Minor is klas "Costo-coracoid Ligament";
- Part b/w Pectoralis the axilla is klas "Suspensory Ligament o
- derived from "costocoracoid Ligament"

Structure piercing the clavi-pectoral fascia ⇒ • Cephalic vein
• Thoraco-acromial Artery
• Lateral Pectoral Nerve
• Lymphatics from breast



QQ Subclavius protects underlying brachial plexus & subclavian vessels from a broken clavicle

Coraco-clavicular Ligament ⇒ two parts

conoid (Medial) — trapezoid (Lateral)

The weight of upper limb is transmitted to the medial 2/3rd of the clavicle & then to the axial skeleton through coraco-clavicular Ligament.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

THE AXILLA

Boundaries ⇒

Anterior wall

- Pectoralis Major
- Pectoralis Minor
- Subclavius

Posterior wall

- Subscapularis
- Teres Major
- Latissimus dorsi (causes extension, Adduction & Medial Rotation @ the Shoulder joint)
  - also k/as "Climber's Muscle"

Medial wall

- Ribs
- Serratus Anterior

Lateral wall

- Humerus
- Coracobrachialis

Apex of A

- Anteriorly
  - ↳ clavicle
- Medial
  - ↳ Outer border of 1st Rib

-axillary canal

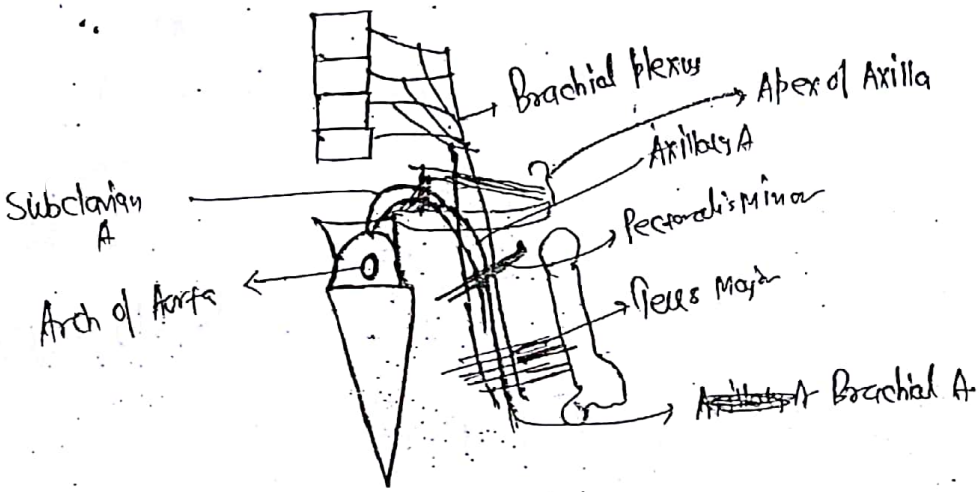
- Posteriorly
  - ↳ Scapula (Subs... bord...

* Axillary A. is divided into 3 parts by ⇒ Pectoralis Minor Muscle

Subclavian A. is divided into 3 parts by ⇒ Scalenus Anterior Muscle

Maxillary A. is divided into 3 parts by ⇒ Lateral Pterygoid Muscle

Lingual A. is divided into 3 parts by ⇒ Hyoglossus Muscle



Axillary Artery

Continuation of the Subclavian Artery at outer border of the 1st Rib

Continues as Brachial Artery below the lower border of Teres Major.

- divided into 3 parts by Pectoralis Minor
- Branches ⇒ 1st part ⇒ Superior thoracic A.
  - 2nd part ⇒ Lateral thoracic A. (Chief A. supplying the breast)
  - Thoracoacromial A.

http://mbbshelp.com WhatsApp +1 (402) 235-1397

3rd Part ⇒ Anterior circumflex Humeral A. } Both, form Anastomosis around surgical Neck
Posterior circumflex Humeral A. }

Subscapular A. (6)

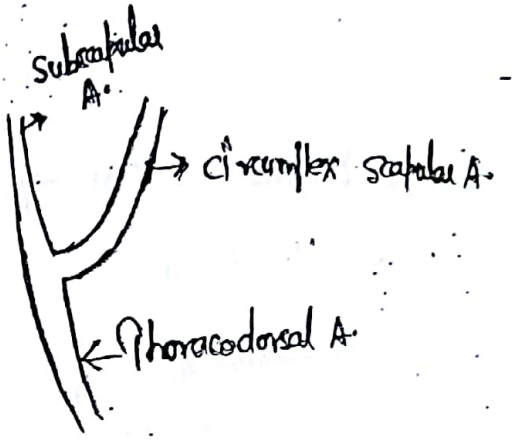
⇓

It gives branches

↙

Circumflex scapular A.

↳ Passes through upper A. Space & takes part in Anastomosis on the dorsal aspect of Scapula.



Continuation of Subscapular A. ⇒ Thoracodorsal A.

⇓

Accompanies the thoracodorsal N. / N. to Latissimus dorsi

Anastomosis on the dorsal Aspect of Scapula.

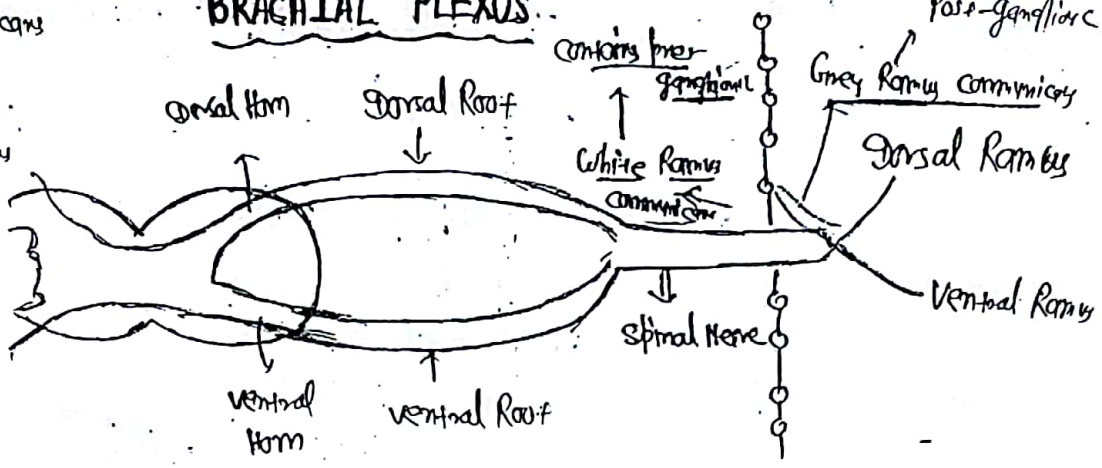
Subclavian
⇓
1st Part
↙ ↘
Suprascapular A. | Deep branch of Transverse cervical A.

Axillary
⇓
IIIrd Part
⇓
Subscapular | Circumflex scapular

White Ramus communicans
⇓
⊕ In T_1-L_2

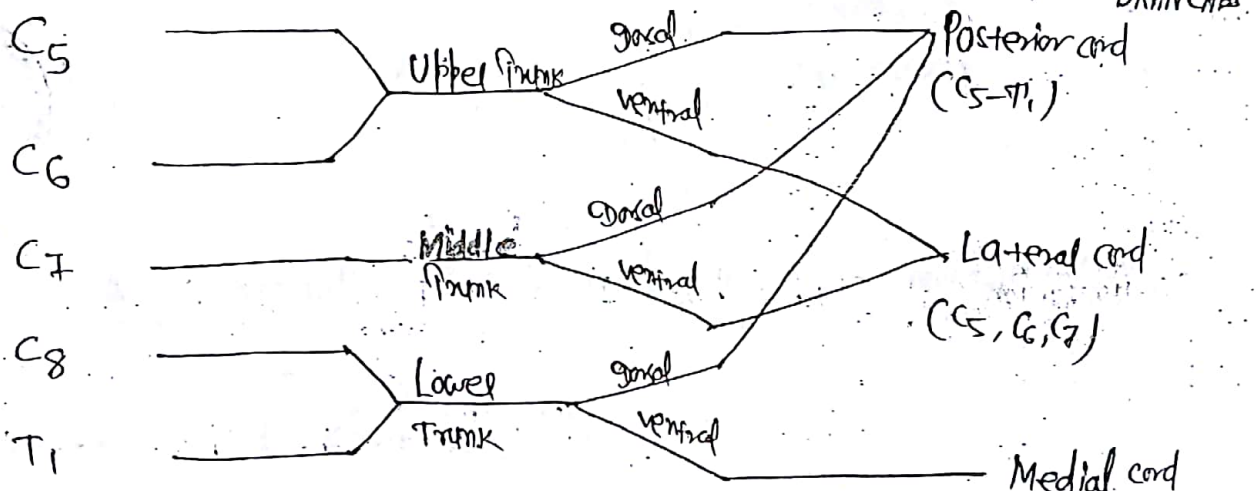
Grey Ramus communicans
⇓
⊕ in all the spinal Nerves

BRACHIAL PLEXUS:



⇒ A plexus is formed by Ventral Ramus of the corresponding spinal Nerve.

⇒



Dorsal division = Posterior division
ventral division = Anterior division

Branches of Lateral cord :→

① Lateral Pectoral N. (C_5, C_6, C_7)

② Lateral Root of Median N. (C_5, C_6, C_7)

③ Musculocutaneous N. (C_5, C_6, C_7)

↳ Damage to Musculocutaneous Nerve
⇓
a) Weakness of flexion of elbow;
b) Loss of supination of semiflexed elbow;
c) Sensory loss along the lateral border of forearm.

http://mbbshelp.com
WhatsApp: +1 (402) 235-1397

Branches of Medial cord ⇒

(7)

① Medial Pectoral N. (C_8, T_1)

② Medial Root of Median N. (C_8-T_1)

③ Medial cutaneous N. of Arm ($C_8 T_1$)

④ Medial cutaneous N. of Forearm ($C_8 T_1$)

⑤ Ulnar Nerve (C_7, C_8, T_1)

Branches of Posterior cord ⇒

"ULNAR"

① Upper Subscapular N. → supplies subscapularis only

② Lower subscapular N. (C_5, C_6) → supplies subscapularis & Teres Major

③ Axillary N. → supplies both Teres Minor & Deltoid

④ N. to Lattismus dorsi / Thoracodorsal N. (C_6, C_7, C_8)

⑤ Radial Nerve ($C_5 - T_1$)

↳ Largest branch of Brachial plexus.

Q: Root value of Median Nerve ⇒ $C_5, C_6, C_7, C_8, T_1, (C_5-T_1)$

Branches from the Roots

C_5 Root ⇒ N. to Rhomboides / Dorsal-scapular Nerve

C_5, C_6, C_7 Root ⇒ N. to Serratus Anterior / Long thoracic Nerve (C_5, C_6, C_7)

C_5 Root ⇒ Accessory Phrenic Nerve (Joins the Main Phrenic (receives C_4) & then goes through / N. to Subclavius)

C_5, C_6 Roots ⇒ N. to Subclavius

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Branches from Upper trunk

① Supra Scapular Nerve – supplies Supraspinatus & Infraspinatus

② N. to Subclavius (occasionally from Roots of C_5, C_6)

* Roots; trunks; & divisions are ⇒ Supraclavicular:

⇓

Lies in Posterior triangle of the Neck between the Scalenus Anterior & Scalenus Medius.

* Cords & Nerves are ⇒ Infraclavicular

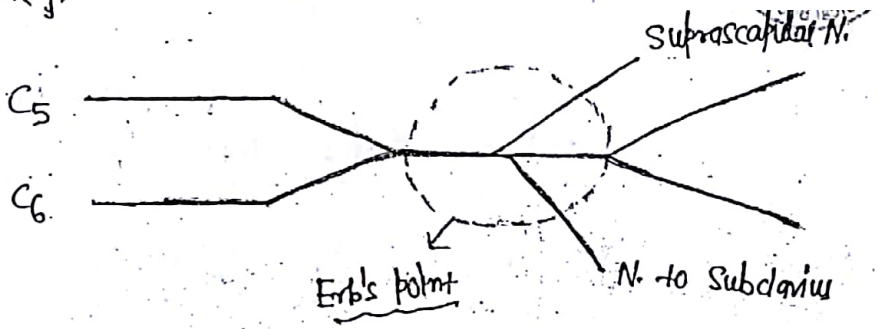
⇓

Lies in the Axilla around the axillary artery.

* Cords are present in the 1st & 2nd part; Nerves are present in 3rd part of Axillary Artery.

* Cords are placed in Afc to their Name in 2nd part of Axillary artery.

Erb's point ⇒



* Pre-fixed Brachial plexus ⇒ Formed from C_{4-8} Spinal Nerve

* Post-fixed Brachial plexus ⇒ Formed from C_{6-8} T_{1-2} Spinal Nerve

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

FRONT OF THE ARM / FRONT OF THE BRACHIUM

Muscles ⇒ 1. Biceps brachii
- Short head – Arises from Coracoid process along with coracobrachialis
- Long head ⇓ Arises from Supraglenoid tubercle of Scapula.

Insertion ⇒ Posterior aspect of Radial tuberosity

N. Supply ⇒ Musculocutaneous Nerve (C_5, C_6)
No + C_7 (X)

Action ⇒ Supinator @ Radioulnar joint
Flexion @ elbow joint
Flexion @ shoulder joint

* Supination in extended elbow ⇓ Supinator
* Supination in flexed elbow ⇓ Biceps brachii

2. Brachialis ⇒ Arises from the shaft of humerus below the insertion of Coracobrachialis

Insertion ⇒ Ulnar tuberosity.

N. Supply ⇒ Medial half ⇒ Musculocutaneous N. (C_5, C_6)
Lateral half ⇒ Radial N. (C_5, C_6)

Action ⇒ Chief flexor of the elbow joint.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

3. Coracobrachialis ⇒ Arises from the coracoid process along with the short head of biceps brachii.

Insertion ⇒ Medial aspect of middle of Shaft of the humerus.

N. Supply ⇒ Musculocutaneous Nerve (C_5, C_6, C_7)

Action ⇒ Weak flexors of the shoulder joint.

**QQ Paralysis after injury to $C_{5,6}$ except ⇒ Coracobrachialis

Musculocutaneous Nerve

Branch of Lateral cord of Brachial plexus.

Prt. on the Lateral aspect of IIIrd part of Axillary A.

- pierces the coracobrachialis.
- Lies b/w biceps & Brachialis.
- Continues as the Lateral cutaneous N. of Forearm.

ERB's PARALYSIS

- Injury to the upper trunk
- N. Roots involved ⇒ C_5, C_6
- Nerves involved ⇒ Axillary N.
  Musculocutaneous N.
  Suprascapular N.
  N. to Subclavius

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Muscle Paralysed		Position of upper Limb
① Axillary Nerve ⇒ Deltoid	⟶	Arm is adducted
Teres Minor	⟶	Arm is Medially Rotated
	⇓	
		"Regimen bathsign"
② Musculocutaneous Nerve ⇒ Biceps	⟶	Forearm is pronated
Brachialis	⟶	Forearm is extended
– Loss of sensation on Lateral aspect of Forearm.		

* "coraco-brachialis" is spared b/c it is supplied by C_7 of Musculo-cutaneous

③ Suprascapular N. ⇒ Supraspinatus	→	Arm is adducted
Infraspinatus	→	Arm is Medially Rotated

KLUMPKE'S PARALYSIS

- Injury to Lower trunk
- N. Roots Involved ⇒ C_8 T_1
- N. Involved ⇒ Median & Ulnar N.
- Muscle Paralysed ⇒ Intrinsic Muscle of hand (T_1)
  Ulnar flexors of the wrist & fingers (C_8)
  ↳ Flexor carpi ulnaris & Medial half Flexor digitorum profundus.
- claw hand & Horner syndrome

http://mbbshelp.com
WhatsApp: +1 (402) 235-1397

FRONT OF THE FOREARM

(Lateral to Medial)

SUPERFICIAL MUSCLE ⇒ 1. Pronator teres

⇓

Origin of all 5 Muscles are from Medial epicondyle of Humerus.

Superficial head / Humeral head

Deep head / Ulnar head

Median N. Passes b/w two heads.

Ulnar A. Passes deep to the deep head.

∴ Deep head separates Median N. from Ulnar A.

2. Flexor Carpii Radialis

Causes Flexion & Abduction @ wrist joint.

3. Palmaris Longus

– Continues in hand as "Palmer Aponeurosis"

4. Flexor digitorum Superficialis

5. Flexor Carpii Ulnaris

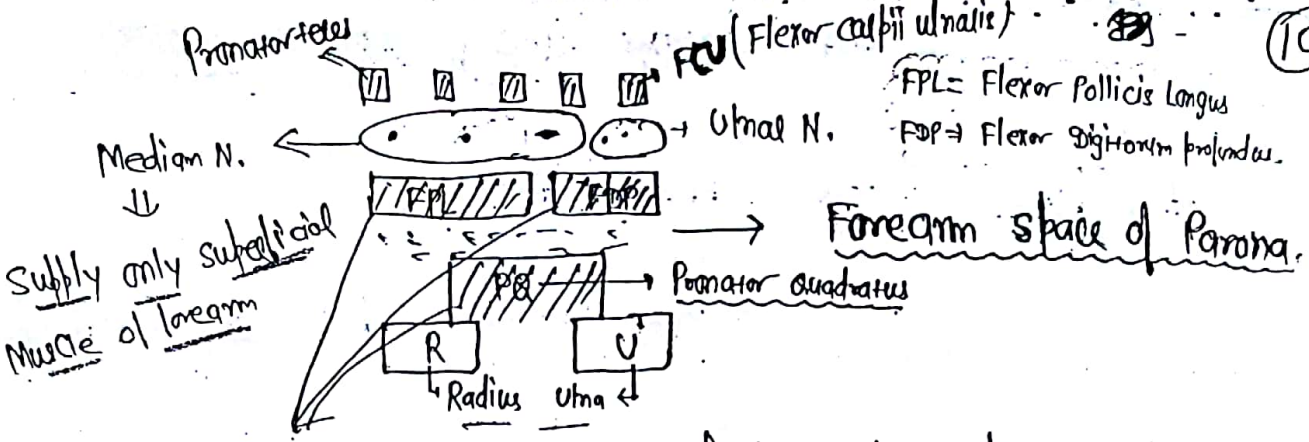
– Causes Flexion & Adduction @ wrist joint.

Intermediate Muscle ⇒ 1. Flexor Pollicis longus – Arises from Radius

2. Flexor digitorum Profundus – Arises from Ulna

Deep Muscle ⇒ Pronator quadratus

http://mbbshelp.com WhatsApp +1 (402) 235-1397



Anterior interosseous Nerve ⇒ supply Lateral half of Flexor digitorum profundus.

↳ Deep branch of Median N.
∴ given after it passes b/w 2 heads of Pronator teres.

↳ Flexor pollicis Longus ; Pronator quadratus & Lateral half of Flexor digitorum profundus are supplied by Anterior Interosseus Nerve.

* Carpel-tunnel syndrome ⇒ Seen when Median Nerve is compressed.
⇓
Carpel-tunnel contains → Median Nerves + 9 tendons
⇓
4 FDS + 4 FDP + 1 FPL

Δx ⇒ Phalen's test; Tinel's sign.

* Pronator teres Syndrome ⇒ Uncommon entrapment of the Median Nerve occuring in the elbow Region.

* Ulnar Nerves enter the forearm by passing b/w the two (Humeral & Ulnar) heads of origin of Flexor carpii ulnaris.

* Froment's sign ⇒ For Adductor pollicis → Seen in ulnar N. injury.

* Card Test ⇒ For Palmer Interossei (Adductors of fingers) → seen in Ulnar N. injury.

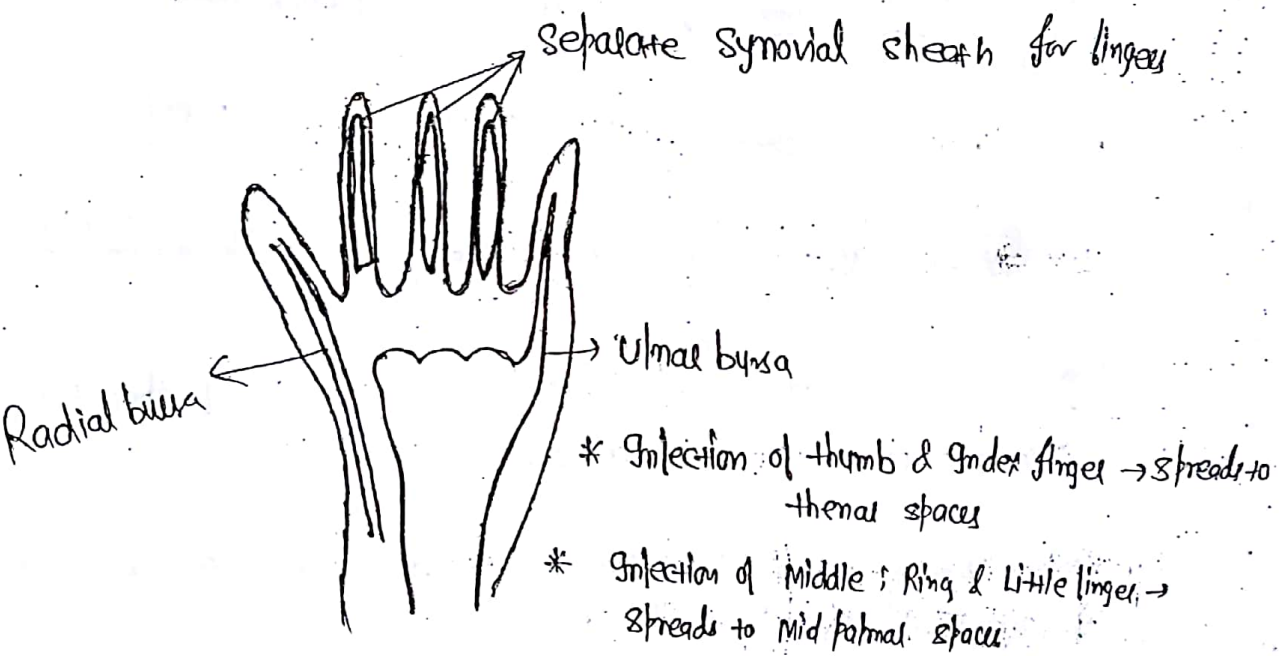
* Claw hand is caused by lesion of ⇒ Ulnar N. > Median N.

* Guyon's canal Syndrome / Handlebar Palsy ⇒ caused by entrapment of the Ulnar Nerve in Guyon canal.

http://mbbshelp.com

FLEXOR RETINACULUM & CARPEL TUNNEL

- Ulnar bursa encloses the tendon of
  - ↳ Flexor digitorum superficialis & Profundus.
  - ↳ continues ⊂ little fingers.
- Radial bursa encloses the tendon of
  - ↳ Flexor pollicis Longus
  - ↳ continues ⊂ thumb.

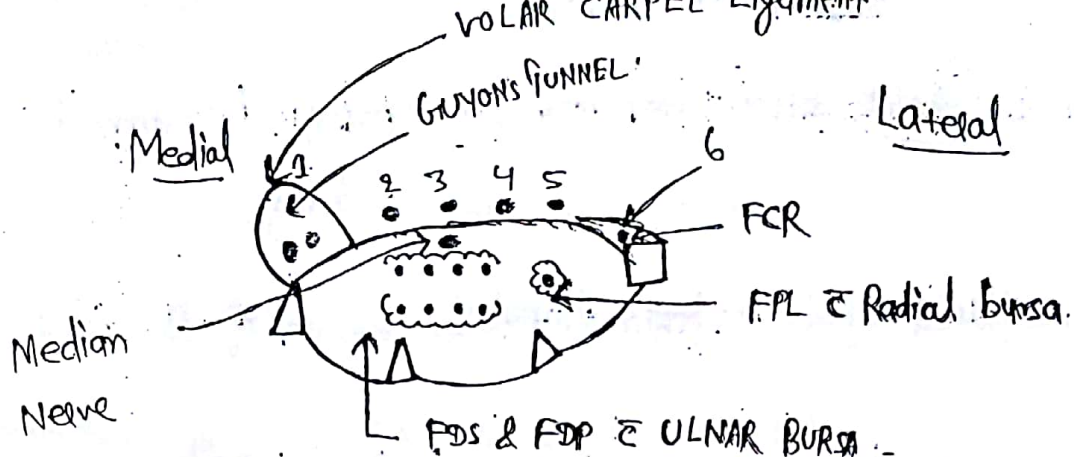


* Structures passing Above Flexor Retinaculum ⇨

- 1. Ulnar Nerve & vessels
  - ↳ passes below the volar carpel Ligament through Guyon's canal.

2. Palmer cutaneous branch of Ulnar Nerve
   - ↳ Supplies the skin over the hypothenar eminence

WhatsApp: +1 (402) 235-1397



3. Palmaris Longus

4. Palmer cutaneous br

↳ Supplies

5. Superficial palmer branch of

6. Flexor carpi Radialis.

ULNAR ARTERY :⇒ Larger terminal branch of Brachial Artery; arising in cubital Fossa,
↳ enters the palm by Passing superficial to flexor Retinaculum.

Branches → (A) In cubital Fossa ⇒ i) Anterior ulnar Recurrent;
ii) Posterior Ulnar Recurrent;
iii) Common interosseous → Anterior interosseous
→ Posterior interosseous.

(B) In Forearm ⇒ i) Palmer carpel branch
ii) Dorsal carpel branch

In Palm ⇒ i) Deep branch;
ii) superficial branch

* REFLEX & ITS ROOT VALUE

Biceps Reflex	→	C_5, C_6
Supinator Reflex	→	C_5, C_6
Triceps jerk	→	C_6, C_7
Knee jerk	→	L_2, L_3, L_4
Ankle Reflex	→	S_1.

http://mbbshelp.c

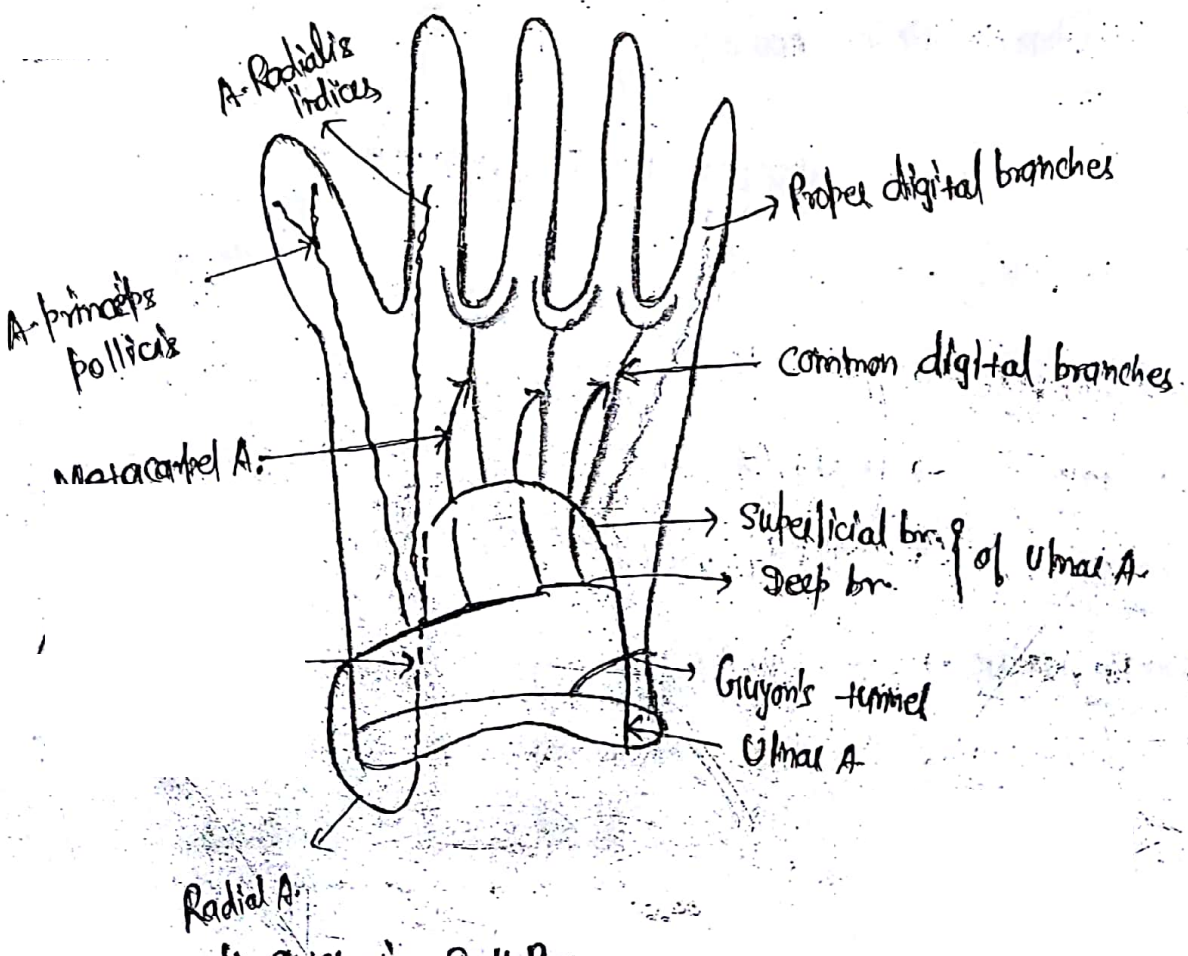
HAND

SUPERFICIAL PALMAR ARCH ⇒ formed by Superficial branch of Ulnar Artery.

Completed by Superficial Palmer branch of Radial A.

- Lies above the flexor tendons (FDS; FDP).
- Lies @ the level of Distal palmar crease.
- Branches ⇒ i) 3 Common digital branches;
  ii) 1 Proper digital branches.

Supplies ⇒ Medial 3½ fingers.



http://mbbshelp.com +1 (402) 235-1397

Deep palmar Arch ⇒ Formed by Radial A.
- Completed by deep branch of Ulnar A.
- Lies deep to the tendons of FDS; FDP
- Lies 1 cm proximal to Superficial palmar arch

Branches ⇒ i) Arteria principalis pollicis;
ii) Arteria Radialis indicis;
iii) 3 Metacarpal Arteria which anastomoses w/ 3 common digital branches of superficial palmar arch.

* The tendon of Flexor digitorum Superficialis is inserted on either side of base of Middle phalanx of the fingers.
  - divides into 4 tendons for 4 fingers opposite to the base of Proximal Phalanx.
  - each tendon divides into 2 slips.
* The tendon of Flexor digitorum profundus is inserted on base of distal phalanx of the fingers.
  - ↳ Causes flexion of DIP joint;

LUMBRICALS ⇒ Flex the Metacarpophalangeal joint & extends Interphalangeal joints.
- Inserted on ⇒ the Lateral aspect of the base of Proximal phalanx of the fingers.
  ⇒ Dorsal aspect of the base of distal phalanx of fingers.

N. Supply ⇒ 1st & 2nd Lumbricals ⇒ Median N.
3rd & 4th Lumbricals ⇒ Ulnar N. (Deep branch)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Action ⇒ : Flexion @ MP joint

Extension @ IP joint

* Paralysis Leads to claw hand.

* Muscles Supplied by Median N. In the Hand ⇒ 5 Muscles

Abductor pollicis brevis

Flexor pollicis brevis (Superficial head)

Opponens pollicis

1st & 2nd Lumbricals.

Grip of the hand is due to ⇒ Flexor tendons (Long)

* Muscles Supplied by Ulnar N. In the Hand ⇒ 15 Muscles

Abductor digiti minimi brevis

Flexor digiti minimi brevis

Opponens digiti minimi

3rd & 4th Lumbricals

4 Palmer Interossei (Adduction of fingers)

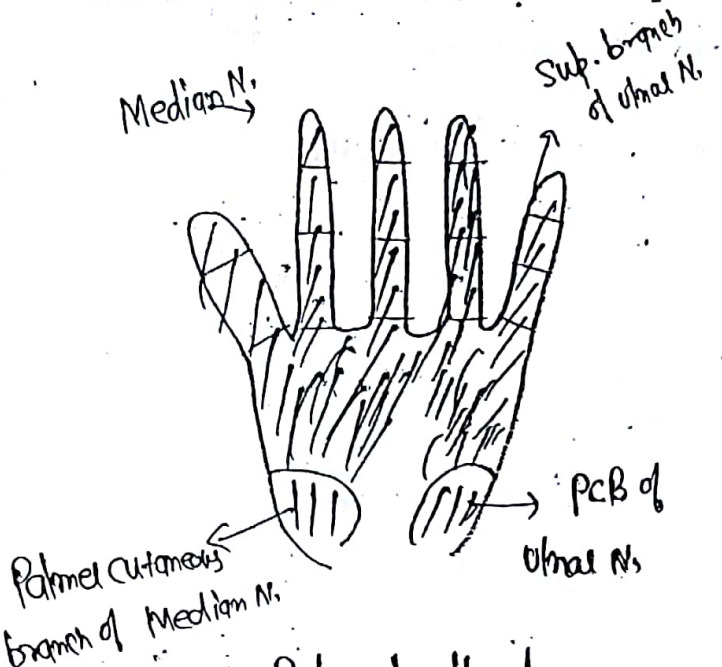
4 dorsal Interossei (Abduction of fingers)

Adductor pollicis (Graveyard of Ulnar N.)

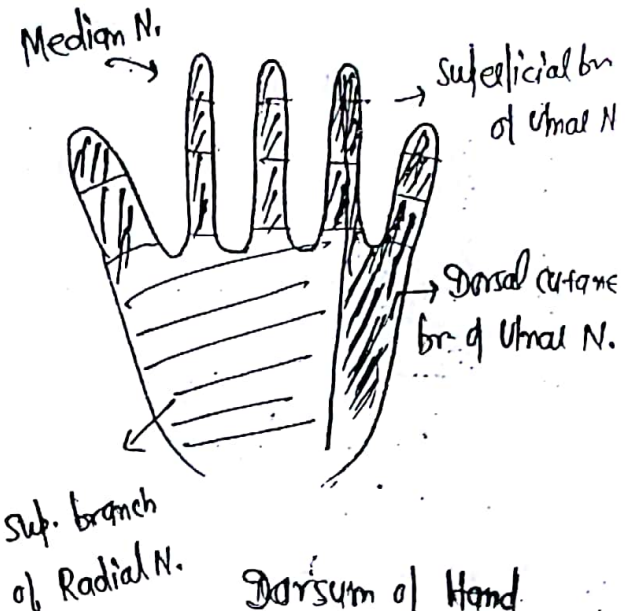
Deep head of Flexor pollicis brevis

* Superficial branch of Ulnar N. supplies ⇒ Palmaris brevis

http://mbbshelp.com WhatsApp: +1 (402) 235-1397



∴ Palm of Hand



Dorsum of Hand

eye of the Hand is which Nerve ⇒ Median N.

eye finger of Hand ⇒ Index finger
(Max^m Proprioceptor ⇒ ⊕)

Ulnar Nerve ⇒ Musician Nerve

Also "Labourer's Nerve"

- The Superficial & deep branches of Ulnar N. is given in hand.
- The Palmer cutaneous branch & dorsal cutaneous branch are given in the forearm / @ the wrist / before the flexor Retinaculum.

* Wartenberg's sign ⇒ Inability to adduct the Small finger in again the Ring finger d/t weakness of Palmer Interossei Muscle

* All Metacarpels (except 1st) have ⇒ Distal (Head epiphysis)

* 1st Metacarpals & all phalanges have ⇒ Proximal (Base epiphysis).

http://mbbshelp.com

RADIAL NERVE (Saturday Night Palsy)

- Branch of Posterior cord of Brachial plexus.
- Brn. on Posterior aspect of 3rd part of Axillary A.

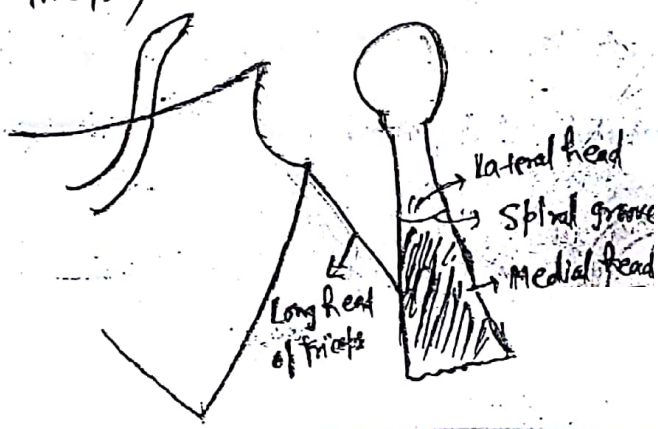
- Branches & Supply

In Axilla

- 2 Muscular
  - Long head of Triceps
  - Medial head of Triceps
- 1 Cutaneous
  - Posterior cutaneous Nerve of Arm.

ii) In Spiral groove

- 3 Muscular
  - Lateral head of Triceps
  - Medial head of Triceps
  - Anconeus (Detached part of Medial head of Triceps)
    - ⇓
    - help in screwing Movement; helps triceps to extend elbow joint.
- 2 cutaneous
  - Posterior cutaneous Nerve of forearm
  - Lower Lateral cutaneous Nerve of Arm.



http://mbbshelp.com

iii) Lateral aspect of the Arm

- Brachialis (Lateral half)
- Brachioradialis
- ECRL (Extensor carpii Radialis Longus)

iv) In the cubital fossa (Ant. to Lateral epicondyle; the Radial N. divide in 2 terminal branches)

Radial N. divides

Superficial branch

↓

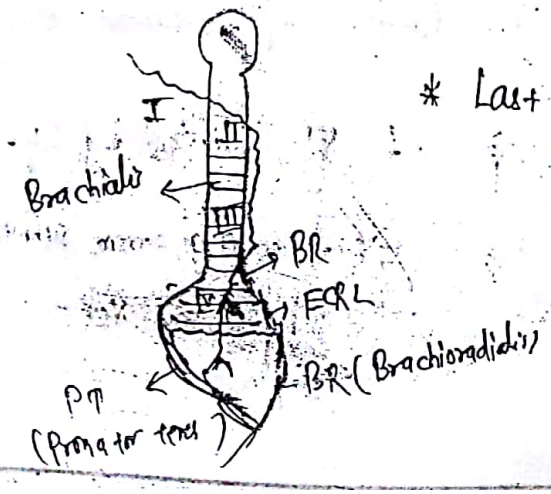
Goes below the Brachioradialis; Lies in the roof of Anatomical Snuff box & supplies the skin on the dorsum of hand & proximal phalanges of Lateral $3\frac{1}{2}$ fingers.

Deep branch / Posterior Interosseous Nerve

↓

pierces the Supinator & supply all the dorsal aspect

Cheralgia Paresthetica ⇒ Compression of the superficial br. of Radial Nerve @ wrist.



* Last Muscle supplied by Radial N.

↓

ECRL

http://mbbshelp.com
WhatsAp

BACK OF THE FOREARM

DNB'16

- **SUPERFICIAL MUSCLE** ⇒ Anconeus – Radial N. ⌜ Inserted on base of 5th Metacarpal bone.

Radial N. on the Lateral aspect of Arm

- Brachioradialis
- Extensor carpii Radialis Longus
- Extensor carpii Radialis brevis
- Extensor digitorum
- Extensor digiti minimi.
- Extensor carpii ulnaris

Muscle of extension compartment of forearm that causes flexion of elbow.

Posterior Interosseous Nerve

Deep Muscle ⇒

- Abductor Pollicis Longus
- Extensor pollicis brevis
- Extensor pollicis Longus
- Extensor Indices
- Supinator

form Anatomical Snuff box

Wrist drop ⇒ d/t Paralysis of ECRL.

Finger drop ⇒ d/t Paralysis of Extensor digitorum.

Extension @ wrist done by ⇒ ECRL supplied by Radial N.

Extension of digit done by ⇒ Extensor digitorum supplied by Posterior Interosseous Nerve

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Lesion of Radial Nerve

High Lesion

- In axilla
- In spiral groove

↓

Wrist drop & finger drop

Low Lesion

Type-I

- b/w spiral groove & Lateral aspect of Arm

↓

Wrist drop & finger drop

Type-II

- In Cubital fossa

↓

Not finger drop & only wrist drop

ANATOMICAL SNUFF BOX

Boundaries :→ **Lateral / Anterior** :→ Abductor Pollicis Longus
Extensor Pollicis Brevis

Medial / Posterior :→ Extensor pollicis Longus

Floor :→ Styloid process of Radius
Scaphoid
Trapezium

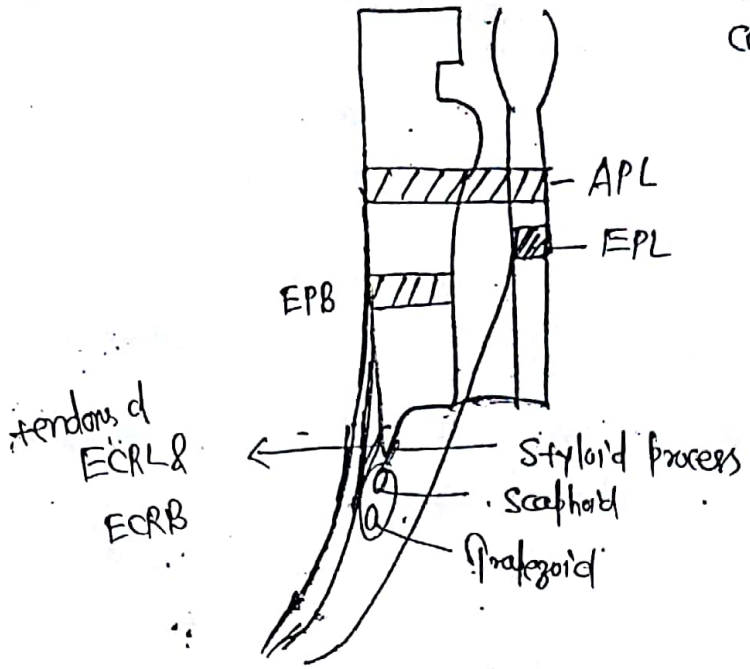
— **Floor** is **Caused by** **tendons of** ECRL & ECRB.

Content :→ Radial A. (only one content)

Roof :→ Cephalic vein
Sup. branch of Radial N.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* finger by which all the Nerves can tested ⇒ Thumb



EXTENSOR RETINACULUM

Lateral to Medial compartment ↳

I st compartment ⇒ Abductor pollicis Longus
Extensor pollicis brevis

II nd compartment ⇒ ECRL
ECRB

III rd compartment ⇒ Extensor Pollicis Longus

IV th compartment ⇒ Extensor digitorum
Anterior Interosseous A.
Extensor Indicis
Posterior Interosseous N.

V th compartment ⇒ Extensor digiti minimi

VI th compartment ⇒ Extensor carpi ulnaris

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

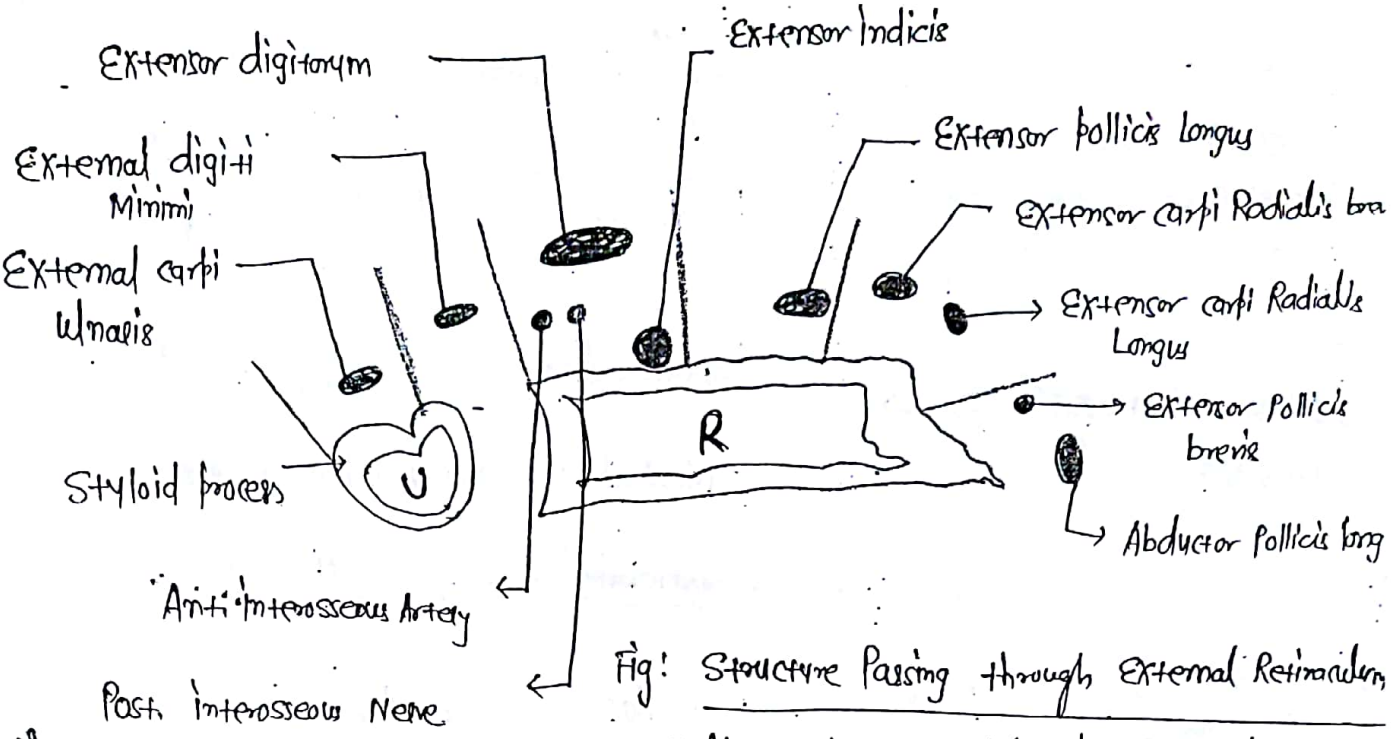
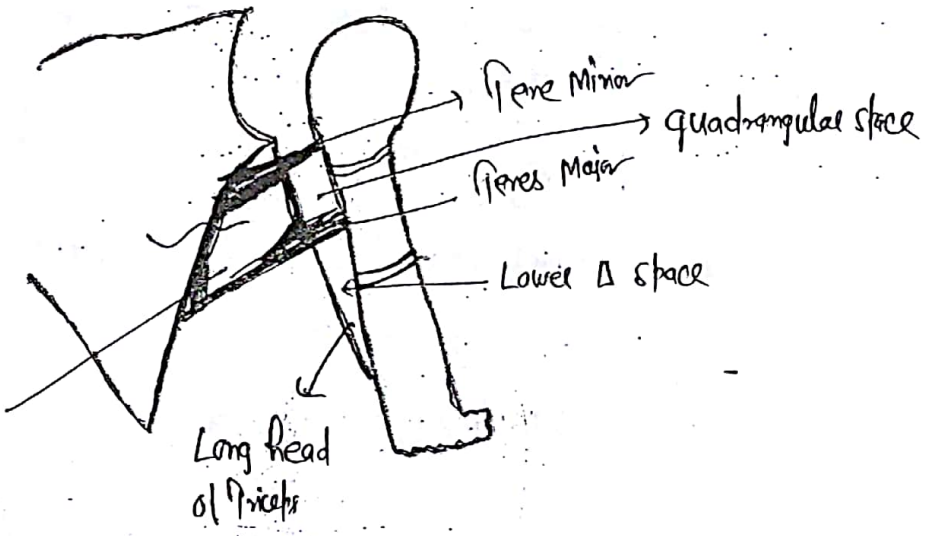


Fig: Structure Passing through External Retinaculum

Viva * De quervain's tenosynovitis :⇒ Inflammation & Nodule formation In the synovial sheath of Abductor Pollicis Longus & extensor Pollicis brevis; Result In Pain over Radial sty

Spaces Around the Arm



Upper Δ space ⇒ content ⇒ circumflex humeral A.

Lower Δ space ⇒ content ⇒ Radial N.
Profunda brachii A.

Quadrangular space ⇒ Content ⇒ Axillary N.
Posterior circumflex humeral vessels.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Region	Boundaries
• Upper Triangular space of Arm ⟹	Superior : Teres Minor Inferior : Teres Major Lateral : Long heads of Triceps
• Lower Triangular space of Arm ⟹	Superior : Teres Major Medial : Long head of Triceps Lateral : Shaft of Humerus
• Quadrangular space of Arm ⟹	Superior : Teres Minor; Inferior : Teres Major; Medial : Long head of Triceps; Lateral : Surgical Neck of Humerus

* DERMATOME :→

THUMB	– C_6
3 fingers	– C_7
Little fingers	– C_8
1st web space	– C_6-C_7
Last web space	– C_7-C_8

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Chief LymphNode draining the breast ⇒ Ant. Axillary

Chief Artery supplying the breast ⇒ Lateral thoracic Artery.

Involvement of cutaneous Lymphatics — In Ca breast leads to ⇒ Peau-de-orange appearance

Involvement of Lactiferous duct — In Ca breast leads to ⇒ Retraction of Nipple

Involvement of Cooper's Ligament in Ca breast leads to ⇒ Puckering/dimpling of skin of breast.

Triangle of Auscultation

Medial ⇒ Trapezius

Lateral ⇒ Medial border of Scapula

Base ⇒ Latissimus dorsi

Floor ⇒ 6th & 7th Rib & Intercostal space b/w them & Rhomboides Major

* Wrist joint is formed b/w Lower end of Radius & 1st 3 Carpel bones (Scaphoid, Lunate & Triquetral) - Separated by Articular disc

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

JOINTS OF UPPER LIMB

Sterno clavicular joint ⇒ Saddle type of Synovial joint.

Acromio clavicular joint ⇒ Plain synovial joint
↳ only gliding Movement

Shoulder joint ⇒ Ball & Socket joint

elbow joint ⇒ Hinge joint

Superior & inferior Radio-ulnar joint ⇒ Pivot joint (synovial) (Trochoid)

Middle Radio-ulnar joint ⇒ Syndesmosis type of fibrous joint

wrist joint. ⇒ Ellipsoidal type of joint.

1st carpo Metacarpel joint ⇒ Saddle type of synovial joint (sellar)

Intercarpel joint ⇒ Plain synovial joint

Metacarpophalengeal joint ⇒ Condylar type of synovial joint (Ellipsoidal More than Condylar).

Interphalengeal joint ⇒ Hinge joint

* Unipinnate Muscle :⇒ Arises from 1 tendon (Eg⇒ 1st & 2nd Lumbricals) or from 1 bone (Eg ⇒ Palmar interossei)

↓ Bipinnate Muscle :⇒ Arises from 2 tendon (Eg ⇒ 3rd & 4th Lumbricals) or from 2 bones (Eg ⇒ Dorsal Interossei)

* Most frequently dislocated joint ⇒ Glenohumeral (Most mobile joint).

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

JOINTS OF FOOT

* Sub-talar joint (Talocalcaneum) → Plain Synovial
* AIIMS NOV 11 Talocalcanonavicular Joint → Ball & Socket
* Calcanocuboid Joint → Saddle
* Smaller Joint of Forefoot → Plain synovial
* Metatarsophalangeal Joint → Condylar Joint
* Interphalangeal Joint → Hinge Joint

TH → Talo-calcaneo Navicular joint
H → Hip joint
I → Ginglostatodial
S → Shoulder joint.

ARCHES OF FOOT

Medial Longitudnal Arch

Bones → Calcaneum, Talus; Navicular; 3 cuneiform; 3 Metatarsal bones

Intersegmental ties → Spring Ligament / Plantar Calcaneo-Navicular Ligament

↓

Supports the head of Talus

Sling → Tibialis Anterior & Tibialis Posterior

Lateral Longitudnal Arch

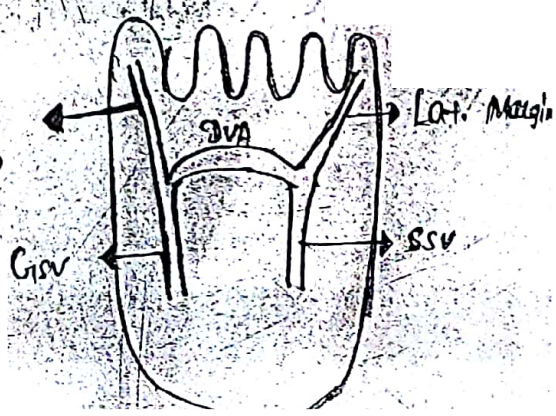
Calcaneum; cuboid; 4th & 5th Metatarsal

Short & long plantar Ligaments

Peroneus Longus & Peroneus Brevis.

VENOUS Drainage of LOWER LIMB

1. Dorsal venous Arch
2. Medial Marginal vein
3. Lateral Marginal vein
4. GSV (Great Saphenous vein)
5. SSV (Short Saphenous vein).



http://mt

Great Sephanous vein (GSV)

- Goes in front of Medial Malleolus
  - 1cm Anterior to Medial malleolus (NEET'16)
- Accompanies the Saphenous N
- Drains into femoral vein
  - Saphenous opening lies 4cm (1.5 inch) below & Lateral to Pubic tubercle where it opens into femoral vein.

Short sephanous vein (SSV)

- → Goes behind the Lateral Malleolus
- → Accompanies the Sural N
- Drains into Popliteal/Post. tibial vein

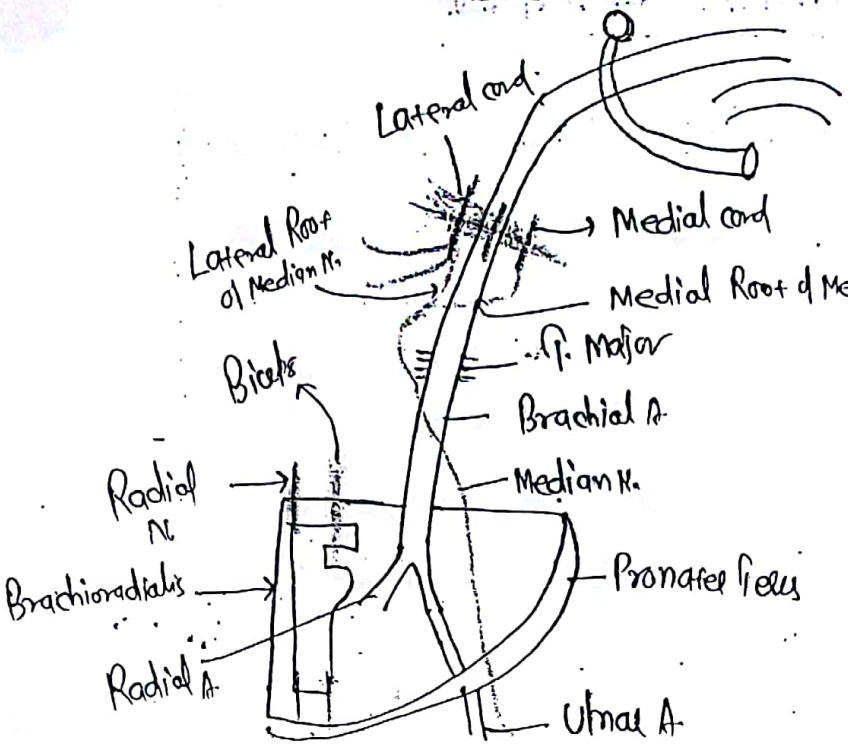
Perforating veins

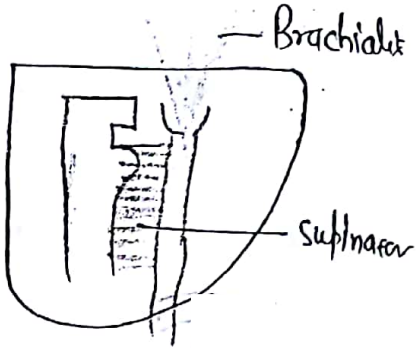
(They connect the superficial veins & the deep veins)

Location	Connects
Mid-thigh (Dodds) Hunterian	Adductor canal	Great sephanous vein with the femoral vein
Knee Perforator (Boyds)	Just below Knee	Great sephanous with the Posterior tibial V.
Leg - Lateral Ankle	Junction of Middle & Lower third	Short sephanous with the Peroneal vein
Leg - Medial Ankle (Cockett)	Upper Medial - Junction of Middle & lower third of Leg Lower Medial - below & behind Medial Malleolus Middle - b/w two	Posterior Arch vein & the Posterior tibial vein

http://mbbshelp.com WhatsApp: +1(402)-235-1397

CUBITAL FOSSA





Floor

AI-IS ✱ Bicipital Aponeurosis lies over Brachial Artery & Median Nerve in cubital fossa.

↳ Structure over bicipital Aponeurosis in cubital fossa ⇒ Veins.

* Tennis Elbow ⇒ Type of Repetitive Strain injury Resulting from tendon overuse & failed healing of tendon.
  - "Extensor carpii Radialis (brevis)" ... Muscles play a Key Role.
  - Also "Lateral epicondylitis" (NEET 2016)

Boundaries of cubital Fossa ⇒ Superior → Inter-epicondylar line of Humerus

Medial → Pronator teres;
Lateral → Brachioradialis;
Floor → Brachioradialis & supinator
Roof → Skin; Superficial fascia; Median cubital vein; Bicipital Aponeurosis.

Content of cubital fossa (Medial to Lateral) ⇒
- Median Nerve (Medial Most);
- Brachial Artery (Bifurcation of brachial A & initial part of Radial & Ulnar arteries)
- Tendon of biceps brachii
- Radial Nerve
- Some Lymph Nodes

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

GENERAL EMBRYOLOGY

→ Fertilisation occurs in ⇒ Ampulla of Fallopian tube

→ Zygote divides to form ⇒ 16 celled Morula

⇓

as it enters in Uterine cavity; fluid from the uterus enters the Morula & divides it into → Outer cell Mass/ Trophoblast

→ Inner Cell Mass/ Embryoblast

– Cavity is k/as "Blastocyst"

– This structure is k/as "Blastula".

→ The outer cell mass/ trophoblast differentiate into → Syncytiotrophoblast

↓

cell walls are abt.; & the Nuclei are scattered

→ Cytotrophoblast

↓

Cell walls are distinct; there is one Nucleus in each cell

→ The Inner cell Mass/ Embryoblast differentiate into → Epiblast

⇓

Tall columnar cells

→ Hypoblast

⇓

cuboidal cells.

help.com WhatsApp: +1 (402) 235-1397

- Epiblast grows around the cyto-trophoblast to enclose Amniotic cavity.

- Hypoblast Similarly encloses the Yolk sac.

- The germ disc is ⇒ Bilaminar.

- The Hypoblast / Yolk Sac forms "Extra-embryonic Mesoderm"

⇓

which lies b/w amniotic cavity; Yolk sac & cyto-trophoblast.

- Small cavities appear here; which joins to form ~~extra-emb~~ coelom / chorionic cavity; this cavity divides the Mesoderm in

Extra-embryonic Splanchnopleuric

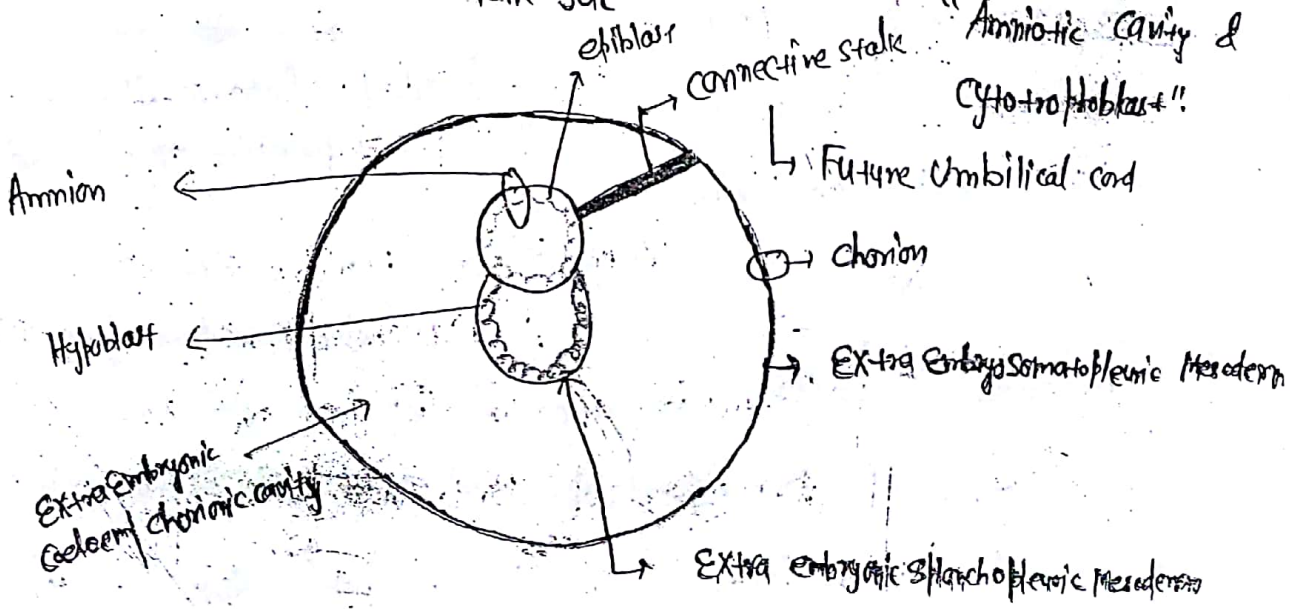
⇓

which lines the "Yolk Sac"

Extra-embryonic Somatopleuric

⇓

which lines the "Amniotic Cavity & Cyto-trophoblast"



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(I) Formation of Pro-chordial plate / Bucco-pharyngeal Membrane ⇒

- The Hypoblast @ one end become columnar.

⇓

they form an elevation in the Amniotic cavity

⇓

K/as "Prochordial plate"

⇓

forms future Mouth

→ determines cephalic end & central axis of embryo.

(II) Formation of Primitive streak ⇒

- The epiblastic cells @ caudal end grows rapidly

⇓

they form an elevation in the amniotic cavity

⇓

K/as "Primitive streak"

⇓

Rounded Anterior structure is K/as "Primitive Knot / node"

⇓

Depression in Primitive Knot is K/as "Blastopore / Primitive Pit"

* cell Responsible for formation of 3 germ layers in an embryo is ⇒ Epiblast;
* 1st germ layer to be formed in embryo is ⇓ Endoderm > Mesoderm > Ectoderm

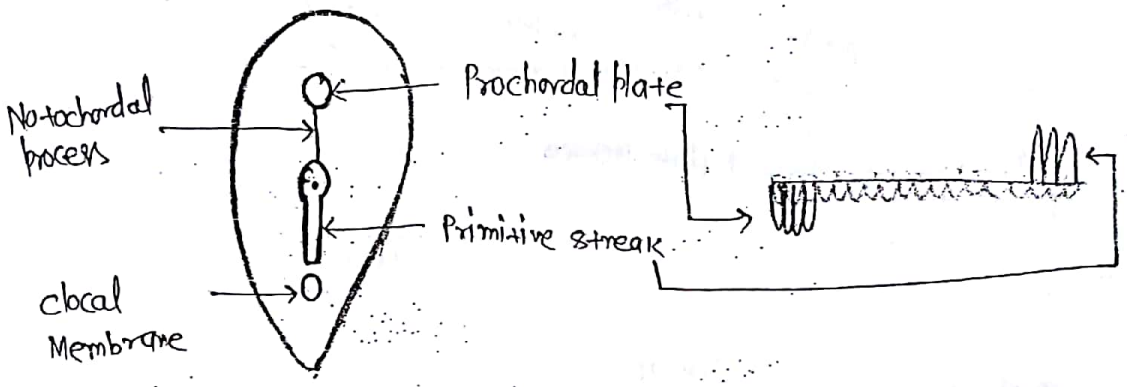
Functions ⇒ (1) Formation of all the germ layers;
(2) formation of Notochordal process

Fate ⇒ It disappears ; but if persists form "Sacrococcygeal teratoma"

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(III) Formation of Notochord ⇒

- derived from Notochordal process (derived from primitive streak)
- The blastopore inside this process to form a Notochordal canal.
- Lies in Mesoderm.
- extents from primitive knot to prochordal plate
- It disappears except ⇒ Nucleus pulposus of intervertebral disc, Apical Ligament of Dense



(IV) Intra-embryonic Mesoderm ⇒ It Migrates b/w Ectoderm & Endoderm

at all the sites except → Prochordal Plate

→ Cloacal Membrane

At this two ends the ectoderm & endoderm are fused

→ Intra-embryonic Mesoderm

- Paraxial Mesoderm ⇓ forms "Somites"
- Intermediate plate Mesoderm ⇓ Forms the "Genitourinary System"
  - Form ⇒ a) Nephrogenic Ridge
    b) Gonadal Ridge
    c) Mesonephric duct
    d) Paramesonephric duct
- Lateral plate Mesoderm ⇓ encloses a cavity ⇓ Intra-embryonic coelom ↳ form Pleural cavity, Peritoneal cavity, Pericardial cavity
  - Also form Smooth Muscle lining the blood vessels except Aorta ⇓ derived from Paraxial Mesoderm

Dermomyotomes

Sclerotomes → Forms vertebral column & Ribs

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

1 Formation of Neural tube ⇒ Derive from ectoderm.

↳ Forms the Brain & Spinal cord;

↳ Ant. Neuropore (cranial) closes by 25th day of IUL.

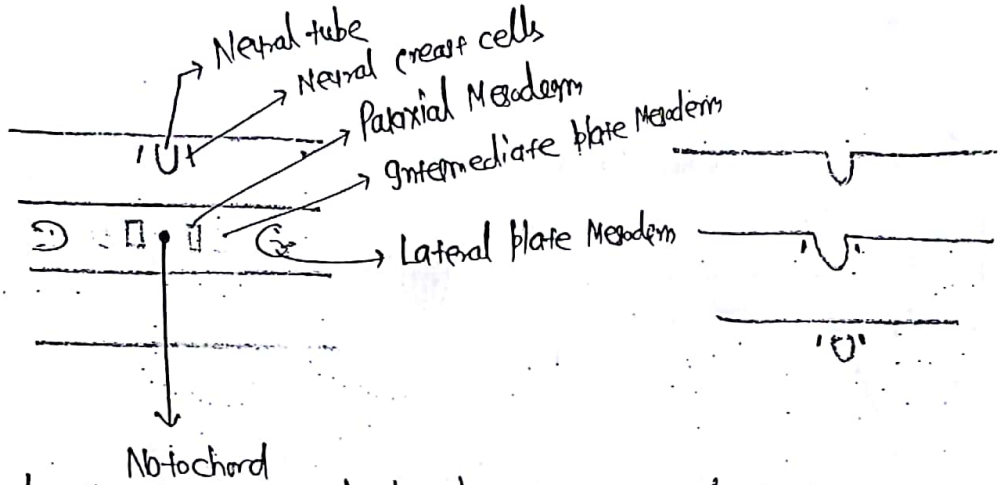
↓

Fail to close ⇒ Anencephaly

↳ Post. Neuropore (caudal) closes by 27th day of IUL

↓

Fail to close ⇒ Spinal bifida



closure of Neural tube begins in the cervical Region; then extends cranially & caudally.

* Derivative of Neural crest cells ⇒

① Adrenal Medulla (88 NEET 16)

② Leptomeninges (Piameter + Arachnoid)

③ odontoblast (teeth forming cells)

④ Melanocytes

⑤ Schwann cells (form Myeline in Peripheral Nervous system)

⑥ Dorsal Root ganglion

⑦ Autonomic ganglion

⑧ Skeleton of Face;

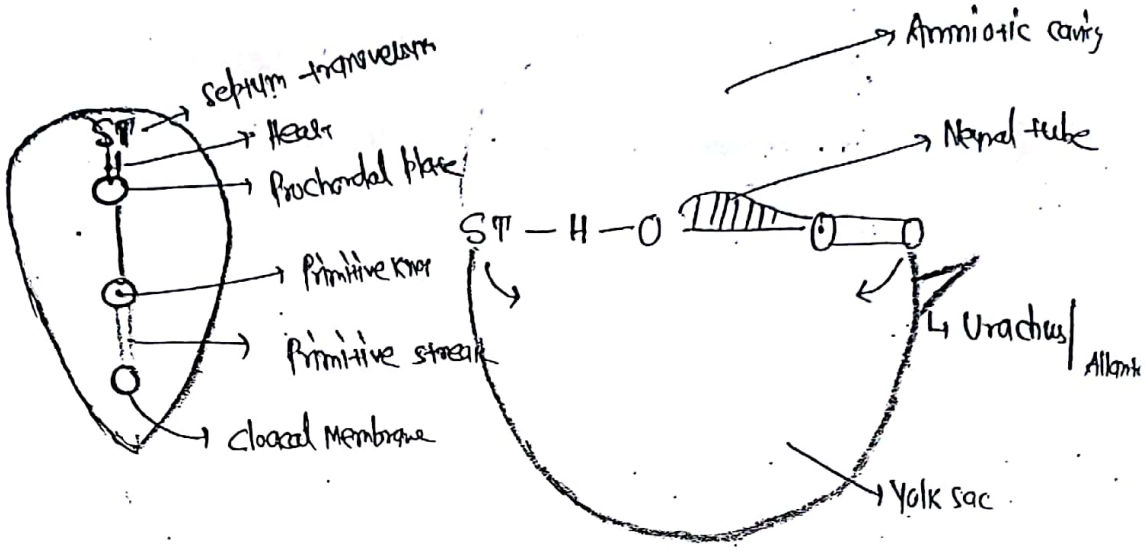
⑨ Nerves of the Pharyngeal Arches

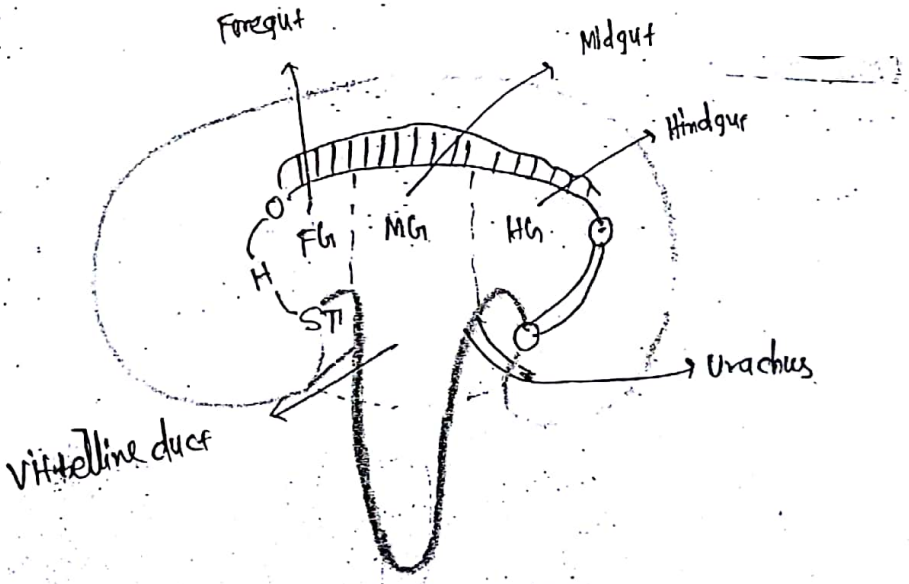
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(10) Endocardial cushion of the heart;

(11) Aortico-pulmonary septum;

(12) Para-follicular "C" cells of thyroid.





1° villus ⇒ Syncytiotrophoblast & cytotrophoblast

2° villus ⇒ Syncytiotrophoblast + cytotrophoblast + Extra-Embryo Mesod

3° villus ⇒ Syncytiotrophoblast + cytotrophoblast + Extra-Embryonic M
+ B. vessels.

http

* Feto-placental barrier ⇒

1. Endothelial cells of maternal B. vessels;
2. Syncytio-trophoblast;
3. Cyto-trophoblast;
4. Extra-Embryonic Somatopleuric Mesoderm;
5. Endothelium of fetal blood vessels.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

INFERIOR EXTREMITY

- Pelvifemoral space ⇒ Lies below the Inguinal Ligament;
  - Similar to apex of axilla,

Meralgia Paresthetica ⇒ Compression of Lateral femoral cutaneous N. of thigh (Branch of Lumbar plexus), against the Inguinal Ligament.

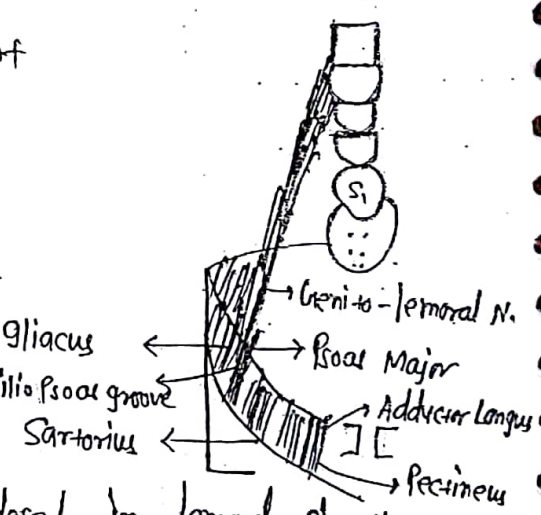
- Femoral triangle ⇒ Boundaries ⇒

Laterally ⇒ Medial border of sartorius

Medially ⇒ Medial border of Adductor Longus

Base ⇒ Inguinal Ligament

Floor ⇒ Iliacus;
(Lateral to Medial) Psoas Major;
Pectineus;
Adductor Longus



Contents ⇒ Femoral vessels enclosed in femoral sheath;
Femoral Nerve.

* Femoral Hernia ⇒ Below & Lateral to Tubercle (Pubic)
  Inguinal Hernia ⇒ Above & Medial to Pubic tubercle

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Femoral sheath ⇒ Funnel shaped fascial sheath enclosing upper 3-75cm of Femoral vessels.

Anteriorly ⇒ Fascia transversalis

Posteriorly ⇒ Fascia illiaca

Femoral sheath

- **Lateral compartment** ⇓ Contain ⇒ Femoral A.; Femoral branch of Genitofemoral N.
- **Intermediate compartment** ⇓ Contain Femoral vein
- **Medial compartment / Femoral canal** ⇓ Upper part of Femoral canal Known as "Femoral Ring"

→ **Boundaries of Femoral Ring** ⇒

- **Anterior** ⇒ Inguinal Ligament / Poupart's Ligament
- **Medially** ⇒ Lacunar Ligament / Gimbernat's Ligament
- **Posteriorly** ⇒ Pectineal Ligament / Cooper's Ligament
- **Laterally** ⇒ Septum separating it from Femoral vein

* Femoral Ring is closed by "Lymph Node of Cloquet / Rosenmuller's ⇓ drain by glans penis or glans clitoris.

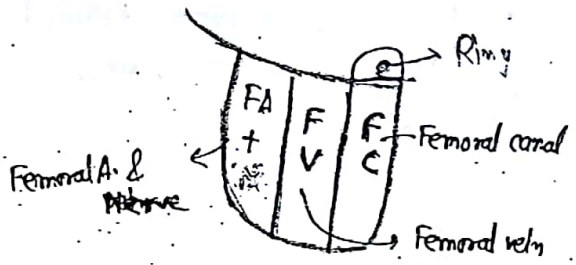
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Femoral Ring is widen in females d/t wider pelvis & Smaller size of blood vessels.

⇓

Occassionally Abnormal obturator artery (Branch of Inferior epigastric A.) lies on Lacunal Ligament; leading to hemorrhage

CE'16 * Femoral Nerve lies outside the Femoral sheath



	Anterior Superior iliac spine (ASIS)	Ant. Inferior iliac spine (AIIS)
Muscle –	Sartorius	Straight head of Rectus femoris.
Ligament –	Inguinal	ilio-femoral Ligament

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Anterior compartment of thigh

SARTORIUS ⇒ Origin ⇒ Ant. Superior iliac spine

↓

Longest Muscle of the body. Insertion ⇒ Medial aspect of shaft of tibia along with gracilis & semitendinosis

↓

Gray Robes (Pes Anserinus)

Action ⇒ Abduction; Lateral Rotation & Flexion @ Hip joint

Flexion & Medial Rotation @ Knee joint

— Also known as "Tailor's Muscle or Honeymoon Muscle"

Quadriceps femoris ⇒ Rectus Femoris + Vastus Medialis + Vastus Intermedius + Vastus Lateralis

Rectus Femoris ⇒

- Straight head ↓ arises from Ant. Inferior iliac spine
- Reflected head ↓ arises above the Acetabulum

Action ⇒ extension @ Knee joint & flexion @ Hip joint.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Vastus Medialis
Vastus Intermedialis
Vastus Lateralis
→ Vastus Medialis stabilizes Patella & prevent its Lateral dislocation.

Insertion of Quadraceps femoris ⇒ Base of the patella

↓

Continues as Ligamentum patellae

↓

Action ⇒ extension @ the knee joint; Rectus femoris also causes flexion @ the hip joint.

- Locking of the knee joint (Medial Rotation of Femur during the final stages of extension; When the foot is on the ground)

⇓

When foot is on the ground → Tibia Rotates Laterally

http://mbbshelp.com WhatsApp +1 (402)-235-1397

Femoral Nerve

- Largest branch of Lumbar plexus;
- formed by the dorsal division of Ventral Rami of L_2, L_4.
- Lies In the ilio-Psoas groove.
- Lies outside the femoral sheath,
- It has a trunk; Anterior & Posterior division.
- Branches from Trunk ⇒ N. to Iliacus;
  N. to Pectineus; (Lateral half)

CET July 16 N. to Pectineus passes Medialward behind the femoral Artery.

- Branches from Ant. division ⇒

1 Muscular ⇓ Sartorius

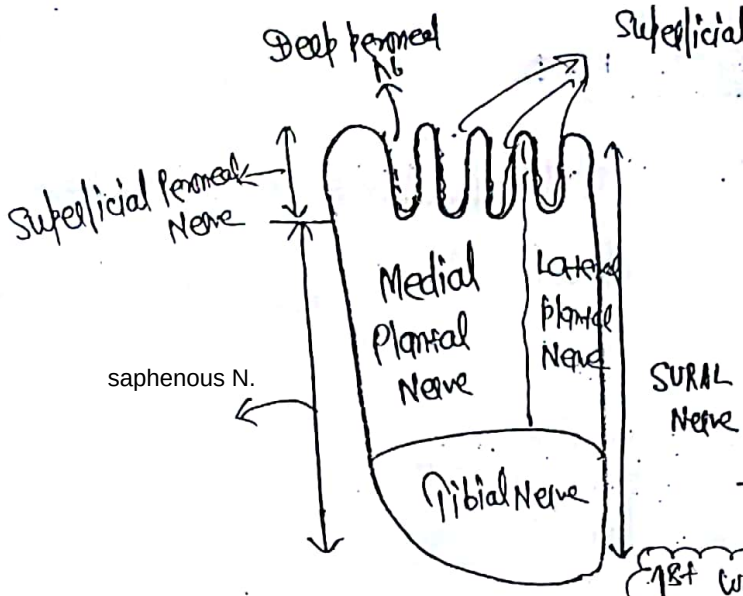
2 cutaneous ⇓ Medial & Ant. / Intermediate femoral cut Nerve of thigh

- Branches from Post. division ⇒

4 Muscular ⇓ Quadriceps femoris

1 cutaneous ⇓ Saphenous Nerve (Longest cutaneous N.)
↳ Supplies the skin on Medial aspect of Leg & foot upto great toe.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397



Mortons Neuroma

- Entrapment of 3rd common digital Nerve (Br. of Medial plantal Nerve).

Baxter's Nerve

- 1st branch of Lateral plantal Nerve

1st web space is supplied by
⇓
Deep peroneal N.
Rest all other web space is supplied by
⇓
Superficial Peroneal N.

Lateral aspect of Little finger
⇓
By sural Nerve

Femoral Artery

- Continuation of external iliac ; below Inguinal Ligament.
- Continues as Popliteal artery ; after piercing Adductor Magnus (at) Hiatus Magnus.
- Branches in the femoral A ⇒

Superficial
⇓
Superficial epigastric A.
Superficial circumflex iliac A.
Superficial external pudendal A.
⇓
Supplies external genitalia

Deep
⇓
Deep external Pudendal
Muscular branches
Profunda femoris
↓
Medial circumflex femoral A.
Lateral circumflex femoral A.
Perforating branches
⇓
Pierces Adductor brevis &

Retinacular branches ; which

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Total No of Perforators ⇒ 4

↳ 2nd Perforating branches gives Nutrient A. to femur

- Branches In Adductor Canal ⇒

Descending Grenicular Artery

↳ Last branch given by the femoral before it pierces the adductor Magnus

Extra edges

* Coronary Ligament :⇒ Attaches the Medial & Lateral Meniscus to the Medial & Lateral condyle of tibia.

* Menisco-femoral Ligament :⇒ attaches the posterior part of Lateral Meniscus to the Femur.

ⓐ Anterior Menisco-Femoral Ligament / Ligament of Humphery :⇒
Goes Anterior to PCL.

ⓑ Posterior Menisco-Femoral Ligament / Ligament of Wrisberg :⇒
Lies behind the PCL

N. of Wrisberg ⇒ Nervus Intermedius (Sensory br. of Facial Nerve)

http://mbbshelp.com

Medial Compartment of Thigh (Adductor of Thigh)

Obturator Nerve ⇒ Branch of Lumbar plexus

- Formed by ventral division of ventral Rami of L_2, L_3, L_4.
- Related to Ala of the Sacrum;
- Forms the lateral boundry of "Ovarian fossa"
- Emerges out through obturator foramen & divides into

Anterior Division

- Adductor Longus
- Adductor brevis
- Gracilis
- Medial half of Pectineus

Posterior Division

- Adductor Magnus
  - Obturator externus
  - Longest Muscle Among Adductor of thigh.

Action ⇒ Adduction & Medial Rotation @ Hip joint;

Gracilis also causes Flexion & Medial Rotation @ Knee joint
(Anti-Rapist Muscle)
(Custodian of virginity)

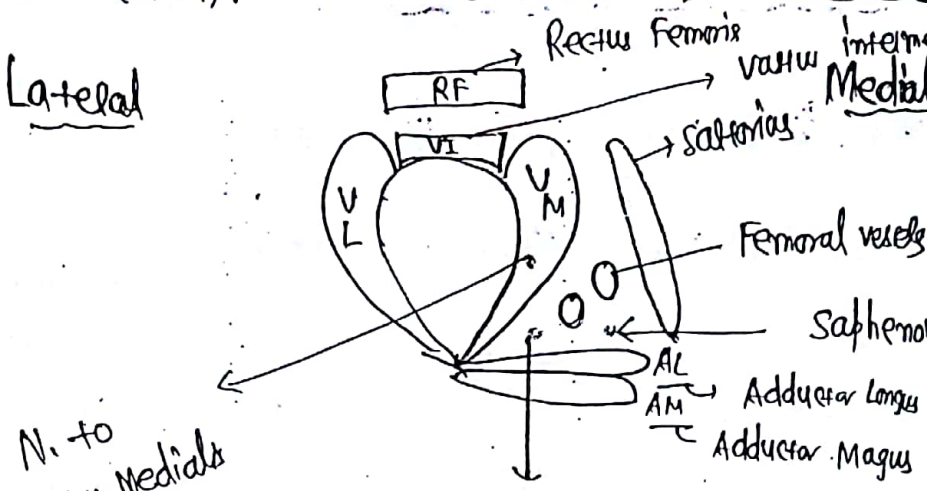
Obturator externus causes Lateral Rotation of the hip joint.

* Obturator N. Supplies both Hip & Knee joints. In case of disease of hip joint May be referred to Knee joint

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Lies beneath the Sartorius Muscle, (UP07):

← Adductor Canal | Subsartorial Canal | Hunter's canal



- Starts at the apex of the femoral Δ & extends distally as far as the distal attachment of the tendon of adductor Magnus

Post. division of obturator Nerve

DNB'16 * Saphenous Nerve is Anterior to femoral A. in Adductor Canal.

Boundaries ⇒ Anterior ⇒ Sartorius;
Lateral ⇒ Vastus Medialis;
Posterior ⇒ Adductor Longus & Adductor Magnus.

CONTENT OF ADDUCTOR CANAL ⇒ Femoral Artery;
Femoral vein;
N. to vastus Medialis;
Saphenous Nerve (largest cutaneous br. of Femoral);
Descending genicular Artery
Muscular br. of Femoral Artery
Some lymph vessels

* Bursa which communicates ∈ cavity of Knee Joint ⇒ Suprapatellar bursa
* Inflammation of Pre-patellar bursa ⇒ Housemaid's Knee
* Inflammation of Infrapatellar bursa ⇒ Clergyman Knee
* Inflammation of bursa over Ischial tuberosity ⇒ Weaver's bottom | Tailor's | Student's
* Anserine bursa ⇒ Separate Insertion of Sartorius, Gracilis & semitendinosus from tibia

Structure passing below Subtalar Joint

- Flexor Hallucis Longus
* Most stable position of Ankle joint is ⇒ Dorsiflexion.
* Deltoid Ligament
  - Tibionavicular
  - Tibiocalcaneal
  - Tibiotalar

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

POSTERIOR COMPARTMENT OF THIGH

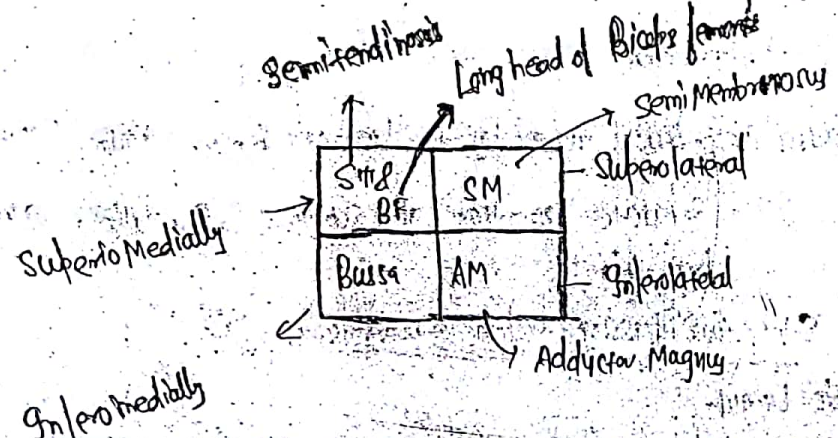
Hamstring Muscle ⇒
- Semi-tendinosus
- Semimembranosus (Inserted on the Medial condyle of tibia; continues as the oblique popliteal Ligament; which lies in the floor of popliteal fossa)
- Adductor Magnus (Ischial head)
- Biceps femoris

Long head

Arises from the Ischial tuberosity

Short head

Arises from Linea Aspera of Femur.



* Adductor Magnus not fulfill the Hamstring criteria b/c of its insertion in femur (Not in Tibia/Fibula) but as it's degenerated part it is considered as "Hamstring Muscle".

↓

Tibial collateral Ligament

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Criteria for Hamstring ⇒ origin ⇒ Ischial tuberosity

Insertion ⇒ Tibia & fibula

N. supply ⇒ Tibial part of Sciatic Nerve

Action ⇒ Extension @ Hip joint & flexion @ the knee joint.

Degenerative Parts

* Tibial Collateral Ligament :⇒

↳ degenerated part of Adductor Magnus

* Fibular Collateral Ligament

↳ degenerated part of Peroneus Longus

* oblique popliteal Ligament

↳ degenerated part of Semimembranosus.

↳ pierced by Middle genicular N. & vessels and the posterior division of obturator N.

* Sacrotuberous Ligament :⇒

↳ degenerated part of Long head of biceps femoris

↳ gives origin to Gluteus Maximus.

* Sacrospinous Ligament :⇒

↳ degenerated part of Coccygeus.

* Articular disc of TM joint ⇒ degenerated part of Lateral Pterygoid

* Articularis genu ⇒ detached part of Vastus Intermedius.

↳ Holds the apex of Supra-patellar bursa.

http://mbbshelp.com WhatsApp: +1-(402)-235-1397

* The short head of biceps is not hamstring b/c ⇒

(a) Arises from Lateral Aspect of femur;

(b) Supplied by Common Peroneal part of Sciatic N.

- Biceps Femoris is inserted on head of fibula.

Glio-tibial tract

- Formed by splitting of Fascia lata;

Muscle inserted ⇒ Gluteus Maximus

Tensor fascia lata.

- This tract is attached to anterior aspect of Lateral condyle of tibia

- Action ⇒ Abduction & flexion @ hip joint.

extension @ Knee joint.

Gluteus Maximus

Origin ⇒ a) Gluteal surface of ilium behind the posterior gluteal line;

b) Dorsal aspect of iliac crest

c) Sacrum & coccyx

d) sacro-tuberous Ligament

* site of i.m. injection in buttock ⇒ Upper outer quadrant (Supero-lateral) site of Gluteal Region.

Insertion ⇒ a) Glio-tibial tract

b) Gluteal tuberosity of femur.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

N. Supply :⇒ Inferior gluteal Nerve

Action :⇒ Extension
Lateral Rotation } @ Hip Joint
Abduction

Gluteus Medius & Minimus

Action :⇒ Abduction & Medial Rotation @ Hip Joint

Mainly by G. Medius — Mainly by G. Minimus

- They support the pelvis when one foot is off the ground
- The superior gluteal Nerve supply ⇒ Gluteus Medius
  Gluteus Minimus
  Tensor fascia lata

Insertion of Gluteus Medius ⇒ Lateral surface of greater trochanter of Femur.

Insertion of Gluteus Minimus ⇒ Anterior surface of greater trochanter of Femur.

* Key Muscle of gluteal Region ⇒ Pyriformis

PELVI-FEMORAL MUSCLE

↳ Lateral Rotators of hip. QQ

1. Pyriformis
2. Superior gemellus
3. Obturator Internus
4. Inferior gemellus
5. Quadratus femoris

(1) → N. to obturator Internus
(4) (5) → N. to Quadratus femoris

* Structure Passing Above the Pyriformis :⇒ ① Superior gluteal Nerve
② Superior gluteal vessels

http://mbbshelp.com WhatsApp +1 (402) 235-1207

Sciatic Bed – It is formed by ⇒

1. Superior gemellus
2. Obturator Internus
3. Inferior gemellus
4. Quadratus femoris
5. Adductor Magnus

Popliteal Fossa

Boundaries ⇒ Superolateral ⇒ Biceps Femoris

Superomedial ⇒ Semitendinosis & Semimembranosus assisted by Sartorius & gracilis

Inferolateral ⇒ Lateral head of Gastrocnemius

Inferomedial ⇒ Medial head of Gastrocnemius

Floor ⇒ Popliteal surface of Femur.
Capsule of the Knee joint
Oblique popliteal Ligament
Popliteus Muscle
Fascia covering the Popliteus Muscle

http://mbbshelp.com WhatsApp: +1-(402) 235-1397

Contents ⇒ Popliteal Artery (deepest)

Popliteal vein

Sciatic Nerve & the tibial & common Peroneal Nerve

* Popliteal artery is difficult to palpate d/t

⇓

it is Not superficial & doesn't pass over any bony prominence.

POSTERIOR COMPARTMENT OF LEG

SUPERFICIAL MUSCLE ⇒ Gastrocnimus
Soleus
Plantaris

Gastrocnemius + Soleus
↳ "Triceps surae"
Kla "Peripheral heart" blc it helps in venous Return from Lower Limb

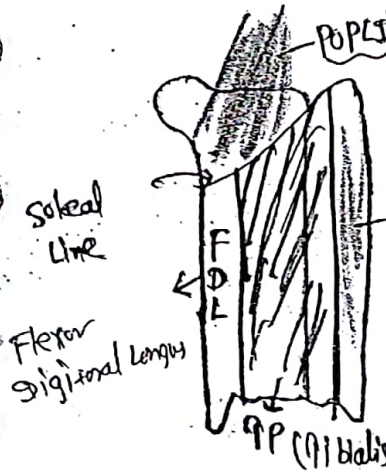
Tendo Achillis
↳ Inserted on Middle 1/3rd of posterior surface of calcaneum.

Plantaris → Feeble & Rudimentry Muscle; which can Rupture during sudden dorsiflexion of Ankle joint.

Action ⇒ Plantar flexion @ Ankle Joint

DEEP MUSCLE ⇒

Muscle	Action
Popliteus	Unlocking of the Knee joint
Tibialis posterior, Flexor hallucis Longus, Flexor digitorum Longus	⇒ Plantarflexion & Inversion



POPLITEUS
↳ Origin ⇒ Lateral surface of Lateral condyle of Femur (Intra-capsular)
Insertion ⇒ Posterior surface of shaft of tibia over soleal line
N. Supply ⇒ Tibial Nerve
Artery ⇒ Post. tibial artery

Structure passing behind the Flexor Retinaculum through Tarsal tunnel (Ant to Posterior)

- Tibialis Posterior
- Flexor digitorum Longus
- Post. tibial A.
- Tibial nerve

Mnemonic ⇒ The Doctors Are Not Here

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

ANTERIOR COMPARTMENT OF LEG

1. Tibialis Anterior;
2. Extensor hallucis Longus;
3. Extensor digitorum Longus;
4. Peroneus tertius.

Action ⇒ Dorsiflexion at ankle joint;

- Tibialis anterior also causes Inversion & acts as a sling for the Medial Longitudinal Arch.

Nerve ⇒ Deep peroneal N.

Artery ⇒ Ant. tibial A. — after piercing the Interosseus Membrane

Structure passing behind the Extensor Retinaculum

Medial to Lateral ⇒ Tibialis Anterior
Extensor hallucis Longus
Anterior tibial A.
Deep peroneal Nerve
Extensor digitorum Longus;
Peroneus tertius

Mnemonic :-
The Himalayas Are Not Dry Plateau

LATERAL COMPARTMENT OF LEG

Muscle ⇒ Peroneus Longus
Peroneus brevis

Nerve ⇒ Superficial peroneal N.

Artery ⇒ Peroneal A. — branch of Posterior tibial A.

Action ⇒ Eversion of foot.

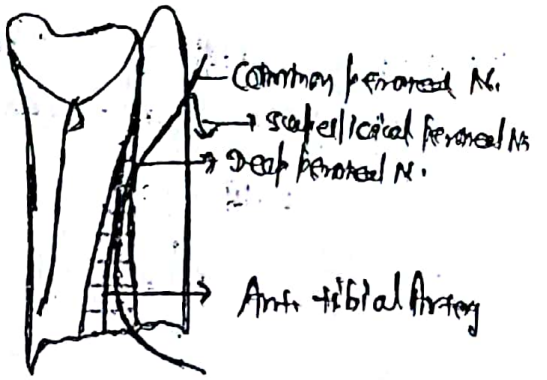
- Act as a sling for the Lateral Longitudinal arch.

* ~~Foot drop occurs due to~~ ↓ Common peroneal Nerve / Deep peroneal Nerve
* ~~"High Stalling/ Stamping/ Marching" GAIT~~

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Nervi Haltans

- Deep peroneal Nerve
  ⇓
  It hesitates to cross the Anterior tibial Artery.



Tibialis Posterior

- winds around the Medial Malleolus
- chiefly inserted on Navicular tuberosity.
- sends slips to all the tarsals & Metatarsals except → Talus, 1st & 5th Metatarsal

- the tendon which winds around Lateral Malleolus
  ↳ Peroneus brevis
  ⇓
  inserted on base & tuberosity of 5th Metatarsal bone

Peroneus Longus

- goes behind the Peroneus brevis till the cuboid; then turns @ Right angle; grooves the cuboid bone; passes below the bases of Metatarsal bones.

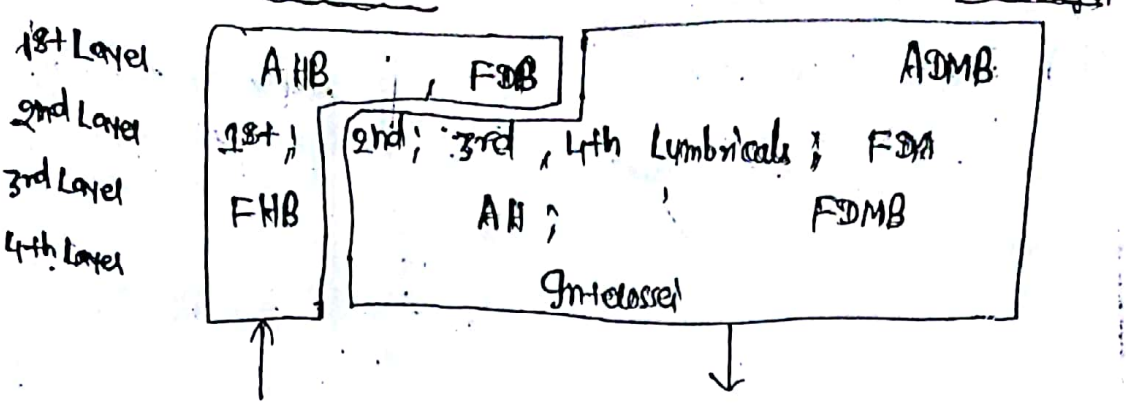
Tibialis Anterior

- inserted on Lateral aspect of base of the 1st Metatarsal & Medial cuneiform
- → Medial cuneiform bone Receives the Insertion of → Tibialis Anterior
  Tibialis Posterior
  Peroneus Longus

LAYER OF SOLE

	Great toe		Little finger
1st Layer ⇒	Abductor hallucis brevis	Flexor digitorum brevis	Abductor digiti minimi brevis
2nd Layer ⇒	FHL; FDL; Lumbricals		Flexor digitorum accessorius/ Quadratus plantae
3rd Layer ⇒	Flexor hallucis brevis	Adductor hallucis	Flexor digiti minimi brevis
4th Layer ⇒	Tibialis Posterior ; Peroneus Longus	Interossei	4 Dorsal, 3 Plantar

http://mbbshelp.com WhatsApp: +1 (402) 235-1397



* Stronger Ligament @ hip joint ⇒ Glio-femoral / Ligament of Bigelow

⇓

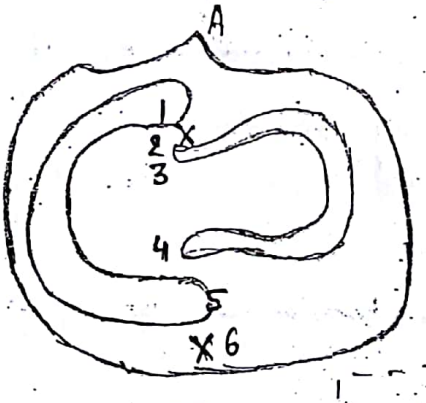
← Inverted "Y" shaped

the stem of "Y" is attached to Anterior Inferior Iliac spine ; two limbs are attached to Intertrochentric line

↳ prevents hyperextension @ Hip joint

prevents trunks to be falling down backward.

* Structure attached to Intercondylar eminence of Tibia !⇒



ACL (Intra capsular & Extra-synovial)

| → Attach to the Posterior aspect of Medial surface of Lateral condyle

| → Prevents Anterior displacement of tibia on Femur

| → Gets tort during extension

PCL (Intra capsular & extrasynovial)

| → Attach to Anterior aspect of Lateral surface of Medial condyle

| → prevents the posterior displacement of tibia on Femur

| → gets tort during flexion

P

① Anterior horn of Medial Meniscus

② Anterior cruciate Ligament

③ Anterior horn of Lateral Meniscus

④ Posterior horn of Lateral Meniscus

⑤ Posterior horn of Medial Meniscus

⑥ Posterior cruciate Ligament

See Page 1 & Last Page after this Page

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

THORAX

- Head of the Rib articulates ē the body of thoracic vertebra
  ⇓
  via "costo-vertebral joint"
- Tubercle of the Rib articulates ē transverse process
  ⇓
  "costo-transverse joint"
- Shaft of the Rib articulates ē costal cartilage
  ⇓
  "costochondral joint"

Bucket-handle movement changes ⇒ Transverse diameter of thorax

Pump-handle movement changes ⇒ AP diameter of thorax

Contraction of diaphragm changes ⇒ vertical diameter of thorax.

* Ossification of Ribs begins Near the Angle towards the end of 2nd Month (Aroung 8th week) of Fetal Life & is seen firstly in 6th & 7th Ribs.

Intercostal space

Intercostal Muscles ⇒ EICM

IICM

Transverse thoracicus

- Sterno-costalis ⇓ Anteriorly part
- Innermost intercostal ⇓ Laterally
- Subcostalis ⇓ Posteriorly

* The Neurovascular plane of thorax lies b/w internal & innermost intercostal in the costal groove along inferior border of the Rib (Vein → Artery → Nerve)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

→ This sequence is Reversed in 1st Rib (N→A→V)

* Neurovascular plane of body ⇒

Neck	Scalenus Posterior	Scalenus Medius	Scalenus Anterior
Thorax	External intercostal	Internal Intercostal	Innermost Intercostal
Abdomen	External oblique	Internal oblique	Transverse Abdominis

NEEDLE12

* Structure pierced during pleural tapping in Mid-axillary line ⇒

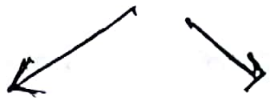
Skin
↓
Superficial fascia
↓
Deep fascia
↓
Serratus Anterior
↓
External Intercostal
↓
Internal Intercostal
↓
Innermost Intercostal
↓
Endo-thoracic fascia
↓
Parietal pleura

AI→IS * While doing thoracocentesis; it is advisable to introduce Needle along – Upper border of the Rib.

http://mbbshelp.com

Internal thoracic Artery

- Branch of 1st part of Subclavian A.
- Lies on either side of the sternum;
- At the six i.c space divides into :-



Superior epigastric

- enters the abdomen through "Foramen of Morgagni | Space of Larry".

Musculophrenic

- Supplies the intercostal muscle & diaphragm
- gives Anterior i/c arteries in Lower spaces

- Anastomosis ∈ the Inferior epigastric A. ; which is the branch of external iliac A.

Anterior Intercostal Artery

- In the upper six i/c spaces a branches of Internal thoracic Artery.
- In the Lower spaces (i.e 7th - 9th i/c spaces) the branches of Musculophrenic Artery.
- There are two Anterior Intercostal arteries in each space.

Posterior Intercostal Artery

- In the Lower (3rd - 11th) i/c spaces are branches of descending thoracic Aorta.
- In the upper two spaces they are branches of

Superior Intercostal A.

branch of costo-cervical trunk

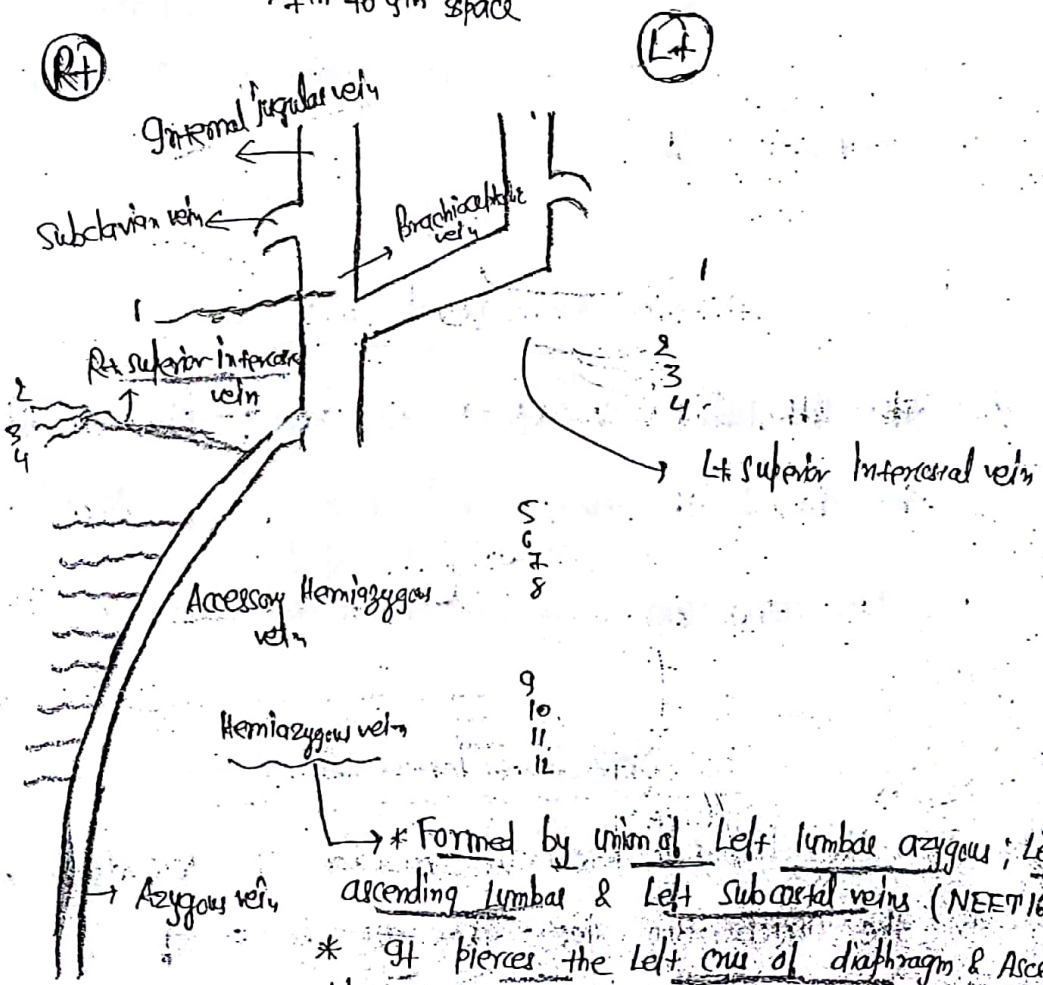
Branch of 2nd part of Subclavian A.

http://mbbshelp.com WhatsApp: +1-(402) 235-1397

- There is one Posterior i/c Arteries in each space.
- At the angle of Rib ; it gives a collateral branches.
- The two Posterior i/c Arteries anastomoses with two Anterior i/c Arteries @ the costo-chondral junction.
- Rt. Posterior ikc artery are longer than the Left.

Anterior Intercostal veins

- In the upper six spaces drains into → Internal thoracic vein
- In the Lower spaces drains into → Musculophrenic vein
  - 7th to 9th space



→ * Formed by union of Left lumbar azygous ; Left ascending lumbar & Left Subcostal veins (NEET 16)

* It pierces the Left crus of diaphragm & Ascends upto 8th level ; where it turns to Right & joins Azygous vein.

NEET It drains 9th to 11th Left posterior i/c vein & esophageal veins

* Rt. bronchial veins drains into Azygous vein & Left bronchial veins drain into Left superior intercostal or hemiazygous vein

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Q9 Internal thoracic veins are tributaries of ⇒ Brachiocephalic vein

Obstruction to the SVC above the opening of Azygous vein ⇒

Internal thoracic vein

Ant. Intercostal vein
↓ Anastomosis with
Post. Intercostal vein
↓
Azygous vein
↓
SVC
↓
Rt. Atrium

Sup. epigastric vein
↓ Anastomosis c
Inf. epigastric vein
↓
external iliac
↓
common iliac
↓
IVC
↓
Rt. Atrium

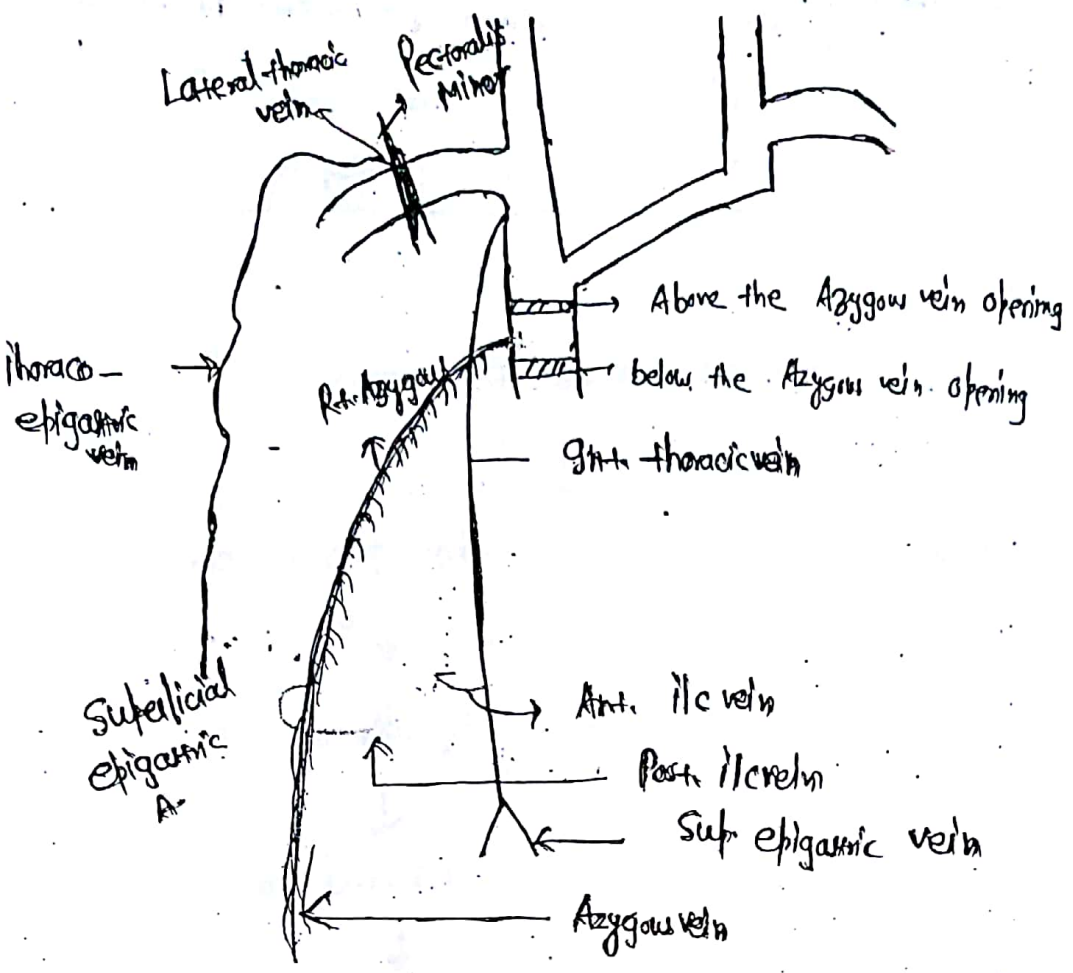
Obstruction to the SVC below the opening of Azygous vein ⇒

Brachiocephalic vein
↓
Subclavian vein
↓
Axillary vein
↓
Lateral thoracic vein
↓
Thoraco epigastric vein
↓
Superficial epigastric vein
↓
Great Saphenous vein
↓
Femoral vein → external iliac vein

Internal thoracic vein
↓
Sup. epigastric vein
↓
Inf. epigastric vein
↓
external iliac
↓
common iliac
↓
IVC
↓
Rt. Atrium

Rt. Atrium
↑
IVC
↑
common iliac vein
↑

http://mbbshelp.com WhatsApp: +1 (402) 235-1397



* Trachea & Bronchii have cartilage (hyaline cartilage) in their walls; while wall of bronchioles & terminal bronchioles don't contain cartilage.

Intercostal Nerve

- It is the ventral Ramus of a thoracic spinal Nerve
- Branches ⇒ Antero-cutaneous branch; } → Anything else if it is supplying; it is ⇒ Atypical
  Lateral-cutaneous branch; }
  Muscular branch

- Typical Intercostal Nerves are ⇒ T_3-T_6
- Atypical Intercostal Nerve ⇒ T_1 ⇒ Joins the brachial plexus & supplies the upper limb.
  T_2 ⇒ Lateral cutaneous Branch of T_2 joins ⊂ Medial cutaneous Nerve of Arm via Intercostobrachial Nerve

http://mbbshelp.com

→ The Lower i/c Nerves supplies the Muscle of Anterior Abdominal walls (T_7-T_{12}).

* Parietal pleura is pain sensitive & supplied by i/c & Phrenic Ne
* visceral pleura is pain insensitive & supplied by Autonomic Nerv

PLEURA & LUNG

	Mid-clavicular	Mid-axillary	Mid-scapular
LUNG →	6th Ribs	8th Ribs	10th Ribs
PLEURA →	8th Ribs	10th Ribs	12th Ribs

* Pulmonary / visceral pleura is supplied by Symphathetic (T_2-T_6 segm & Parasymphathetic (Vagus N.)
* The Mediastinal & diaphragmatic pleura are supplied by phrenic Nerve
* The costal & cervical pleura are supplied by Intercostal Nerve
* Apex of the Lungs projects 5 cm above the 1st Rib & 2.5 cm ab the clavicle. ↳ covered by Cervical Pleura
  ↳ Further covered by Sibson's fascia / cervic fascia

diaphragm / supphrenic Membrane

http://n... WhatsApp: +1 (402) 235-1297

NEET'18

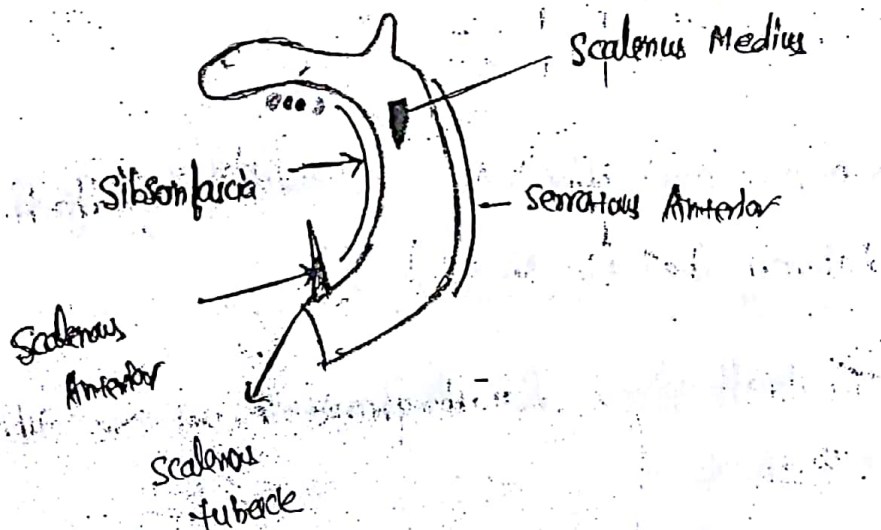
Sibson's fascia ⇒ extends from transverse process of C7 to inner border of 1st Rib laterally.

Oral-diaphragm ⇒ Formed by Mylohyoid;

Pelvic-diaphragm ⇒ Formed by Levator Ani;

Urogenital-diaphragm ⇒ Formed by Sphincter Urethrae
Deep transverse perinei

→ **Structure attaches to the 1st Rib** ⇒



CHASSAIGNAC TUBERCLE ⇒ Ant. tubercle of transverse process of C6 Vertebrae

Relation of the Neck of 1st Rib ⇒ ① Sympathetic chain
② 1st Posterior I/C vein
③ Sup. Intercostal Artery
④ 1st thoracic Nerve

SVAN (Med → Lateral)

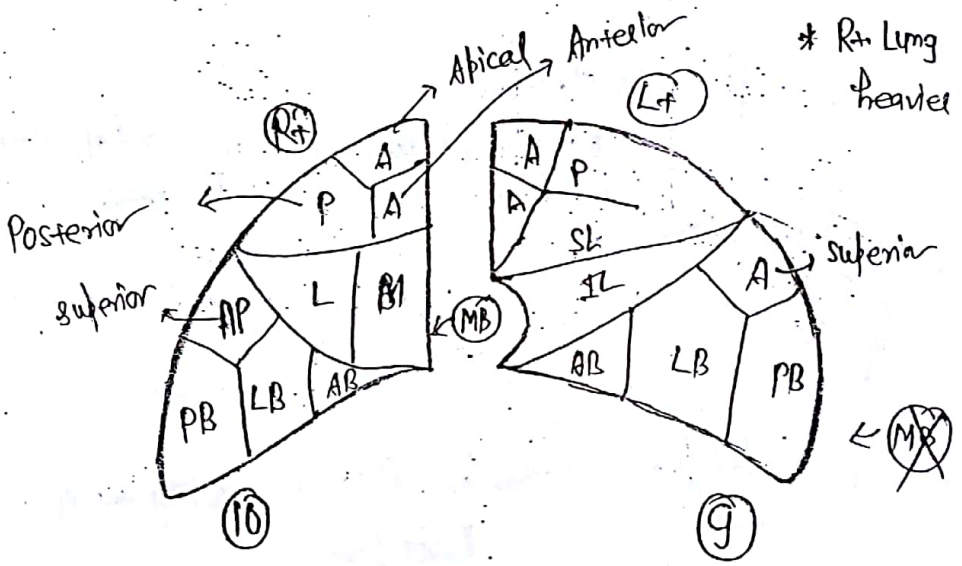
http://mbbshelp.com WhatsApp: +1 (402) 235 1397

Relation of Ala of Sacrum ⇒ Sympathetic chain
SLIO (Med + Lateral) Lumbosacral trunk
Iliolumbal Artery
Obturator Nerve

* TRUE RIBS :→ Directly articulates ē sternum through costal cartilage eg = 1st to 7th Ribs
* FALSE RIBS :→ 8th to 12th Ribs don't articulate directly ē the sternum.

NEEDS ⇒ 8th, 9th & 10th Ribs are attached to 7th Ribs by ⇒ Synovial joints.
* 11th & 12th Ribs have No costal cartilage & they have Anterior ends (Floating Ribs).
↳ Surgically Resectable.

BRONCHOPULMONARY SEGMENT ⇒ Largest Subdivision of a Lobe
– Part of the Lung supplied by one Tertiary branches.



* Rt Lung is shorter; wider & heavier (625gm) than Left Lung (565g

http://mbbshelp.com WhatsApp. +_ 33-1397

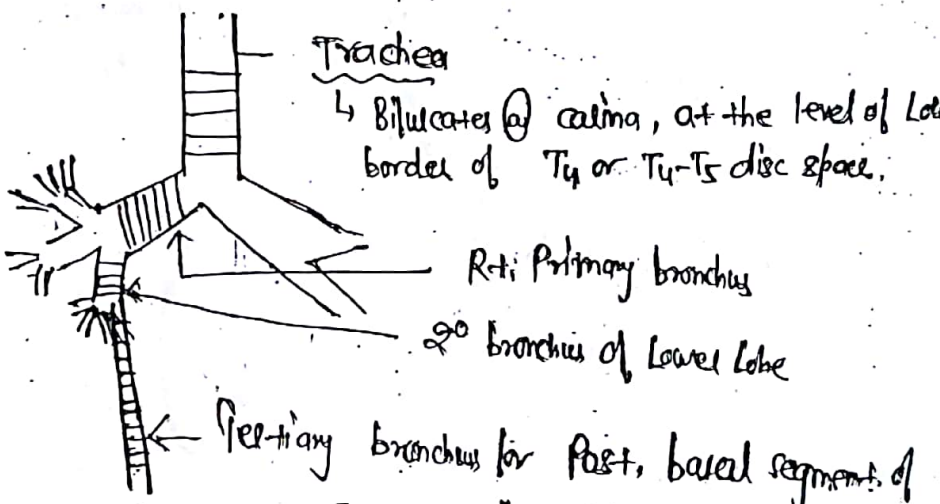
→ Each broncho pulmonary segment is conical in shape

- It has its — Pulmonary Artery & Tertiary bronchus.

- The Pulmonary veins are — Intersegmental.

- A foreign body entering the Nose ; enters into Posterior basal segment of the Right Lung.

- Aspiration Pneumonia is common in ⇒ (Apical segment of Lower Lobe / superior segment of Lower lobe OR Posterior segment of upper Lobe) ← b/c of Most dependent part of Lung while in supine position..



* Structure which arches ē the hilum of Rt. Lung ⇒ Azygous vein
Structure which arches ē the hilum of Lt. Lung ⇒ Arch of Aorta

Nerve in front of hilum ⇒ Phrenic N.
Nerve Behind hilum ⇒ Vagus N.

QQ * Bronchial Arteries supply the Lung till the beginning of Respiratory bronchiole (conducting part) & then Anastomose ē Pulmonary arteries.

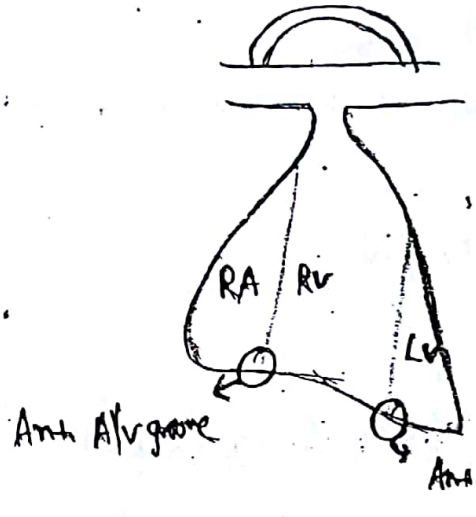
http://mbbshelp.com WhatsApp: +1 (402)-235-1397

HEART & PERICARDIUM

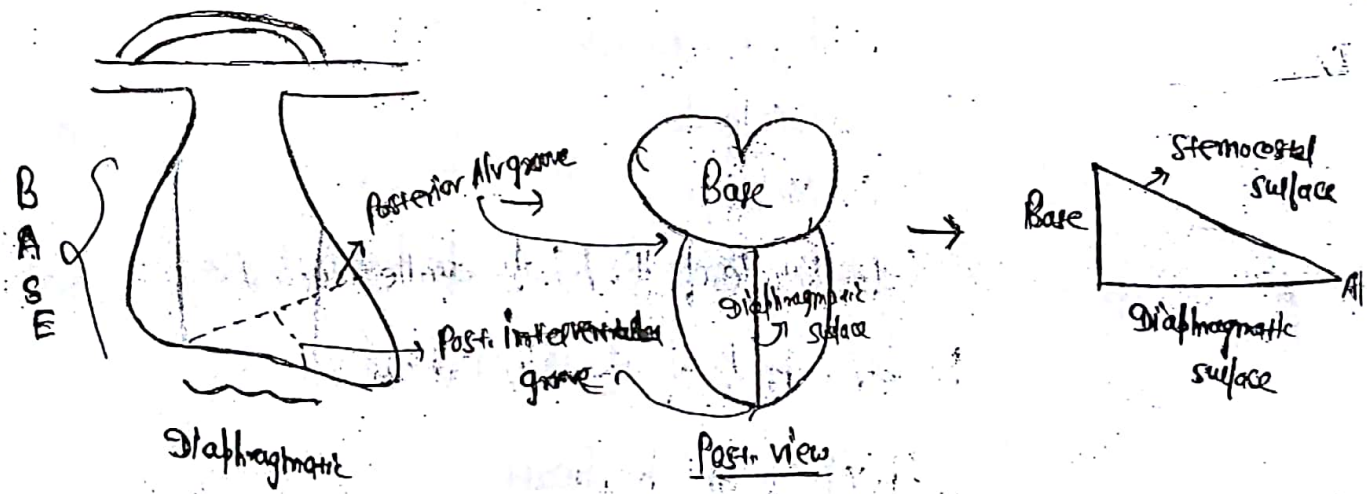
↳ Sympathetic innervation of heart
↳ $T_1 - T_5$ (cardiostimulatory)

* Parasympathetic innervation of heart
↳ Vagus Nerve (cardioinhibitory)

Sternocostal surface of heart :⇒



Sternocostal surface of heart
⇓
Main part ⇒ "Rt. ventricle"



* Base of the heart is formed by ⇒ Both the Atria ⌐ Major part by Left Atria

* The groove which separate Base from Diaphragmatic surface
⇓
Posterior A/V groove

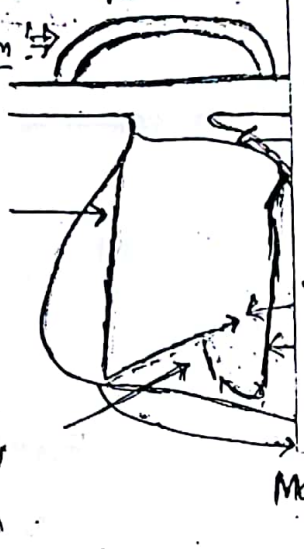
* Apex of the heart is formed by ⇒ Left ventricle

Right ventricle ⇒ • Most Anterior (sternocostal) surface of heart; it forms inferior bord of heart.
• Triangular in shape, on cross section it appears like a crescent.
• wall thickness ⇒ 3-5 mm

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Trigonum Fibrosum Sinistrum ⇒
Fibrous tissue b/w Aortic & Mitral Rings

* Trigonum Fibrosum Dextrum ⇒
Fibrous tissue b/w AV Rings & Aortic Rings



Heart Valve	Surface Marking	Auscultatory Area
• MITRAL →	Sternal end of Left 4th costal cartilage	cardiac Apex.
• TRICUSPID →	Right half of sternum along 4th & 5th intercostal spaces	Right Lower end of sternum.
• AORTIC →	Sternal end of Left 3rd costal cartilage	Right 2nd intercostal space
• PULMONARY →	Sternal end of Left 3rd costal cartilage (upper end)	Left 2nd intercostal space

Right Coronary Artery (RCA)

Supplies ⇒ Right Atrium ;
Right ventricle ;
SA Node ;
AV Node
Left Bundle of His (Left bundle branch)
Posterior 1/3rd of the I/V septum
Apex of the heart

LCA (Left coronary Artery)

Supplies ⇒ Left Atrium
Left ventricle
Left & Right Bundles of His
Anterior 2/3rd of I/V septum
Apex of the Heart

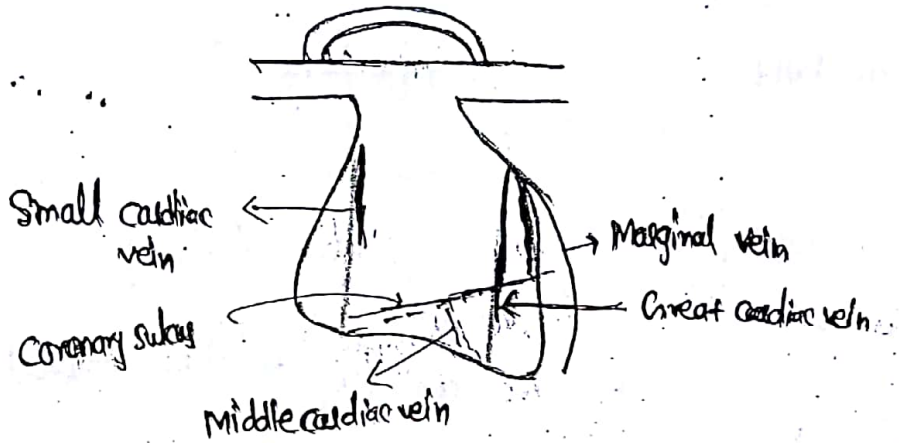
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* The Posterior i/v artery is the branch of Rt. coronary
In 85% of the cases ⇒ Rt. coronary dominance

* if it is a branch of circumflex ⇒ Lt. coronary dominance

* if both gives this branch ⇒ Co-dominance

VEINS OF HEART



QQ Coronary Sulcus is ⇒ Posterior A/V groove

QQ All the veins drain in coronary sinus except

↓

Anterior Cardiac vein
Vene cordae Minimi (Thebasian vein)

↓ drain into

Rt. Atrium

* Oblique Sinus of the pericardium lies behind Lt. Atrium.
↳ to accommodate more blood coming from Pulmonary veins

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Right Atrium

- The Line joining SVC to IVC from outside is k/a "Sulcus terminalis"
- The same Line from inside is k/a "Crista terminalis"
- It divides Rt Atrium

Rough part

↓

Shows structure similar to teeth of comb

↓

k/a "Musculus Pectinati"

Soft part

↓

Shows the opening of
- SVC & Guarded by Eustachian valve
- IVC
- Coronary sinus – guarded by Thebasian valve

- Fossa ovalis is Represented by "Septum primum"
- Limbus Fossa ovalis is Represented by "Septum secundum"
- **Triangle of Koch** –

Boundaries – ① Septal Leaflet of Tricuspid valve
② Opening of Coronary sinus
③ Tendon of Todaro

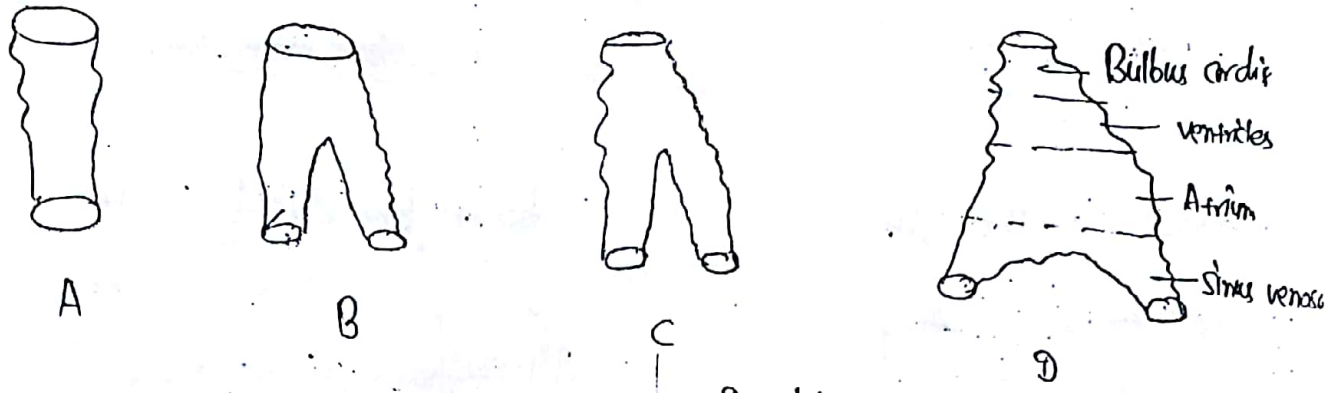
- AV Node is lies in this triangle
- SA Node Lies in the Junction of SVC & Rt. Atrium

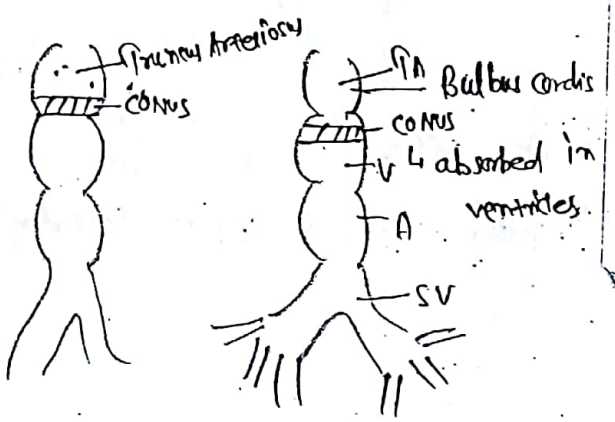
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Embryology of Heart & Blood vessels

Heart tube is formed by Hyaluronic acid secreted by Myocardium (NEET'16)

Heart tube or Tubular heart is formed at ⇒ 3 weeks (NEET'16)





- Development of Right Atrium ⇒

PART	DERIVED FROM
• Smooth Posterior wall	→ Right horn of Sinus venosus
• Rough Anterior wall	→ Primitive Atrial chamber
Interatrial septum	→ Septum Primum & Secundum

Sinus horns ⇒ Portal vein, Hepatic vein, enteric vein & hepatic segment of IVC

Sinus venosus develops from ⇒ Right vitelline vein (R.V.); Left vitelline vein & Dorsal Anastomosis b/w the two.

* Veins draining in the Sinus venosus

② Vitelline from Yolk sac;

③ Common cardinal from body wall

* Fate of Sinus venosus ⇒ The Rt. & Left horn of Sinus venosus opens in the Atrium through Sino atrial orifice.

- The Left horn becomes small in size; gets detached from the atrium forms Coronary Sinus and now opens into the Rt. horn.
- The Right horn is absorbed into the atrium ⇒ Septum Spurium

It is bounded by Left & Right Venous valve

- The Left fuses with Interatrial septum &

WhatsApp: +1 (402) 235-1397

Interventricular septum

Muscular part ⇓ Grows in the floor of the ventricular cavity

Membranous part ⇓ derived from ⇒ ① Bulbar septum ⇓ Formed in conus ② Proliferation of AV cushion.

- Final closure of foramen ovale occurs d/t fusion of "Septum primum & septum secundum"

Truncus Arteriosus ⇒ The Aortico-pulmonary septum divides the truncus arteriosus into Ascending aorta & Pulmonary trunk.

- Failure of Migration of Neural crest cells in this segment Results in —

① **TOF** :⇒ M/c cyanotic congenital heart defects
↳ occurs when septum shift Anterior & to the Right ; leading to ⇒ Pulmonary stenosis
RVH;
Membranous i/v septal defect;
Overriding of Aorta.

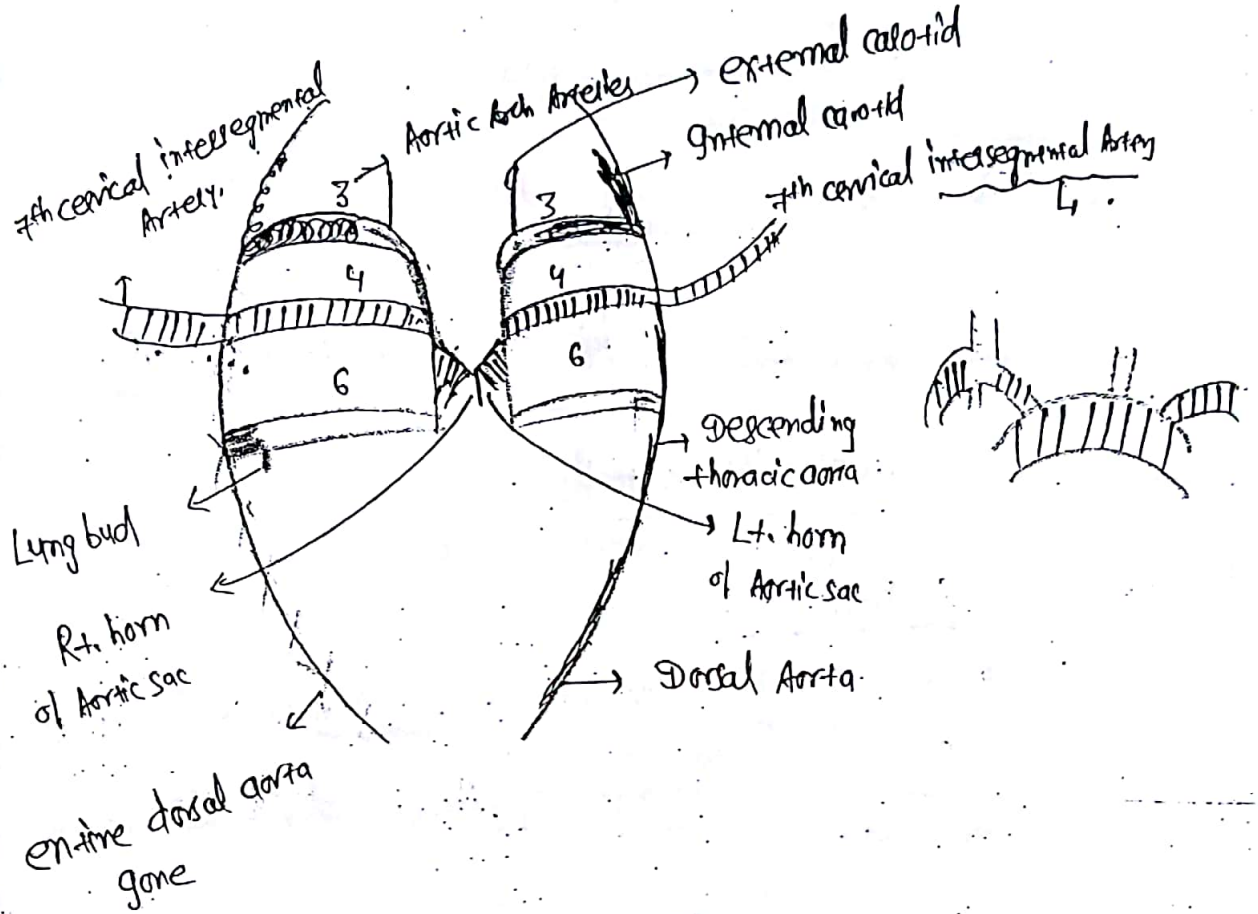
② **Transposition of great vessel** ⇒
↳ occurs when Septum fails to develop into Spiral Manner
↳ Aorta Arise from → Rt ventricle

M/c d/t cyanosis immediately after birth

http://mbbshelp.com WhatsApp +1 (402) 235-1397

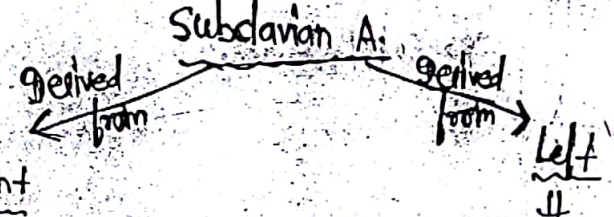
③ Persistant truncus Arteriosus ⇒

↳ occurs when septum fails to develop, a single vessel carry blood from both ventricles.



ARCH OF AORTA

derived from → Left horn of Aortic Sac & the left 4th arch Artery



http://mbbshelp.com WhatsApp: +1 (402)

Brachiocephalic trunk

derived from ⇒ Rt. horn of Aortic sac

Pulmonary Arteries

derived from - 6th arch arteries

Ductus Arteriosus

derived from - Left 6th arch arteries b/w Lung bud & the dorsal Aorta

Common carotid

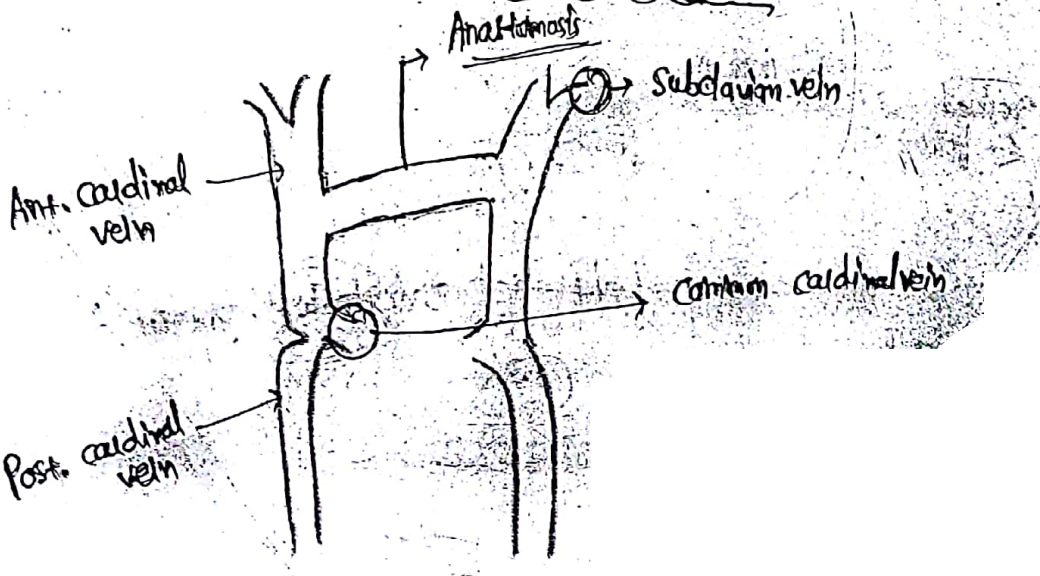
derived from - 3rd Arch arteries

- it gives a bud for external carotid & itself continues as internal carotid along with dorsal Aorta

Descending thoracic Aorta

- derived from Left dorsal Aorta

Development of vein



http://mbbshelp.com

Internal Jugular vein

- derived from Ant. cardinal veins above the attachment of subclavian vein.

Right Brachiocephalic vein

Derived from ⇒ Rt. Ant. cardinal vein b/w subclavian vein & Anastomosis

Lt. Brachiocephalic vein

Derived from ⇒ Lt. Ant. cardinal vein subclavian vein & Anastomosis & Anastomosis itself

Superior Vena Cava

derived from ⇒ Rt. Anterior cardinal vein below Anastomosis;
- Rt. common cardinal vein

- A left sided SVC drains into ⇒ Coronary Sinus

Develops from ⇒ Coronary Sinus
- Lt. common cardinal vein
- Lt. horn of Sinus venosus

* Left. superior i/c veins ⇒ derived from left Anterior cardinal vein below the anastomosis
  Proximal part of left posterior cardinal vein.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Diaphragm

derived from :⇒
Septum transversum

- Dorsal & ventral Mesentry of oesophagus;
- Body wall
- Pleuro-peritoneal Membranes

- Muscles are derived from ⇒ Cervical Myotomes

- Bochdalac's Hernia ⇒ A Postero lateral defect in the development of diaphragm d/t Non-fusion of Pleuro-peritoneal Membrane.

Root of

- Lies opposite to T7 s
- Arrangement of structures
- Anterior to Posterior →

(V-A-B)

Relations of the Hilum of the Lung

Anterior ⇒ common on both side ⇒ • Phrenic Nerve
• Pericardiophrenic vessels.
• Anterior pulmonary plexus

on Rt. side ⇒ • SVC
• Part of Rt. Atrium.

Posterior ⇒ common on both side ⇒ • Vagus Nerve
• Posterior pulmonary plexus

on left side ⇒ • Descending Thoracic Aorta

Superior ⇒ on Rt. side ⇒ Terminal part of Azygous vein

on left side ⇒ Arch of Aorta

Inferior ⇒ Pulmonary Ligament.

Bronchus

- Superior to Inferior →

Right	Left
AIIMS 07 • Pulmonary Artery	• Epiarterial bronchus (Superior Most) NEET 16
AIIMS 15 • Bronchus (1° Bronchus)	• Pulmonary Artery
• Pulmonary vein	• Hyparterial bronchus
	• Inferior pulmonary vein (Inferior Most) 99

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

MEDIASTINUM

- Middle space left in thoracic cavity in b/w the Lungs.
- divides into Superior & Inferior by a imaginary line from Sternal Angle to lower border of T_4. (NEET'16).

(I) Superior Mediastinum ⇒

Retrosternal
- Sternohyoid Muscle
- Sterno-thyroid Muscle
- Thymus

Intermediate
- Formation of SVC
- Arch of Aorta & its branches
- Vagus & Phrenic N.

Pre-vertebral
- Trachea (10–15 cm Long)
- Esophagus
- Left Recurrent Laryngeal N.
- Thoracic duct

(II) Inferior Mediastinum ⇒

Anterior
- Superior & Inferior sterno-pericardial Ligaments

Middle
- Heart & pericardium;
- Bifurcation of Trachea;
- Ascending Aorta;
- Rt. & Lt. Pulmonary vein;
- Phrenic Nerve

Posterior
- Esophagus
- Thoracic duct
- Descending thoracic Aorta
- Azygous vein
- Splanchnic Nerve from lower 8 thoracic ganglia
- Hemiazygous vein & Accessory he

* ESOPHAGEAL CONSTRICTIONS

NUMBER	Distance from Incisor	Bony Level	Anatomical Landma
1	15 cm (6 inch)	C_6	At its beginning (Pharyngo-esophageal junctio
2	22.5 cm (9 inch)	T_4	crossing of Aortic Arch
3	27.5 cm (11 inch)	T_6	crossing of Left Main Bro
4	37.5 cm – 40 cm (15-16 inch)	T_{10}	Piercing diaphragm (At LE

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* INTER-ATRIAL SEPTUM

- Septum primum grows from the wall of the Atrium towards the A-V cushion.
- opening b/w them is klas → "Foramen Primum".
- Septum primum fuses c the A-V cushion & breaks off
  ⇓
  this opening is klas "Foramen Secundum"
- Another septum starts to grow from wall of the Atrium
  ⇓
  klas "Septum Secundum"
  ⇓
  - Lies Next to septum primum.
  - opening b/w them is klas "Foramen ovale"
- Final closure of Foramen ovale occurs d/t fusion of Septum primum & Septum Secundum.

ASD (Atrial septal Defect)

1. Septum Secundum type of ASD ⇒ M/c ASD
   - Occurs d/t excessive Resorption of septum primum or Underdevelopment or Reduced size of septum Secundum.
2. Septum primum type of ASD ⇒
   - Failure of Septum primum to fuse c endocardial cushion.
   - May be combined c defects of endocardial cushion.

NEET '16

* BLOOD SUPPLY OF ESOPHAGUS

PART OF ESOPHAGUS	ARTERIAL SUPPLY	VENOUS DRAINAGE
Cervical →	Inferior thyroid Artery	Inferior thyroid veins
Thoracic →	Esophageal branch of descending thoracic Aorta, Bronchial Arteries	Azygous veins
Abdominal →	Left gastric Artery, Left Inferior phrenic Artery	Left gastric veins

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

ABDOMEN & PELVIS

DIAPHRAGM

Origin :-

- **Sternal** ⇓ **Xiphoid process**
- **Costal** ⇓ **Inner aspect of Lower 6 Ribs.**
- **Vertebral** ⇓
  - i) Rt. & Lt. crus ;
  - ii) Medial arcuate Ligament (Thickening of Psoas fascia)
  - iii) Lateral arcuate Ligament (Thickening of Ant. layer of ~~thoraco~~ lumbar fascia)

Insertion ⇒ Central tendon

* AIIMS NOV17 Caval opening @ the level of T_8 vertebral passes through the "central tendon of Diaphragm

Openings of diaphragm :-

			Part of diaphragm
T_8	⇒	IVC ; Rt. Phrenic Nerve	• Central tendon (AIIMS 1
T_{10}	⇒	Esophagus c Rt. & Lt. vagus	• Muscular portion derived from Right crus
T_{12}	⇒	Aorta c Azygous vein & thoracic duct	• B/w Right & Left crus (Posterior to diaphragm,

* The Sympathetic chain enters the Abdomen behind Medial Arcuate Ligament

* The Subcostal Nerve & vessels enters behind — Lateral Arcuate Ligament.

* Foramen of Morgagni / space of Larrey — A small defect b/w sternal & costal origins of diaphragm, the Superior epigastric vessels enters the abdomen through this gap

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

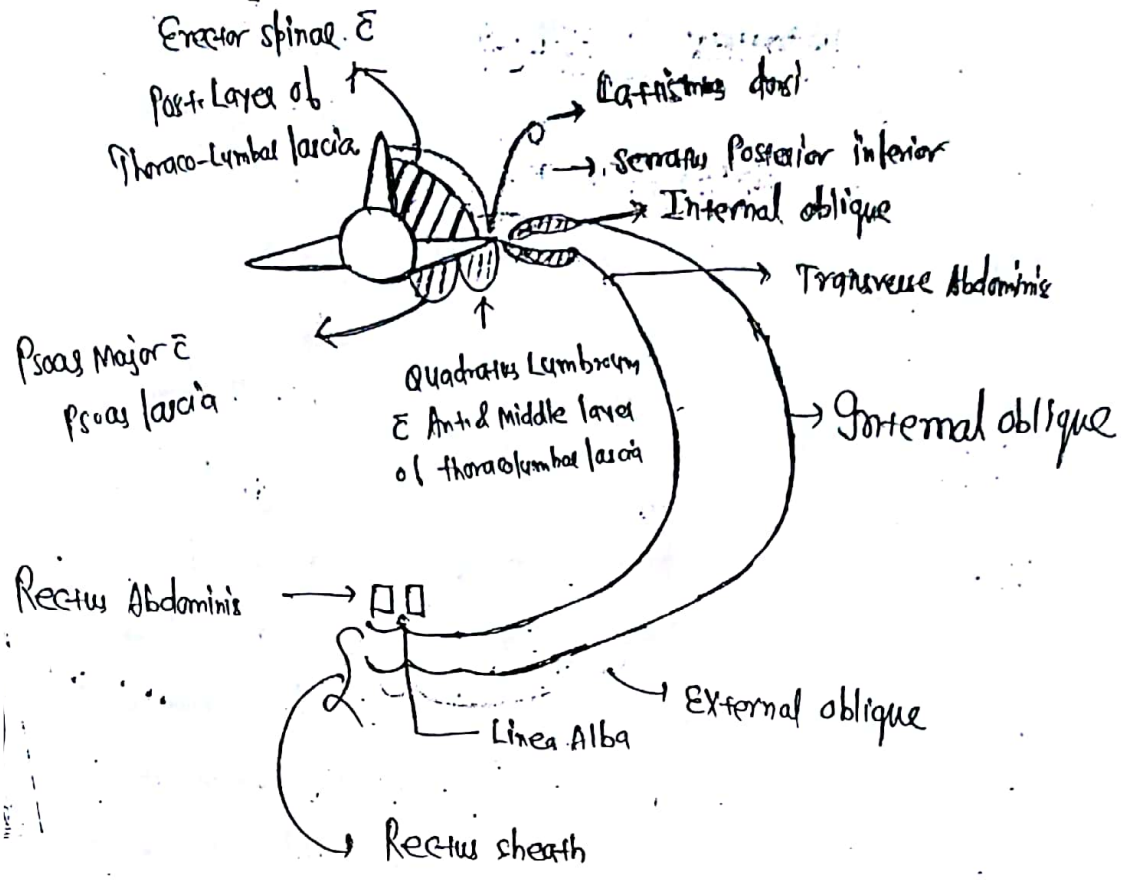
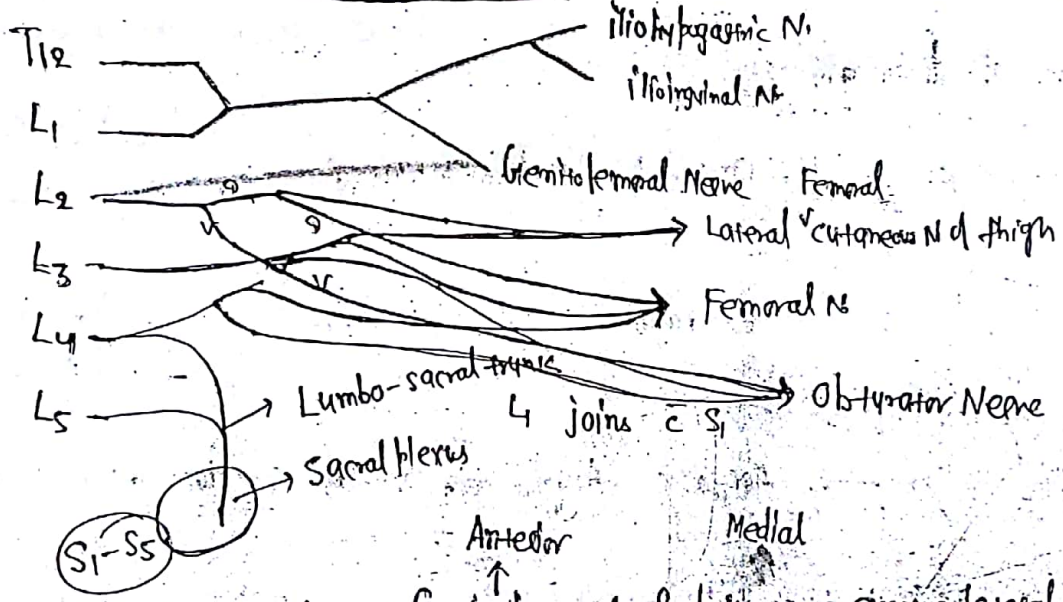


Fig: Posterior Abdominal wall (cut section of Abdomen)

LUMBER PLEXUS

↳ Formed from Anterior Rami of L_1-L_4; inside Psoas Major Muscle & also from T_{12}.



* All the Nerve except → Genitofemoral & obturator emerge lateral to Psoas Major.
* Nervus fugalis → L_4 (takes part in the formation of Lumbar & Sacral plexus)
* Largest branch of Lumbar plexus → Femoral N.
* N. lying in Ilio-Psoas groove → Genitofemoral N.

http://mbbshelp.com WhatsApp +1 (302) 285-1397

Abdominal Aorta & its branches (2,3,4,5)

2 → Terminal branches at L_4 — Common iliacs

3 → Ventral branches

- Coeliac trunk (T_{12}) ⇓ Supplies the foregut
- Superior Mesenteric (L_1) ⇓ Midgut
- Inferior Mesenteric ⇓ Hindgut.

4 → Lateral branches → all in Pairs

- Inferior phrenic
- Middle supra-renal
- Renal
- Gonadal

5 → Dorsal branches

- 4 Pairs of Lumbar arteries
- 1 Median Sacral Artery.

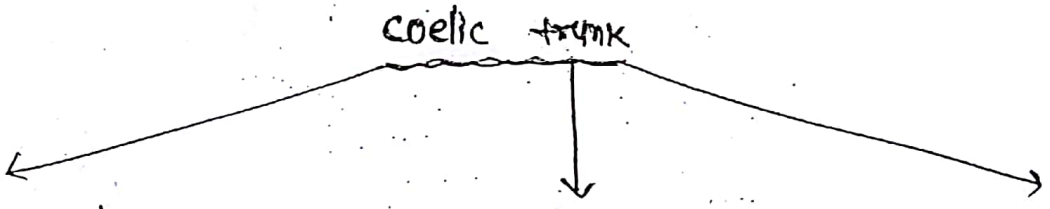
* Nut cracker sign's refer to ⇒ Left Renal vein.
* L_5 vertebrae is supplied by ilio-lumbar artery, branch of posterior division of Internal iliac Artery

http://mbbshe

Foregut ⇒ extends from Mouth to upper half of 2nd part of duodenum upto the opening of the bile duct
- Also includes Liver, Pancreas & Spleen.

Midgut ⇒ extends from Lower half of 2nd part of duodenum to Rt. 2/3rd of transverse colon.

Hindgut ⇒ extends from Left 1/3rd of transverse Colon to Anal canal.



Left gastric A.
- Runs along the lesser curvature in the lesser omentum & anastomoses c Rt. gastric arteries

Splenic A

Branches →
1. Pancreatic branches
2. Short gastric branches
3. Left gastro epiploic A.

Runs along the superior border of body of Pancreas to enter the hilum of spleen.
- Lies in Lieno-Renal Ligament

common hepatic A
3 branches

QQ "Arteria Pancreatica Magna" ⇒ Branch of Splenic A

QQ "Posterior gastric Artery" ⇒ Branch of Splenic A.

http://mbbshelp.com WhatsApp: +1(202) 235-1397

Common hepatic A.

Rt. gastric | Gastro-duodenal | Hepatic Artery Proper

Gastro-duodenal → Rt. gastro-epiploic Artery | Sup. Pancreatico duodenal Artery

Sup. Pancreatico duodenal Artery ↓

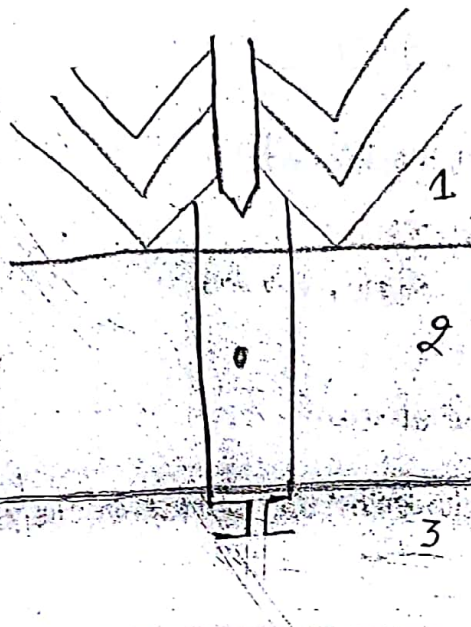
enters the Pancreatico-duodenal groove & Anastomosis c the Inferior pancreatico-duodenal which is the 1st branch of Sup. Mesentric Artery.

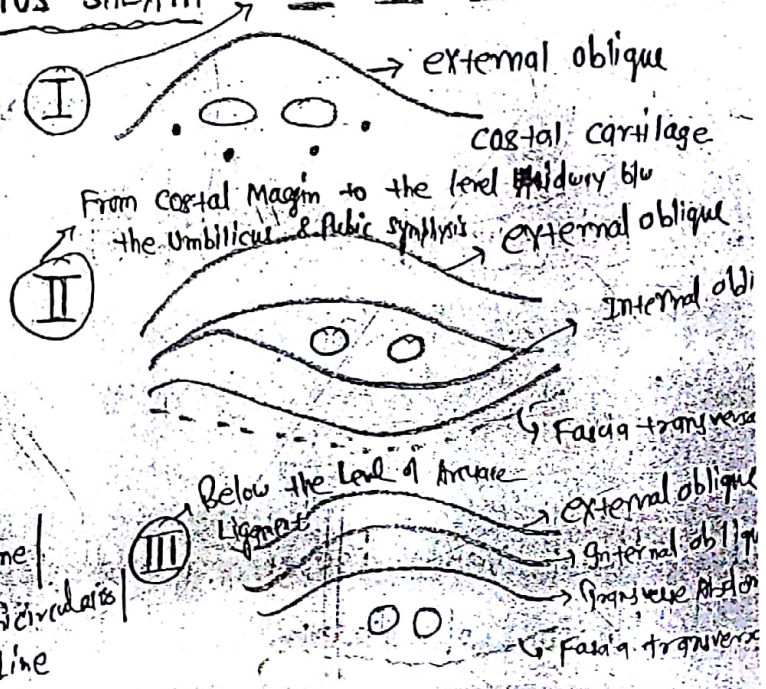
* Grillith's point (Junction of Right 2/3rd & Left 1/3rd of transverse colon)
↳ watershed Line

⇒ Anastomosis b/w Superior Mesenteric Artery (Middle colic) c Inferi Mesenteric Artery (Left colic).

* Sudeck's point → @ Recto-sigmoid junction; Anastomosis b/w Inf. Mesentry artery (superior Rectal) c Internal iliac (Middle & Inf. Rectal Artery).

* RECTUS SHEATH





http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Portal vein

- Length ⇒ 8cm & Formed by Union of Superior Mesenteric vein & splenic vein behind the Neck of Pancreas.

i) Supra-duodenal part ⇒ Anterior & Right ⇒ Bile duct

Anterior & Left ⇒ Hepatic artery

Posterior ⇒ IVC separated by epiploic foramen.

ii) Retro-duodenal part ⇒

Anterior & Right ⇒ Bile duct

Anterior & Left ⇒ Gastro-duodenal A.

Posterior ⇒ GVC

iii) Infra-duodenal part ⇒

Anterior ⇒ Neck of the Pancreas

Posterior ⇒ GVC

* Tributaries of Portal vein ⇒ Left gastric vein,
Right gastric
Superior pancreatico-duodenal;
cystic
Para-umbilical veins

* Portal vein passes behind 1st part of duodenum; so; divided on the Location of duodenum.

http://mbbshelp.com WhatsApp: +1 (492) 235-1397

Bile duct ⇒ Formed by Union of cystic & common hepatic duct.

↳ Gall bladder ⇒ Lies on the Inferior surface of Liver close related to segment IV or the quadrate lobe

Length ⇒ 8cm

i) Supra-duodenal part ⇒ Left ⇒ Hepatic Artery

Posterior ⇒ Portal vein

ii) Retro-duodenal part ⇒

Left ⇒ Gastroduodenal A.

Posterior ⇒ IVC

iii) Infra-duodenal part ⇒

Anterior ⇒ Head of the Pancreas.

Posterior ⇒ IVC

NEET PG QQ Canal of Hering / Intrahepatic bile ductules ⇒ Part of outflow system of exocrine bile products from the Liver.

Superior Mesenteric Artery

Branches ⇒ Inferior Pancreatico-duodenal A.

Jejunal & ileal branches

Middle colic

Rt. colic

Ileo colic → Ascending branch

→ Descending branch

↓

a) Ant. cecal

b) Post. cecal

c) QQ Appendicular

d) Iliac - supply last part of ilium,

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Recurrent appendicular Artery

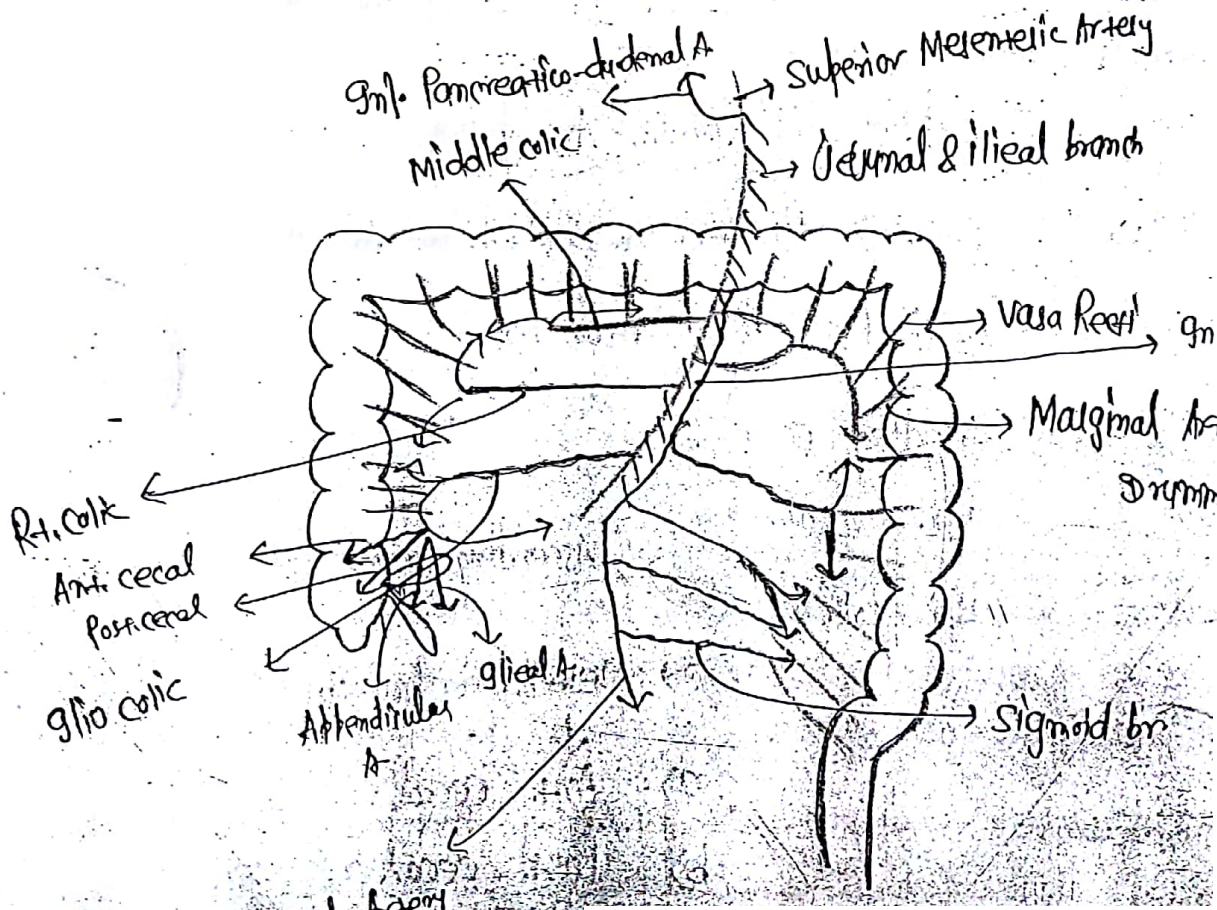
↳ Branch of Appendicular / Post. cecal Artery

Accessory appendicular Artery of SHESHACALAM

↳ Branch of Post. cecal Artery

* Inferior Mesenteric Artery

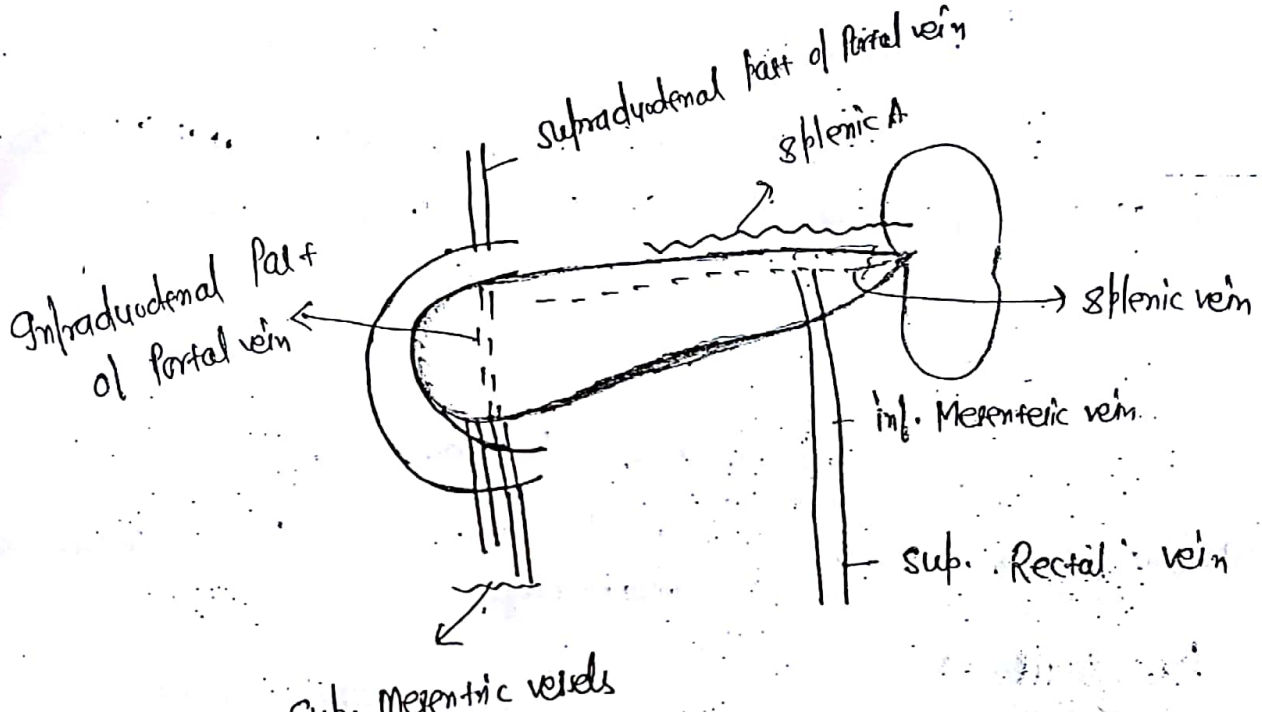
Branches – Left colic
– Sigmoid branches
– Superior Rectal arteries (continuation of Inf. Mesenteric A.)



http://mbbshelp.com

* Blood vessels Related to Pancrease ⇨

Along the Superior border of the body → Splenic Artery
Behind the Body → Splenic vein
On the Uncinate proces → Sup. Mesenteric vessels
Behind the Neck of Pancreas → Portal vein



Inferior vena cava

- Formed at L_5 by two common iliacs.
- Tributeries ⇒ common iliacs
  Rt & Lt Renal
  Rt Suprarenal
  Rt Gonadal
  Hepatic veins
  Inferior phrenic veins
  3rd & 4th Lumbal veins

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

ANTERIOR ABDOMINAL WALL

Layers ⇒ i) Skin;
ii) Superficial fascia: → Superficial Fatty Layer (Fascia of camper or camperi's fascia)
→ Deep Membranous Layer (Fascia of Scarpa or scarpa's fascia)
Superficial to Deep
iii) External oblique Muscle;
iv) Internal oblique Muscle;
v) Transversus Abdominis Muscle;
vi) Fascia transversalis;
vii) Extraperitoneal tissue;
viii) Parietal Layer of Peritoneum.

* Deep Fascia is absent in the Anterior Abdominal wall to allow the bulging of abdominal wall after Meal; during Pregnancy etc

Inguinal canal (Length = 4-6cm)

↳ extends from deep Inguinal Ring to superficial Inguinal Ring.

Boundaries ⇒

Ant. wall ⇒

On its entire extent → External oblique

On its lateral part → Internal oblique & transverse abdominis

Post. wall ⇒

On its entire extent → Fascia transversalis

On its Medial part ⇒ Conjoint tendon

Roof ⇒ Conjoint tendon

Floor ⇒ External oblique & Inguinal Ligament.

http://mbbshelp.com WhatsApp: +1 (462) 235-1397

AI+B

* Superficial Inguinal Ring ⇒ defect in External oblique Aponeurosis,
* Deep Inguinal Ring ⇒ defect in Fascia transversalis,
* Conjoint tendon is formed by Fusion of Aponeurotic fibres of internal oblique & Transversus Abdominis.

Coveing of testis

External spermatic Fascia → derived from external oblique Aponeurosis,

Cremastric Fascia ⇒ derived from cremaster/ Internal oblique

Internal Spermatic Fascia ⇒ derived from fascia transversalis

Tunica vaginalis ⇒ derived from Peritoneum (Mainly Parietal)

Tunica Albuginea ⇒ covering of connective tissue

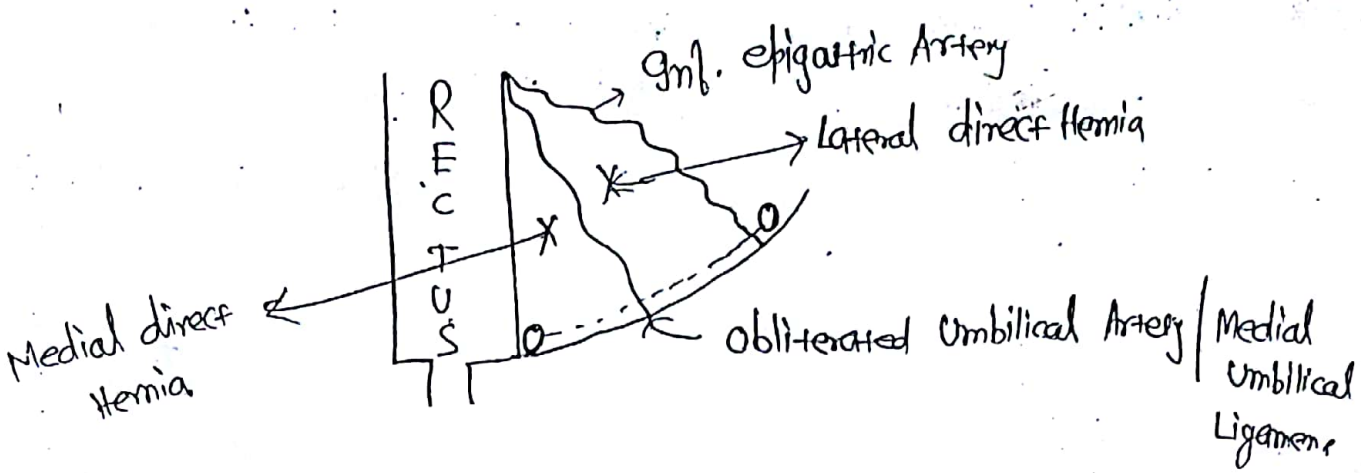
Tunica vasculosa ⇒ covering of Blood vessels

CONTENTS OF SPERMATIC CORD

- Vas deferens (Ductus deferens)
- Artery to the vas (Branch of Superior vesical Artery)
- Cremastric Artery — Branch of Inferior epigastric Artery
- Testicular Artery — Branch of Abdominal aorta
- Pampiniform plexus of veins
- Genital br. of Genitofemoral Nerve
- Lymphatics from the testis
- Sympathetic Nerve fibres

Mnemonics ⇒ Pills Dont Contribute To Good sex Life

http://mbbshelp.com WhatsApp: +1 (402) 235-1397



Median Umbilical Ligament ⇒ Obliterated Urachus / Allantois

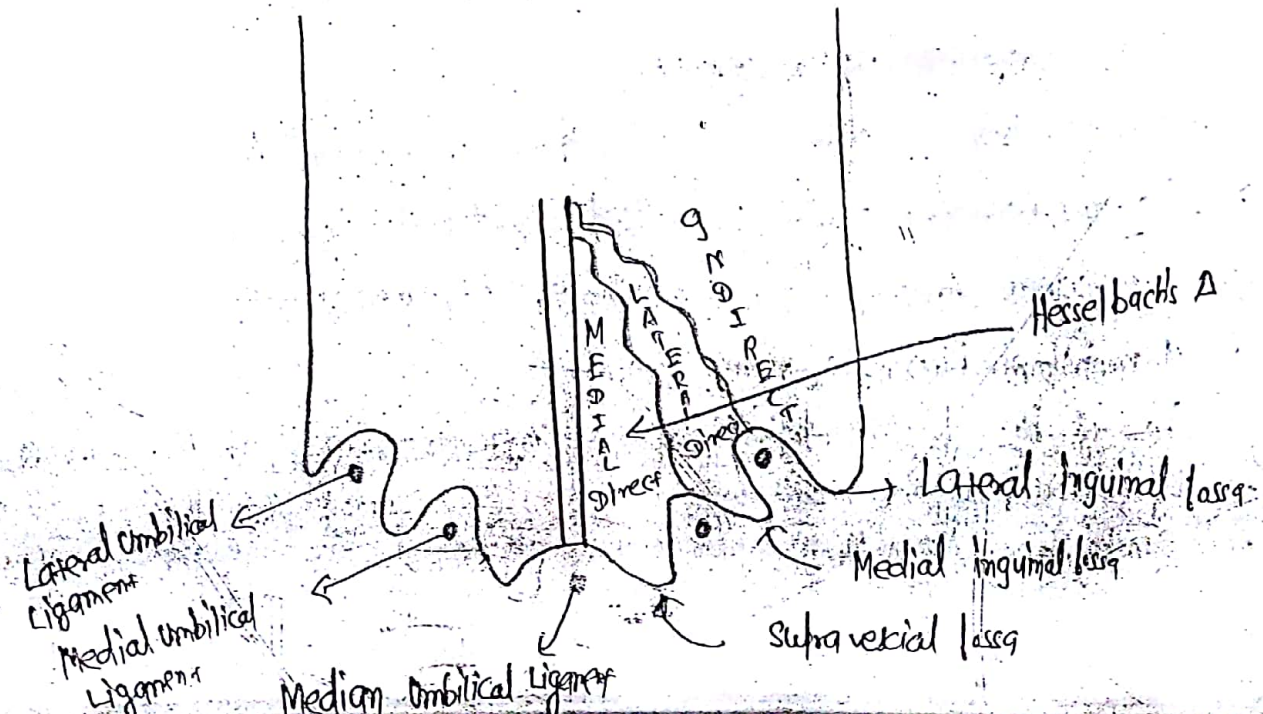
⇓

If it doesn't obliterate

→ Weeping Umbilicus

Medial Umbilical Ligament ⇒ obliterated Umbilical Artery

Lateral Umbilical Ligament ⇒ It is fold of Peritoneum ; which covers inferior epigastric Vessels.



http://mbbshelp.com WhatsApp: +1(402)235-1397

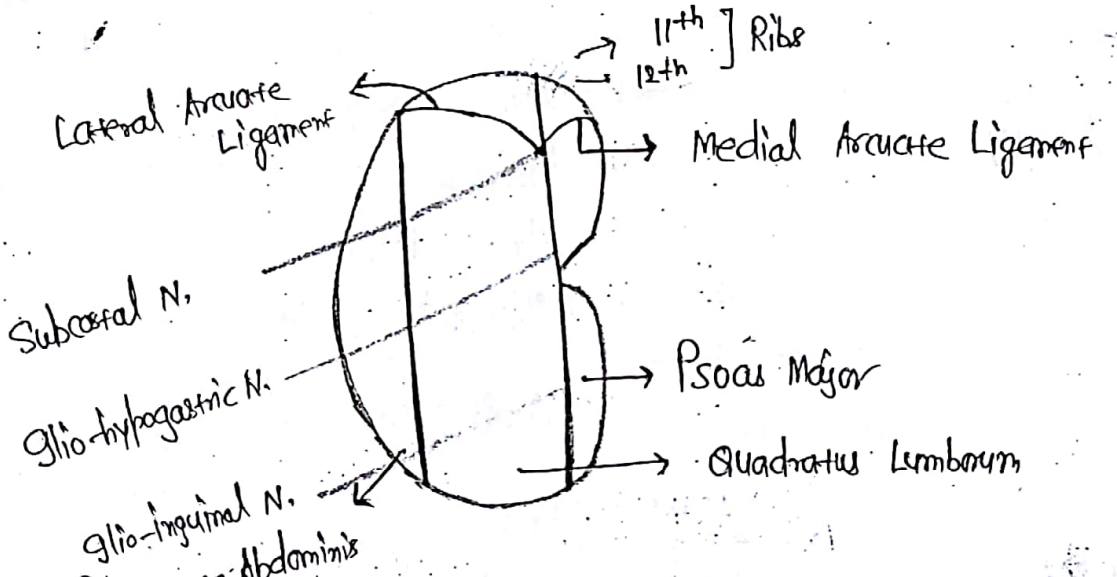
* Hesselbach's Δ → Medial Border → Lateral Margin of Rectus sheath (Linea Semilunaris);

Superolateral Border → Inferior epigastric vessels.

Inferior Border → Inguinal Ligament (Poupart's Ligament).

KIDNEY

Posterior Relations of kidney ⇒ of both kidney are same except Rt. Kidney is Related to only 12th Rib; while Left Kidney related to both 11th & 12th Ribs.



Left Kidney

* Venous drainage of Kidney ⇒ • Renal veins (both Left & Right) drains into IVC;
• Left Renal vein is Longer & passes in front of Abdominal Aorta; behind origin of Superior Mesenteric Artery.
• Left Renal vein also receives Lt. Inferior phrenic vein; Lt. gonadal vein & Lt. Suprarenal (Adrenal gland);
• Each Renal vein begins beneath the true capsule as "Stellate vein".

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Anterior Relation of ⇒ (A) Right Kidney ⇒

- Rt. Supra Renal gland
- Liver
- 2nd part of duodenum
- Ascending colon
- Hepatic flexure of the colon:
- Small Intestine

(B) Left Kidney ⇒

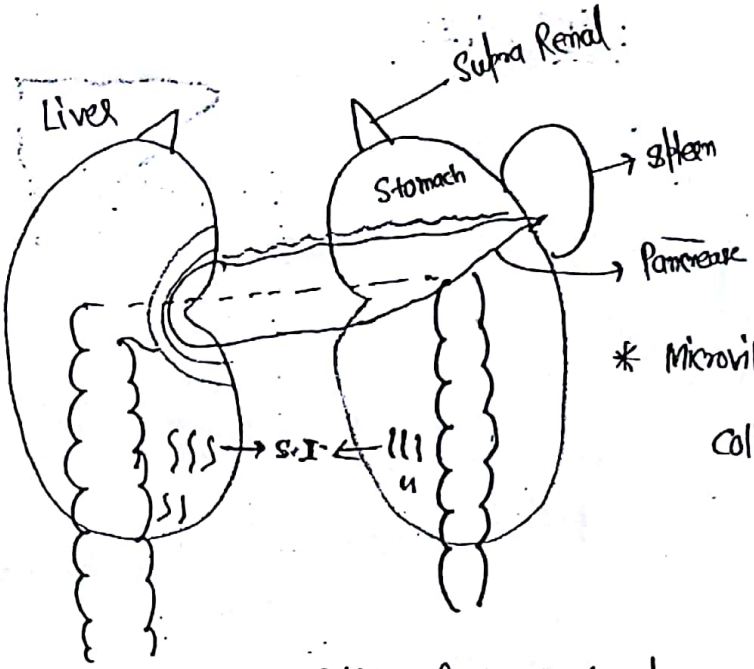
- Lt. Supra Renal gland
- Stomach
- Spleen
- Splenic Artery
- Pancreas
- Splenic flexure
- Descending colon
- Small Intestine

STOMACH BED

Formed by ⇒

- Lt. SupraRenal
- Lt. kidney
- Spleen
- Splenic Artery
- Pancreas
- Transverse Colon
- Left cru of diaphragm

http://mbbshelp.com WhatsApp: +1 (402) 235-1397



* Microvilli are abt. in
⇓
Collecting duct

QQ(NEEFIG)
* DUCTS OF BELLINI ⇒ Papillary (collecting) ducts are Anatomical structures of kidney; K/as "DUCTS OF BELLINI".

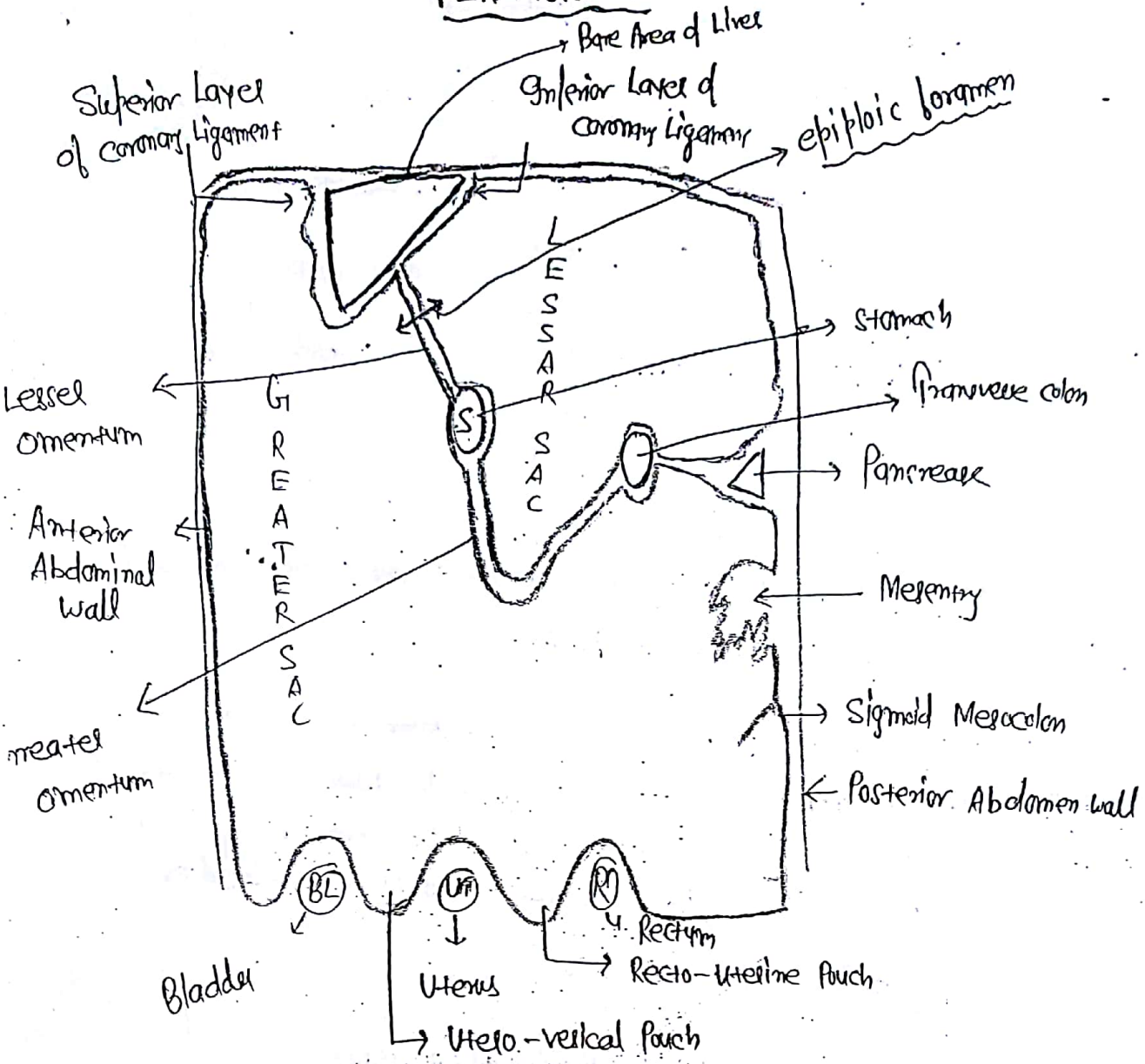
QQ(NEEFIG)
* CAUDATE LOBE OF LIVER ⇒ Anatomically situated on Posterior surface of Right l
- It belongs physiologically to both Right & Left lobes b/c it receives blood from Right & left hepatic arteries; Right & Left branches of Portal vein & dr bile into both Right & Left hepatic duct. Thus it is considered as "Physiological Independent lobe".
→ "Segment I"

* SPACE OF DISSE ⇒ K/as "Perisinusoidal space".
- Space b/w Hepatocytes & Hepatic sinusids.
- Exchange of substance b/w hepatocytes & blood takes place in the space of Disse
- Microvilli of hepatocytes extend into this space; ↑ed surface area for Absorption;
- Major constituents of space of Disse ⇒ Blood plasma

* RENAL VASCULATURE ⇒ Each kidney is supplied by Renal Artery (Branch of Abdominal Aorta) & is drained by Renal vein to IVC;
- Rt. Renal Artery is longer & passes behind IVC;
- Renal Artery divides into → (A) Posterior division ⇒ Supplies Posterior segm
(B) Anterior division ⇒ 4 branches → Apical; Upper Anterior; Middle Anterior & Lower
- Branches of Renal artery are end arteries.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

PERITONEUM



Retroperitoneal organs ⇒

1. Kidneys
2. Supra-Renal
3. duodenum except a small area of the 1st & 4th part.
4. Pancreas.
5. Ascending & descending colon
6. Aorta & IVC
7. Ureters.

http://mbbshelp.com WhatsApp +1 (402) 235-1397

↳ Set of tissue ; which is formed by the double fold of Peritoneum that attaches the Intestine to the wall of Abdomen.

Root of Mesentry ⇒ extends from D-J flexor (Left transverse proc of L_2) to Right Sacro-iliac joint.

→ duodeno-jejunum flexor.

— QQ Structures crossing by the Root of Mesentry. !⇒

- 3rd Part of duodenum
- Aorta
- IVC
- Rt. Psoas Major
- Rt. Ureter.

↳ Also "Foramen of Winslow" ⇒ Passage b/w greater sac & lesser sac

Epiploic foramen (Boundaries)

Anteriorly ⇒ Lesser omentum containing hepatic artery ; Portal & Bile duct

Posteriorly ⇒ IVC
Rt. Suprarenal gland
Body of T_{12} vertebrae

Superiorly ⇒ Caudate lobe of Liver (caudate process)

Inferiorly ⇒ 1st part of duodenum

* Length of epiploic foramen ⇒ 4-6 cm

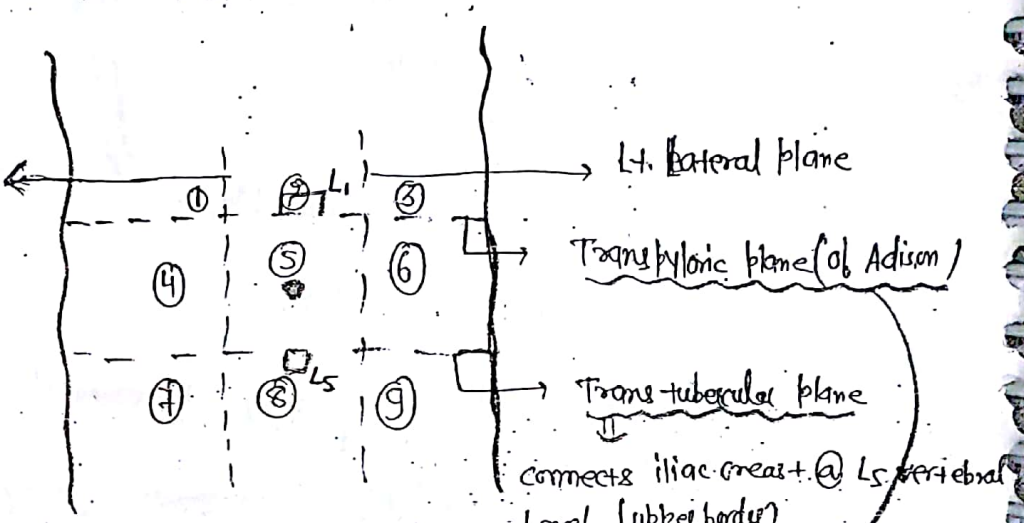
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

NEET'16 ⇒ A Posterior gastric ulcer May perforate Into the Lessar Sac (omental bursa). The leaking fluid passes out through epiploic foramen to Reach hepatorenal pouch.

⇓

Sometimes; in these cases the epiploic foramen is closed by Adhesion; the lesser sac become distended & can be drained by a tube passed through Lesser omentum.

*



① → Rt. Hypochondrium
② → Epigastrium
③ → Lt. Hypochondrium
④ → Rt. Lumbar Region
⑤ → Umbilicus
⑥ → Lt. Lumbar Region
⑦ → Rt. iliac Fossa
⑧ → Hypogastrium
⑨ → Lt. iliac Fossa

- Passes Anteriorly through tips of 9th costal cartilage & Posteriorly through Lower border of L_1 vertebrae.
- Organs @ this Level ⇒ Hilum of kidney; Pylorus of stomach; Beginning of duodenum; Neck of Pancreas; Fundus of Gall bladder & origin of Superior Mesentric vessels

* Renal Angle ⇒ Angle b/w Last Rib & outer border of erector spinae.

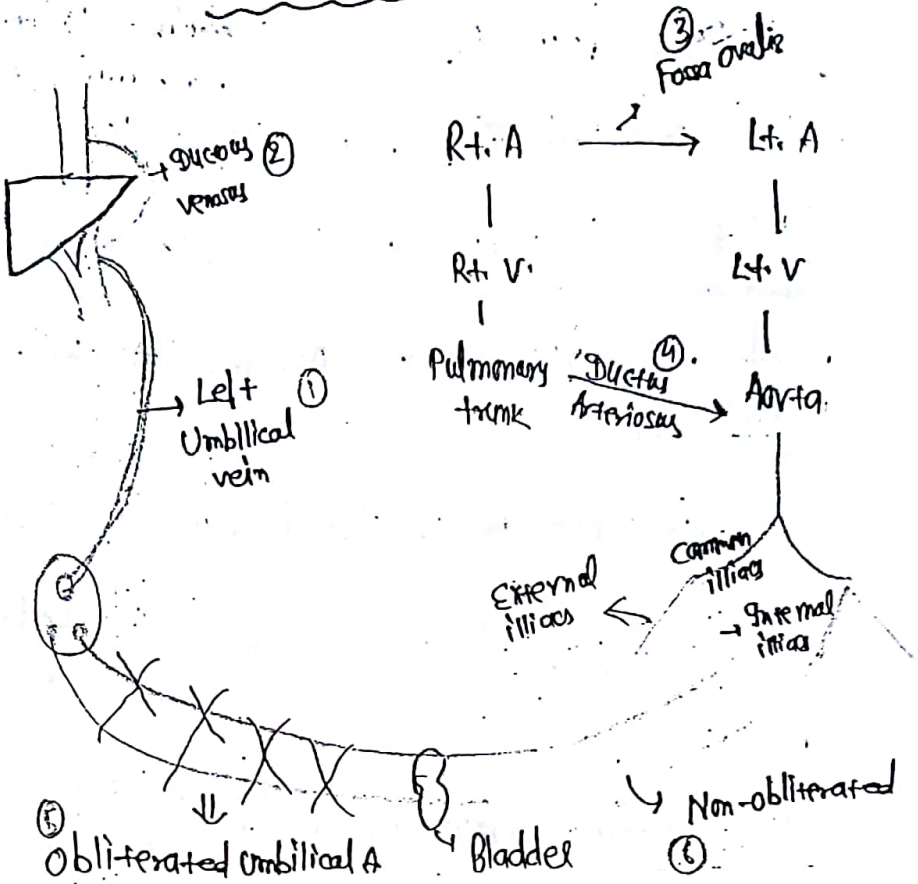
* Umbilicus ⇒ Lies b/w L_3 & L_4 vertebrae

SURGERY Highest point of iliac crest lies @ L_4 vertebrae. The supracristal plane is Indicated by a Horizontal line through the highest points of iliac crests

* Umbilicus is watershed; Lymph flows upwards to drain into Axillary Lymph Nodes; Below the level of Umbilicus lymph flows downwards to drain into Superficial Inguinal Lymph Node

http://mbbshelp.com WhatsApp +1 (402) 235-1397

FETAL CIRCULATION



* Uterine A. & ovarian A. together form Arcuate Artery Anastomosis; which then give off the Radial arteries & finally branches into basal & spiral Arteries

Uterine Artery ⟶ Arcuate artery ⟶ Radial Artery ⟶ Spiral Artery

① Obliterated Left Umbilical vein ⇒ Ligamentum teres

② Ductus Venosus ⇒ Ligamentum Venosum

③ Foramen ovale ⇒ Fossa ovalis

④ Ductus Arteriosus ⇒ Ligamentum arteriosum

⑤ Obliterated Umbilical Artery / Distal part of Umbilical Artery ⇒ Medial Umbilical Ligament

⑥ Non-obliterated part of Umbilical Artery / Proximal part of Umbilical Artery ⇒ Superior vesical Artery

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

DEVELOPMENT OF STOMACH

- develops from Foregut
  - Length = 10 inches
  - At birth capacity = 30ml; Adults ⇓ 1500–2000 ml
- It has Rt. & Lt. Surface; Ant. & Post. borders

i) 1st Rotation Along vertical Axis :⇒

Left Surface becomes Anterior & the Right becomes Posterior

- The Anterior border becomes → Right
- Posterior border becomes → Left

ii) 2nd Rotation Along Antero-posterior axis :⇒

Pylorus comes to lie @ a higher level

- The left border grows rapidly to form greater Sac
- during Rotation the dorsal Mesogastrium also turns to the left; thus forming lesser Sac

* Derivatives of ventral Mesogastrium :⇒

i) Falciform Ligament —contains→ Ligamentum teres & Paraumbilical vein

ii) Lesser omentum

iii) Superior & Inferior Layers of coronary Ligament

iv) Rt. & left. triangular Ligaments

http://mbbshelp.com WhatsApp: +1-(402)-235-1307

The Main Support of Liver is :- Hepatic vein draining into IVC

* Derivatives of Dorsal Mesogastrium :⇒

i) Gastro-splenic Ligament ⇒ Contains short gastric vessels & Left gastroepiploic vessels

ii) LinoRenal Ligament ⇒ Contains splenic vessels & tail of the pancreas

iii) Greater omentum

iv) gastro-phrenic Ligament.

* Blood Supply of Stomach :⇒

Along the Lesser curvature → Lt. & Rt. gastric Arteries;
Along the Greater curvature → Lt. & Rt. gastro-epiploic arteries;
Fundus → Short gastric Arteries

* Venous drainage :⇒

Lt. & Rt. gastric veins → drains into the portal vein;
Lt. gastro-epiploic & short gastric veins → drains into splenic vein;
Rt. gastro-epiploic vein → drains into Superior Mesenteric vein.

NEET16 → The prepyloric vein of Mayo is a tributary of the Rt. gastric vein & is the external Landmark of Gastroduodenal junction.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Development of Pancreas

Dorsal Pancreatic bud forms → Upper part of head; Neck & tail of the Pancreas

Ventral Pancreatic buds forms → Lower part of head & Uncinate process

Annular Pancreas is dt defective Migration of Ventral Pancreatic bud.

Non-fusion of two buds Result in ⇒ Pancreatic divisum
- two ⇓ : Dorsal & ventral buds.
- Pancreatic divisum ⇓ : M/c congenital Anomaly of Pancreas

Main Pancreatic duct / Duct of Wirsung :⇒

- derived from the duct of dorsal bud; ventral bud & the anastomosis b/w them.
- opens @ Major duodenal papillae; 8 to 10 cm from the Pylorus

Accessary Pancreatic duct / Duct of Santorini :⇒

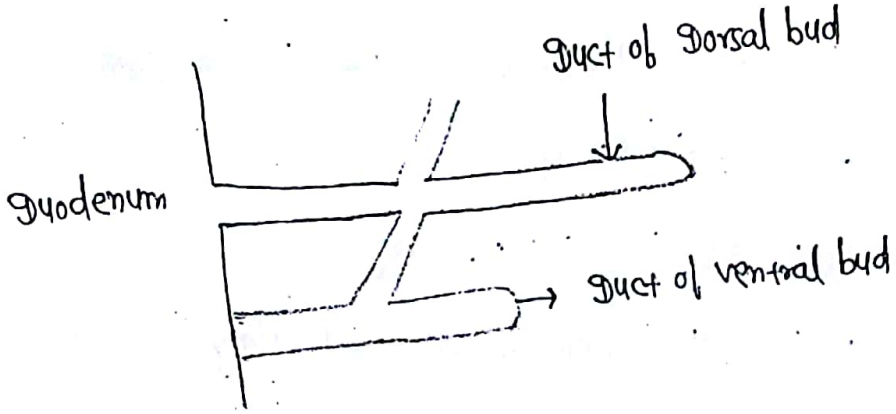
- formed from duct of dorsal bud
- opens @ Minor duodenal papillae; 6 to 8 cm from the pylorus

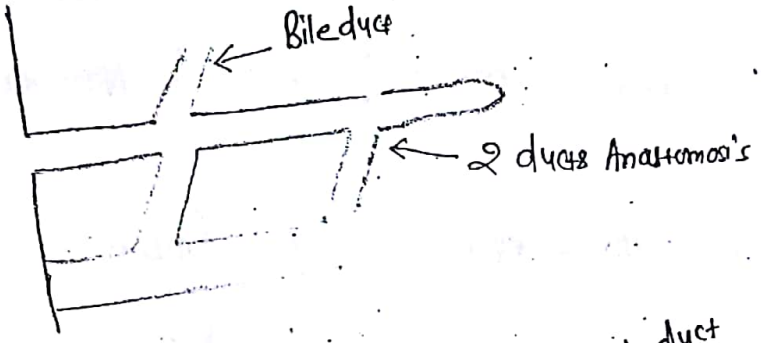
Accessory Pancreatic tissue May be found in :⇒

(A) Wall of Stomach; Duodenum; Jejunum or Ileum

(B) Meckel's diverticulum.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397





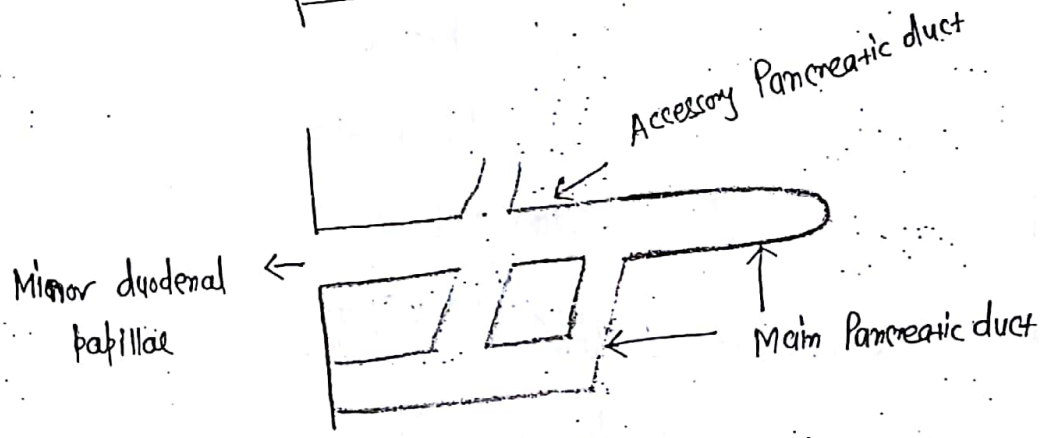


Fig: Development of Pancreatic duct

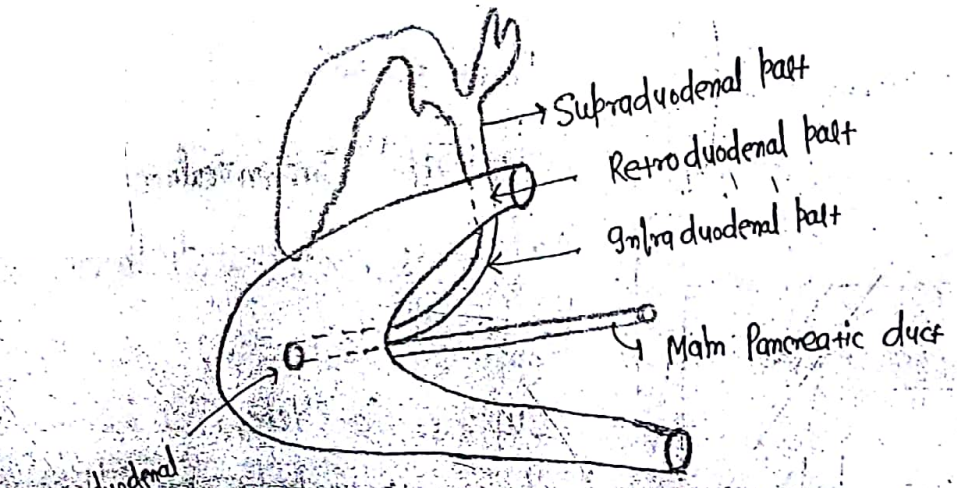


Fig: Part of Bile duct in Relation to diaphragm

http://nobleshelp.com
WhatsApp: +1 (402) 235-1397

SPLEEN (1, 3, 5, 7, 9, 11, 10)

- 1 X 3 X 5 — dimension of spleen (in Inches)
- 7 ounces of wt (250 gm)
- ⊕nt b/w the 9th & 11th Ribs
- Long axis of the spleen is directed along 10th Rib
- Spleen Makes an angle of 45° ∈ the Hz plane
- It projects into the greater Sac

∴ Superior border of spleen is Notched.

* Impression on spleen — a) Gastric
b) Renal
c) Pancreatic
d) colic
e) Diaphragmatic

* Ligaments of spleen — a) Gastro-splenic
b) Lieno-Renal
c) Phrenico-colic
↳ Also "Sustentaculum Lienis".
↳ extends from the diaphragm to splenic flexure of colon
↳ Supports the spleen
↳ prevents the downward displacement of spleen.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Q9 Accessory spleen can be found in →

Hilum

Tail of Pancreas

Derivatives of dorsal Mesogastrium

Broad Ligament of Uterus

Spermatic cord

* PALS (Periarteriolar Lymphoid sheath) is a histological feature of ⇒ White pulp of the spleen

ROTATION OF GUT

- The pre-arterial segment lies — Superiorly
  Post-arterial segment lies — Inferiorly

i) 1st Rotation (90°) ⇒

- the pre-arterial segment lies on Rt. side
- it forms the Small Intestines
- as it Returns back to the Abdominal cavity, 2nd Rotation occurs

ii) 2nd Rotation (90°) ⇒

- the post-arterial segment lies superiorly
- → cecum lies in the midline
- → As it [illegible] back → 2nd Rotation occurs

http://mbbshelp.com

iii) 3rd Rotation → 90°

Cecum lies on Rt. side – Subhepatic cecum

* Herniation of Midgut loop occurs by ⇒ 6 weeks
* Herniation of Midgut loop Reduced by ⇒ 10 weeks

* MALROTATIONS :⇒

1. Mixed Rotation :⇒ The pre-arterial segments alone rotates by 90°.
   - The Post arterial segment rotates by 180°

   QQ cecum lies in the Midline behind the stomach.

2. Non-Rotation :⇒ 1st Rotation is Normal
   - Further Rotation doesn't occur
   - cecum lies on Left side
   - Left sided colon

3. Reverse Rotation :⇒ 1st Rotation is Normal
   - 2nd Rotation occurs by 180° in the Reverse direction
   - Transverse colon lies behind small Intestine

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

HIND-GUT (Urachus Fistula ⇒ Patent Allantois)

- Part of the hind-gut below the attachment of Allantois

⇓

Cloaca

- The Uro-Rectal septum divides the cloaca into

↙ ↘

Urogenital sinus Anteriorly

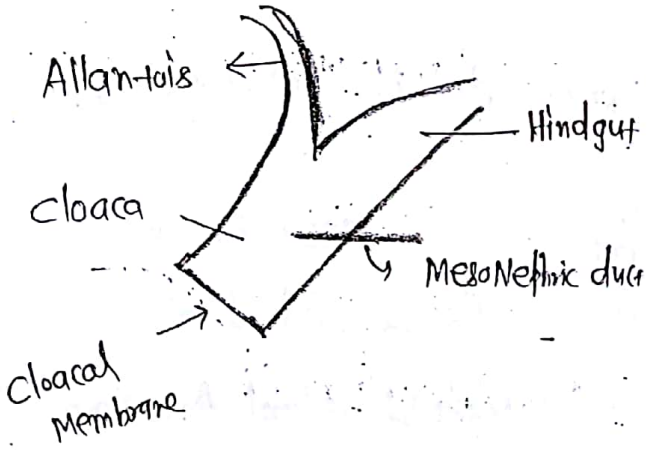
Rectum & Anal canal Posteriorly

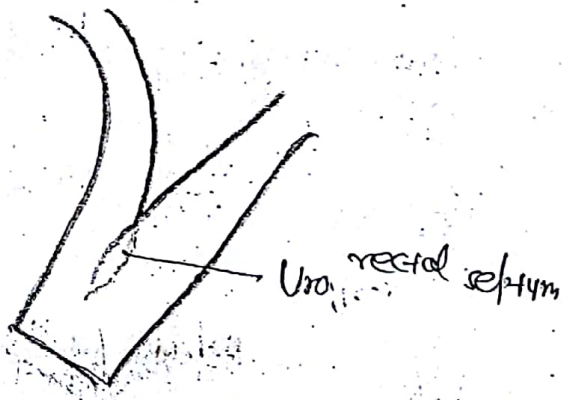
- The cloacal Membrane divides into

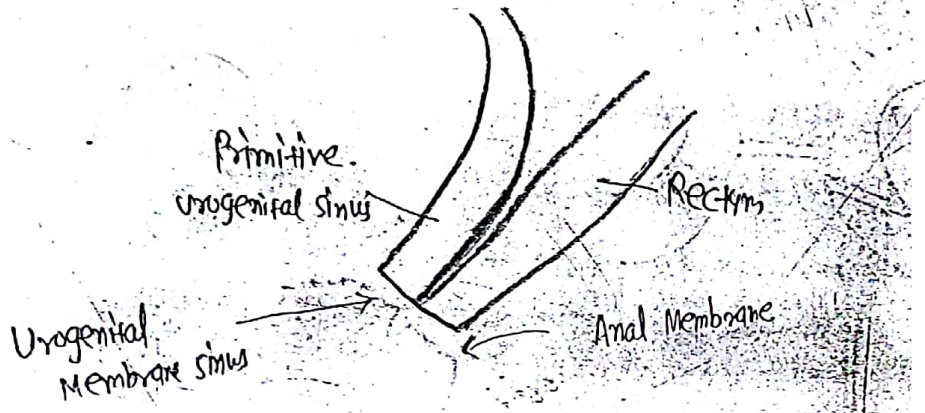
↙ ↘

Urogenital Membrane Anteriorly

Anal Membrane Posteriorly







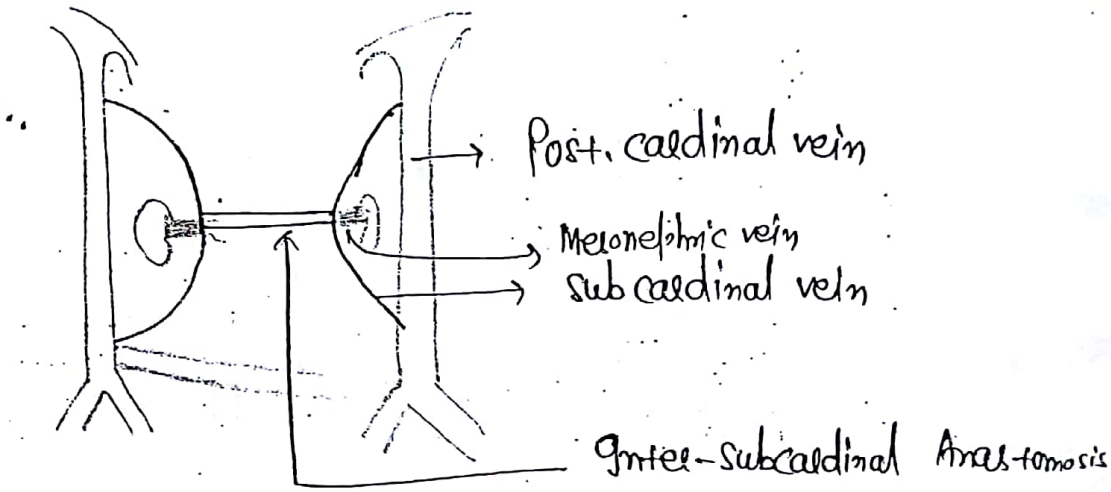
http://mbbshelp.com

* Blood supply of Supra-Renal gland :⇒

① Superior Supra-Renal Artery → Branch of Inferior phrenic Artery

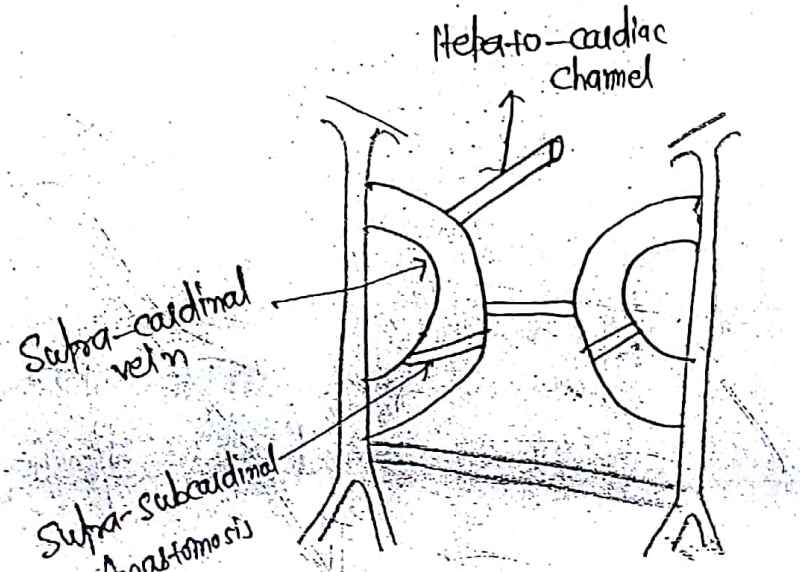
② Middle supra-Renal Artery → Branch of Abdominal Aorta

③ Inferior supra-Renal Artery → Branch of Renal Artery



Rt. Renal vein ⇒ derived from Rt. Mesonephric vein

Lt. Renal vein ⇒ derived from – Lt. MesoNephric vein
Lt. Subcardinal vein
Inter Subcardinal Anastomosis



http://mbbshelp.com
WhatsApp: +1 (402) 235-1397

* clinical sign of different Porto-systemic circulation :⇒

esophageal varices (Bleeding) → PORTAL HYPERTENSION

Hemorrhoids → PORTAL HYPERTENSION

Caput Medusae → PORTAL HYPERTENSION

NEET'16

1. TEMPORARY MUCOSAL FOLDS :⇒ Mucosal fold ; which are Obliterated by distension.
eg :⇒ Gastric Rugae of stomach & Longitudnal fold.

2. PERMANENT MUCOSAL FOLDS :⇒ eg :⇒ Plica circularis (valves of Kerkri of Small Intestine;
- Crescentric Mucosal folds of cystic duct (Spiral valve of Heister)
- Transverse (Horizontal) Rectal folds (Houston's valve or plica transversalis);
- Permanent Longitudnal Rectal columns or folds (Found in Lower Rectum. Anal canal).

PETIT TRIANGLE (Inferior Lumbar triangle)

NEET'16

Boundaries :⇒ Base ⇒ Iliac crest.
Anterior Boundary (Abdominal Boundary) ⇒ Posterior border of External oblique Mu
Posterior Boundary (Lumbar Boundary) ⇒ Anterior border of Latissimus dorsi
Floor ⇒ Internal oblique Muscle

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

PELVIS

* Structures winding Around Ischial spine →

P → : Pudendal Nerve

I → Internal Pudendal vessels

N → N. to obturator Internus

they leave the Pelvis through Greater sciatic foramen and enters the perineum through Lesser sciatic foramen.

- The tendon of obturator Internus emerges out through lesser sciatic foramen.

* Blood supply of Pelvis :⇒

- Internal iliac Artery – Small terminal branch of common iliac A.

Anterior division

- Superior vesical Artery
- Inferior vesical Artery (Supplies the prostate)
- Middle Rectal Artery
- Obturator Artery ; While Accessory (Aberrant) obturator Artery is the branch of Inferior epigastric Artery ⇓ it is the branch of external iliac Artery → Inferior epigastric A. / Femoral A. / Deep circumflex iliac A.
- Uterine & Vaginal Artery
- Inferior Gluteal Artery
- Internal Pudendal Artery

→ In female it is Replaced by " Uterine & Vaginal Artery ".

Posterior division

- Superior Gluteal Artery
- Lateral Sacral Artery
- Ilio-Lumbal Artery ⇓ it supplies L5 vertebrae

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

URETER

- Length ⇒ 25 cm (10 inches)
- completely Retroperitoneal organ.

Abdominal Part -

Post. Relation → Transverse process of Lumbar process
Psoas Major
Genito-femoral Nerve

Ant. Relation of Right Ureter → 3rd Part of duodenum
- Rt. colic vessels
- ilio-colic vessels
- Root of Mesentry
- Gonadal vessels
- Terminal part of ileum

Ant. Relation of Left Ureter → Left colic vessels
Sigmoid vessels
Sigmoid Mesocolon
Gonadal vessels

Pelvic part - goes backwards along greater Sciatic Notch alc internal iliac vessels behind it.
- turns anteriorly at ischial spine & enters the supero-lateral angle of Trigone of bladder
- In Males; the ureter is crossed by vas deferens
- In Female; the ureter is crossed by Uterine ar

http://mbbshelp.com
WhatsApp: +1 (402) 235-1397

Blood supply of Ureter :⇒

① At its beginning → Renal Artery;

② Below it → Abdominal Aorta;

③ Little below it → Gonadal Artery;

④ At the Pelvic inlet → Internal iliac / common iliac

⑤ Near the base of bladder →
- Superior vesical
- Inferior vesicle
- Middle Rectal

Constriction of Ureter :⇒ Diameter = 3mm

① Pelvi-Ureteric junction

② Crossing of the pelvic brim / bifurcation of common iliacs / crossing of external iliac

③ Crossing by the ductus differens / Broad Ligament

④ Entry into the bladder (Narrowest part of Ureter)
↳ K/as "vesicoureteric junction"

⑤ Opening into the Trigone

URINARY BLADDER

QQ Retropubic space of Retzius:
↳ Lies behind the Pubic symphysis
‖
contains vesicle venous plexus

* except → Trigone; Rest all are derived from "Vesicourethral canal" (endodermal)
* 1st desire of Micturation usually appears @ 150–250 ml filling.

http://mbbshelp.com
WhatsApp +1 (402) 235-1397

OVARY

- Suspended from posterior leaflet of broad Ligament by Mesovarium
- Attached to cornu of the uterus by Ligament of ovary and Lateral pelvic walls by Suspensory Ligament of ovary/ infundibulo-pelvic Ligament.
- drains into the para-aortic Lymph Nodes.

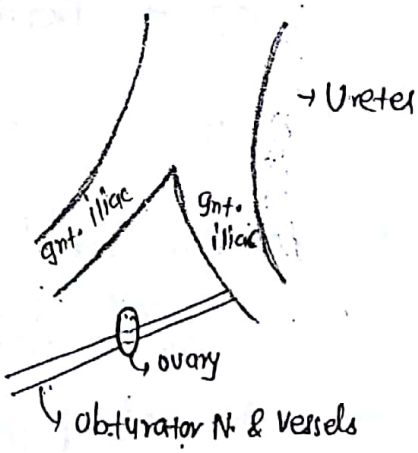
OVARIAN FOSSA

Boundaries →

Superiorly → external iliac vessels

Posteriorly → Ureter & internal iliac vessels

Laterally & the floor → Obturator Nerve & vessels



UTERUS

FUNDUS ← BODY → CERVIX (2.5 cm Long)

Round Ligament of Uterus is attached to → i) CORNU;
ii) Labia Majora

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Base of the bladder :⇒

In Males →

- Separated from the Rectum in the upper part is by Recto-vesicle pouch

- Related to vas deferens, Ampulla of vas, Seminal vesicle & ejaculatory duct.

In Females - Related to supra-vaginal part of the cervix & vagina

Fascia of Dennonvillees ⇒ extends from Rectoveside pouch to the perineal body

↳ Separates the Rectum from Seminal vesicle & prostate in Males.

* N. Supply :⇒ Sympathetic :⇒ $T_{10} - L_2$

↳ Contracts the sphincter & Relaxes the Muscle

Parasympathetic :⇒ $S_{2,3,4}$

↳ Contracts the Muscles & Relaxes the sphincter

* Epithelium of Bladder Mucosa :⇒ Transitional

URETHRA

Male urethra on section → At bulb → Trapezium

In the Penis → Horizontal slit

At base of glans → Inverted "T" shape

At external urethral orifice → vertical slit

Epithelial Lining

→ Above the opening of ejaculatory duct → Transitional

Upto Middle of gland → columnar

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Lymphatic drainage of Uterus !⇒

Fundus & Upper part → Paraaortic Lymph Node

Middle Part → external iliac Lymph Node

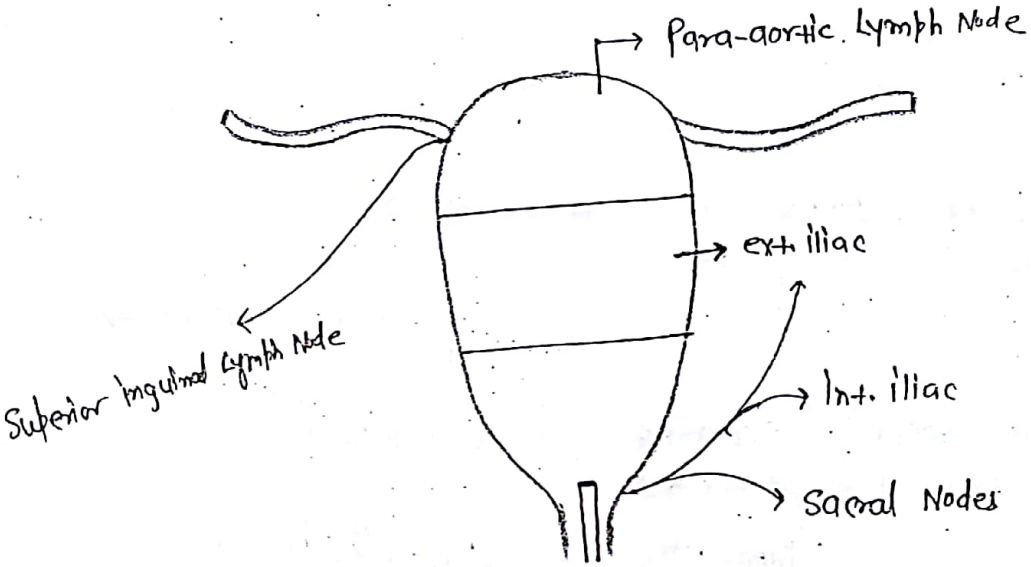
Lower Part → In all direction

Anteriorly ⇒ External iliac L.N.

Laterally ⇒ Internal iliac L.N.

Posteriorly ⇒ Sacral L.N.

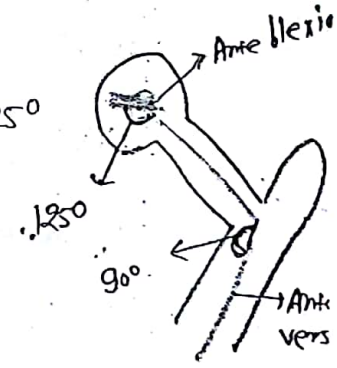
Cornu → Superficial Inguinal Lymph Node



* Uterus c̄ vagina ⇒ 90° ; Uterus c̄ cervix ⇒ 125°

↓ ↓

Anteversion Antiflexion



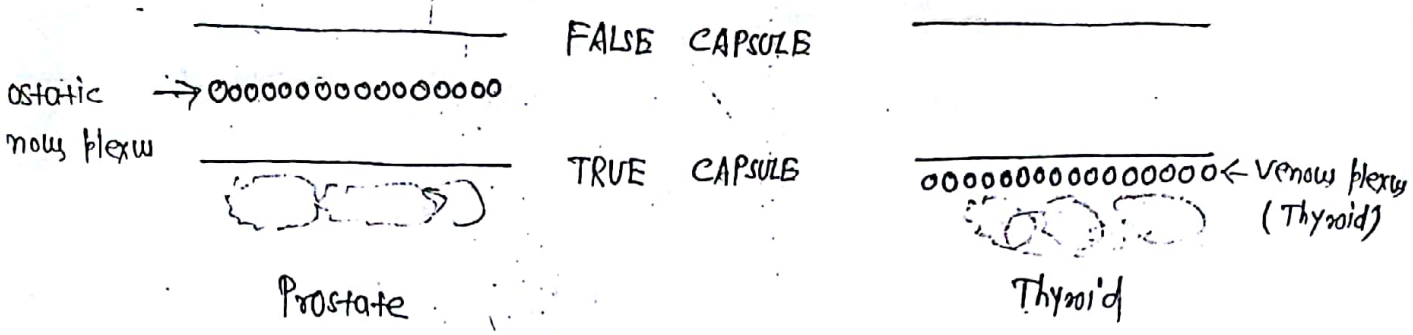
* Uterine cavity ⇒ Lined by ciliated columnal epithelium;
Cervical canal ⇒ Lined by Non- ciliated simple columnal epithelium;

* Nerve Supply → Sympathetic :→ From T_{12} ; L_1 segments & carry painful sensation from the body of Uterus.

Parasympathetic → From $S_{2,3,4}$ & carry painful sensation from cervix.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

PROSTATE



- Prostatic venous plexuses communicates c ⇒ vesicle venous plexus
  ↓
  Dorsal vein of penis
- this further communicates c vertebral venous plexus
  ↓ valveless communication
  ↓
  Batson's plexus
  ⇒ through it the prostatic carcinoma can spread to vertebral column & skull.
- Medial Lobe is More prone to hypertrophy (BPH)
- Posterior lobe is More prone to Cancerous changes (Prostatic cancer)
- Anterior lobe → Devoid of glandular tissue hence Adenoma seldom occurs.

* Prostate ⇒ is also klas "Fibro-Muscular-glandular organ".

4 Surfaces

Anterior
⇓
lies behind Pubic Symphysis; Separated from it by extra-peritoneal fat in Retropubic Space (Cave of Retzius)

Posterior
- Separated by Fascia of Denonvilliers from Rectum
- Palpated on P/R examination

2 Inferolateral

{ Peripheral Zone ⇒ Posterior Lobe
Central Zone ⇒ Median Lobe }

http://mbbsnotes.com

PROSTATIC URETHRA

- Shows an elevation in Midline ⇒ Urethral Crest
  ⇓
  Form d/t continuation of Trigonal Muscle the bladder.

- Another elevation in the Middle of Urethral crest
  ⇓
  VERUMONTANUM / COLLICULUS SEMINALIS

- Opening of Prostatic utricle in the centre and ejaculatory du on the either side of verumontanum

- Opening of Prostatic gland / Prostatic Sinuses along Posterior Cu

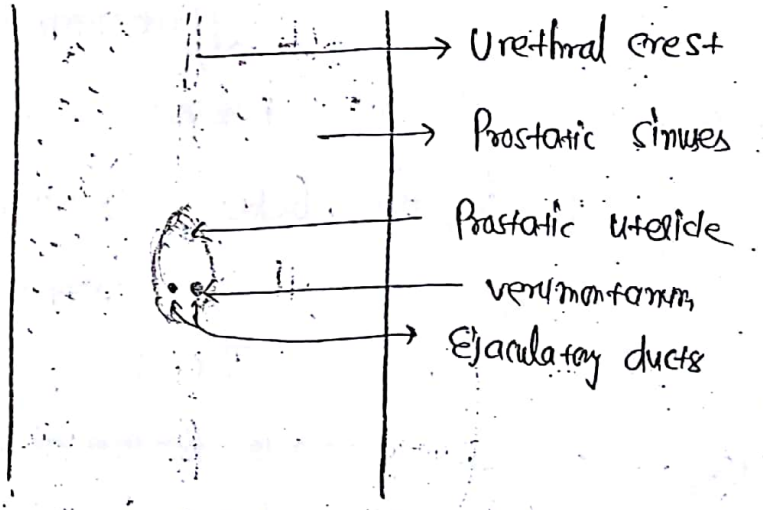


Fig: Prostatic Urethra ⇒ Ant & Post. the junction of Ant. 1/3rd Post. 2/3rd of gland

* Corpora Amylacea (Amyloid bodies) → Prostate
* Corpora Arenacea → Pineal gland

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

RECTUM

Length – 12 cm

Saccula tions; Appendes epiploicae & Taenia coli are absent.
↳ Characteristics of Large Intestine

* Horizontal folds | Plica transversalis :⇒

1st → Rt. wall → 12–14 cm Above Anal canal

2nd → Lt. wall → 7.5 cm Above Anus

3rd → (valve of Houston)

Anterior & Right wall → At the upper end of Rectal Ampulla; Above Anus

* Development of Rectum :⇒

Part of Rectum Above the houston valve
↓↓ developed from
Hindgut

Part of Rectum below the houston valve
↓↓ developed from
Cloaca

* Waldeyer's Fascia ⇒ connects Rectum to Sacrum.

* B. Supply of Rectum :⇒ a) Superior Rectal Artery (Major supply) ⇒ Continuation of Inferior Mesenteric Artery.
b) Middle Rectal Artery ⇒ Branch of Anterior division of Internal iliac Artery;
c) Median Sacral Artery ⇒ Branch of Aorta

* venous drainage :⇒ a) Superior Rectal vein → Drains into Inferior Mesenteric vein
b) Middle Rectal vein → Drains into Internal iliac vein;
c) Median Sacral vein → Joins Lt. common iliac vein.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

	MALE		FEMALE
①	Mesonephric Duct (Wolfian duct) ⇒	COMMON (Collecting tubules; Minor calyx; Major calyx; Pelvis, Ureter & Trigone of the bladder)	
		– Epididymis – Vas-deferens – Seminal vesicles – Ejaculatory duct – Mesoderm of Prostate	– Gartner's duct (Remnant)
②	Paramesonephric Duct (Mullerian duct) ⇒	Prostatic Utricle Appendix of Testis	• Fundus • Body • Cervix • Upper 2/3rd of vagina • Fallopian tubes (Lower 1/3rd of vagina is derived from Sinovaginal bulbs formed from "Urogenital sinus") ↳ endodermal in origin. ↳ Also "organ of Rosen"
③	Mesonephric tubules ⇒	Paradidymis (Not functional)	Epophoron & Para-ophoron
④	Genital tubercle ⇒	Penis	Clitoris
⑤	Genital swelling ⇒	Scrotum	Labia Majora
⑥	Genital Folds ⇒	Ventral aspect of Penis	Labia Minora

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

PERINEUM

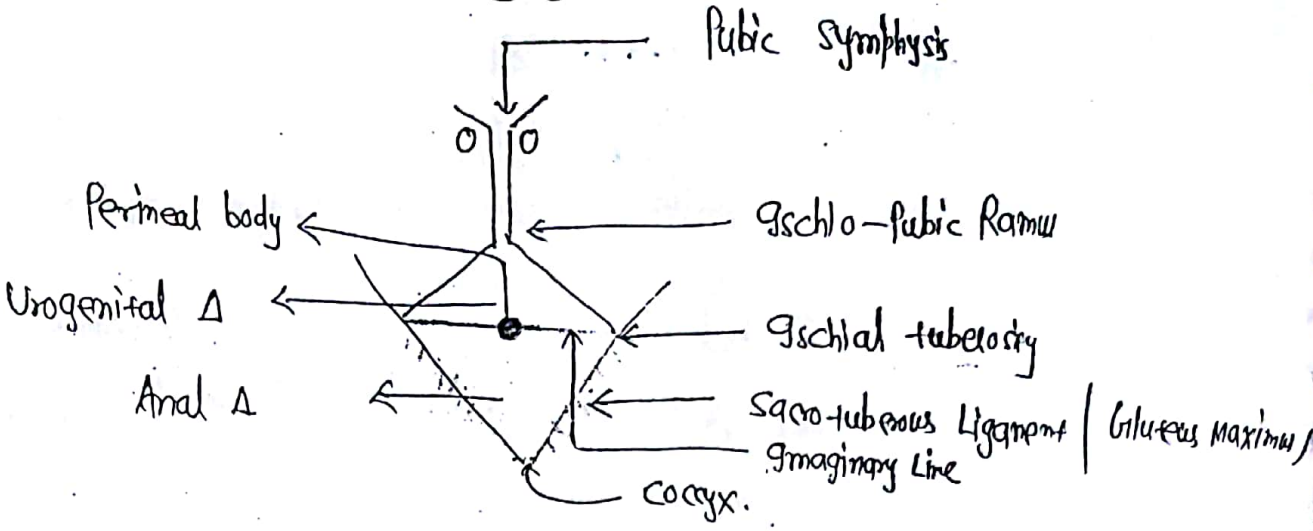
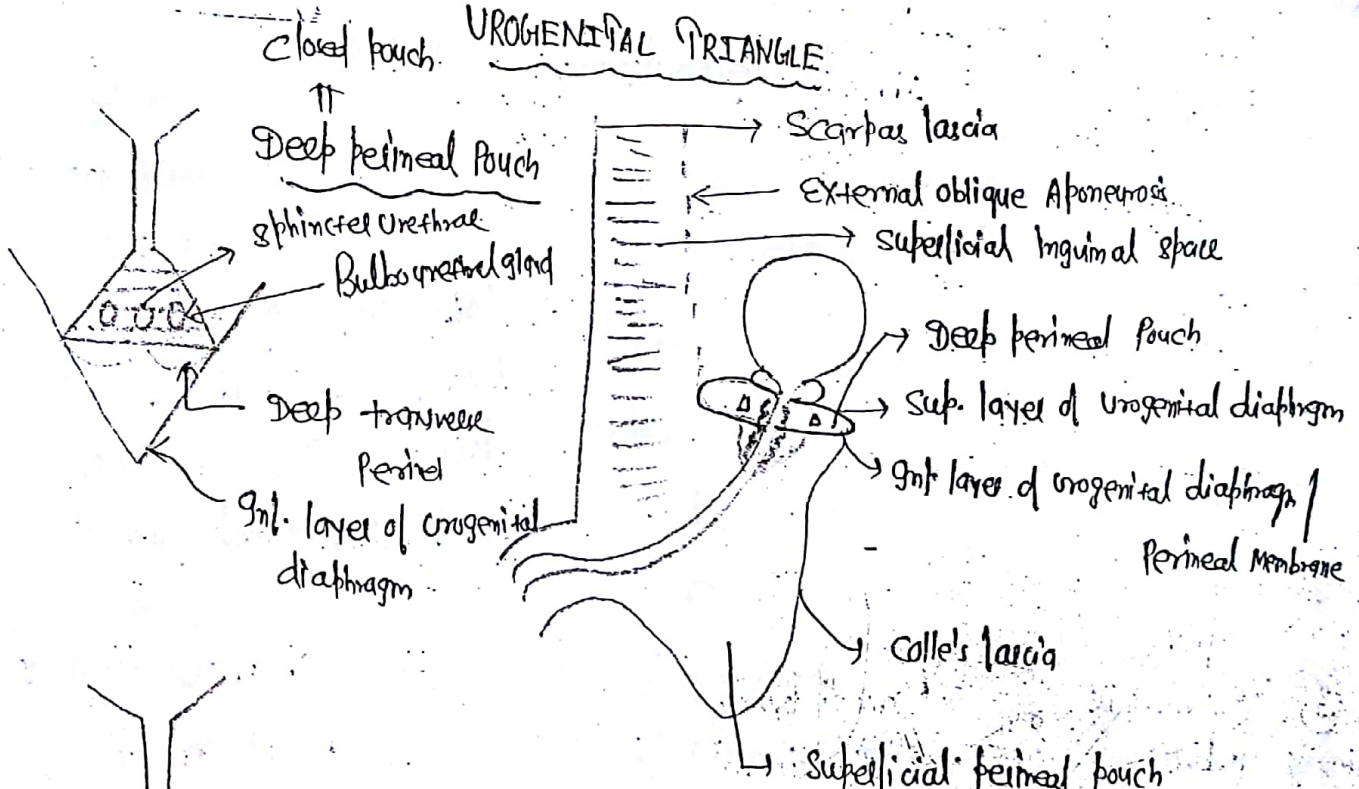
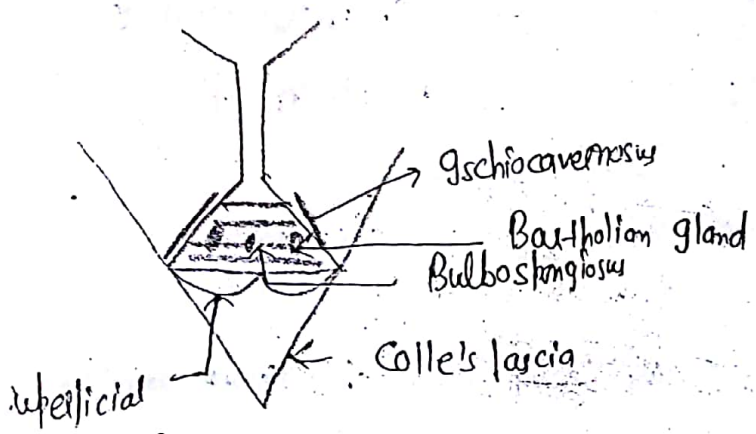


Fig.: Boundaries of Perineum In Litho-tomy Position

UROGENITAL TRIANGLE





Superficial perineal pouch

http://mbbshelp.com
WhatsApp: +1 (402) 295-1397

Deep perineal Pouch :⇒

Contents ⇒ i) Sphincter Urethrae Muscle } (common in ♂/♀)
ii) Deep transverse Perinei

In Males ⇒ i) Bulbourethral gland / cowper's gland
ii) Dorsal Nerve of Penis;
iii) Membranous Urethra

Superficial perineal Pouch :⇒

Contents ⇒ i) Ischio-cavernosus } (common in ♂/♀)
ii) Bulbo-spongiosus
iii) Superficial transverse Perinei

In Females ⇒ Bartholin glands / greater vestibular glands
In Males ⇒ Root of Penis (Bulb & crura); Posterior scrotal Nerve; Urethra

* Chief Nerve of Perineum → Pudendal Nerve (Mixed Nerve)
⇓
Arises from Sacral plexus ($S_2 S_3$).

* PERINEAL BODY ⇒ Ten Muscle converge →

a) External Anal Sphincter; } Unpaired
b) Fibres of Longitudinal Muscle coat of Anal canal

c) Bulbospongiosus; } Paired.
d) Superficial transverse Perinei;
e) Deep transverse Perinei;
f) Levator Ani

http://mbbshelp.com WhatsApp: +1-(402) 235-1397

Holden's Line ⇒ A Line drawn Laterally from Pubic tubercle;

↳ Urine doesn't cross this line d/t firm attachment of Fascia lata along this line

* Length of Prostatic Urethra ⇒ 4cm (Most dilatable part of Male Urethra)
Length of Membranous Urethra ⇒ 1.5–2cm (Narrowest part of Urethra) NEET16
Length of Penile Urethra ⇒ 15–20cm

Least ∵ dilatable part ⇒ External Urethral Meatus
Membranous Urethra

Anal canal ⇒ Length ⇒ 38mm (3.8 cm)

15
15
8

Dentate/Pectinate Line ⇒ Represents the Lower end of Anal columns

White line of Hilton ⇒ Represents the Muco-cutaneous junction of Anal canal.

Extravasation of Urine/Rupture of Urethra in the Superficial perineal Pouch

⇓

→ Urine collects in the scrotum, Penis & enters the superficial Inguinal Space;

→ Urine doesn't cross the Holden's Line;

* ALCOCK's CANAL :⇒ Also "Pudendal canal"

⇓

It is fascial canal in the Lateral wall of ischiorectal fossa; enclosing Pudendal Nerve & Internal Pudendal vessels (Artery & veins);

• It is Space b/w obturator fascia & Lunate fascia.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* MESORECTUM (MESENTRY OF THE RECTUM) & ITS CONTENTS ⇒

- Superior Rectal Artery & its branches;
- Superior Rectal vein & Tributaries;
- Superior Rectal & Pararectal Nodes and Lymphatics along the Superior Rectal Artery;
- Branches from the Inferior Mesenteric plexus & descend to Innervate the Rectum.

SOME EXTRA EDGE

→ Gubernaculum in Male forms ⇒ Gubernaculum Testis;
In Female forms ⇒ Ligament of ovary;
Round Ligament of Uterus.

* Differentiation of Genital Ridge; into Lineage of Female or M gonads i.e. ovary or Testis occurs @ 6-10 weeks. By 12 week this differentiation has occured in all fetus.

* Prostate Analog in ♀ ⇒ Skene gland (Periurethral gland);

* Uterus & vagina Analog in ♂ ⇒ Prostatic Utricle

* Lower 1/3rd of vagina derived from ⇒ Urogenital Sinus.

* Upper 1/3rd of Rectum ⇒ covered by Peritoneum on the front &

* Middle 1/3rd of Rectum ⇒ covered by Peritoneum on the sides only.

* Lower 1/3rd of Rectum ⇒ devoid of Peritoneal Attachment.

http://mbbshelp.com

ISCHIO-RECTAL FOSSA

Boundaries -

- Anteriorly - Imaginary line joining two Ischial tuberosities.
- Posteriorly - Sacrotuberous Ligaments & Coccyx
- Laterally - Ischial tuberosity & obturator Internus
- Medially - Anal canal
- Roof - Levator Ani
- Floor - Perianal skin

Contents - ① Pudendal Nerve & vessels
② Inferior Rectal Nerve & vessels

TRIGONE OF BLADDER

- Lined by "Transitional epithelium"
- Mucosa is smooth & firmly Adherent;
- Ureters opens at lateral Angle of base & Internal urethral orifice Lies at Apex;
- Has Trigonal Muscle of bell (Smooth Muscle Layer just beneath Mucosa)

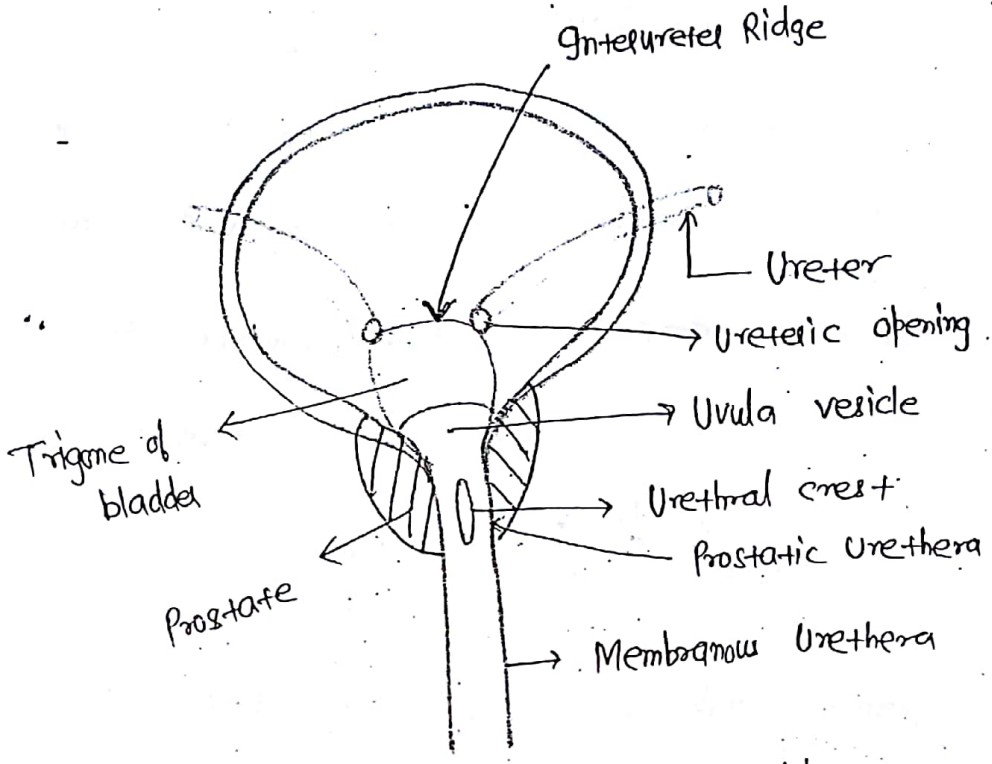
NEET'16 Derived from Absorbed part of Mesonephric duct (wolffian duct)

- In the Region of Trigone, Muscular coat (Detrusor Muscle) is Separated from Trigonal Muscle of Bell by "Fascia of Waldeyer" .QQ
  - ⇓
  - Layer of Smooth Muscle just beneath the Mucosa of Trigone.
  - It Replaces "Submucous coat in Trigone Area".

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Interureter Ridge ⇒ Kias "Mercier's bar"
→ Length → 2.5 cm; when empty &
5 cm; when Full

* Micturation centre ⇒ Cerebral cortex → Medial frontal cortex
Brain stem → Pons (Barrington's cortex).



Coronal section of Bladder

* LAYER OF SCROTUM :⇒ i) Skin;

ii) Dartos Muscle (Smooth Muscle Layer) ⇒ Continues ē Colle's Fascia of Perineum posteriorly - and Scrapa's fascia & camper Fascia Anteriorly.

iii) The external Spermatic Fascia ⇒ Extension from external oblique.

iv) The Cremastric Muscle ⇒ Continues ē fascia from Internal Oblique;

v) The internal Spermatic Fascia ⇒ continues ē fascia from Fascia transversalis

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

HEAD, FACE, NECK

NERVES OF THE PHARYNGEAL ARCH

1st Pharyngeal Arch ⇒ Mandibular

2nd Pharyngeal Arch ⇒ Facial

3rd Pharyngeal Arch ⇒ Glossopharyngeal

4th Pharyngeal Arch ⇒ Superior Laryngeal

6th Pharyngeal Arch ⇒ Recurrent Laryngeal

(5th Arch ⇒ Disappears)

FACE → each half of the face is supplied by 14 Nerves; 1 Motor & 13 sensory.

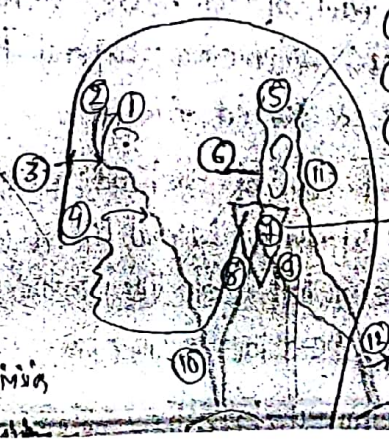
Motor Nerve supply ⇒ By Facial Nerve through its 5 branches

- Temporal
- Zygomatic
- Buccal
- Marginal Mandibular
- Cervical (supplies the platy

→ Facial N. Supplies all facial Muscles except ⇒ Levator palpebrae superior ⇓ By 3rd C.N

Venous drainage of Face ⇒

1. → Supra-orbital vein
2. → Supra-trochlear vein
3. → Angular vein
4. → Facial vein
5. → superficial temporal vein
6. → Maxillary vein
7. → Retro Mandibular vein
8. → Ant. division



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

DANGEROUS AREA OF FACE

- Upper lip & in lower part of Nose

↓ Infection from Dangerous Area

Facial vein

↓

Angular vein

↓

Superior ophthalmic vein

↓

Cavernous Sinus

Deep Facial vein

↓

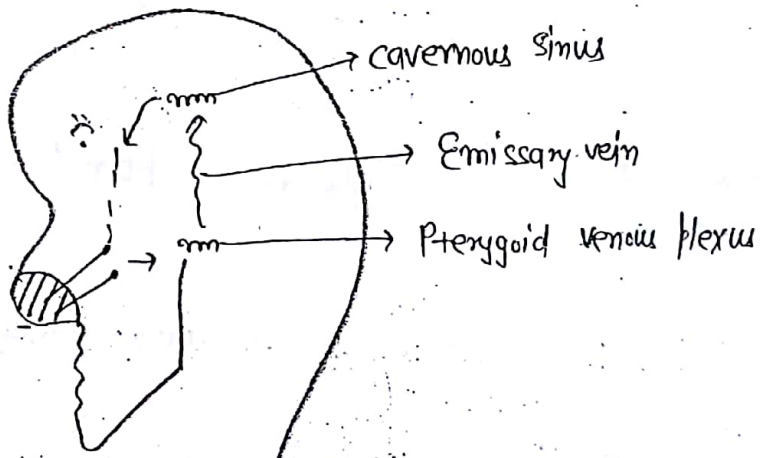
Pterygoid venous plexus

↓

emissary vein

↓

Cavernous Sinus



NEET'16

* Lymphatic drainage of Face :⇒ I. Upper Area :→ By Pre-Auricular Parotid Nodes / superficial Parotid Nodes

Upper Area ⇒ Greater part of Forehead; Lateral ½ of eyelids; conjunctiva; Lateral part of cheek & Parotid Area.

II. Middle Area :→ By Sub Mandibular Nodes

Middle Area ⇒ Central part of Forehead; External Nose; Upper lip; Lateral part of Lower lip; Medial half of eye-lids; Medial part of cheek & greater part of Lower jaw

III. Lower Area ⇒ By Sub-Mental Nodes

Lower Area ⇒ central part of Lower lip & chin.

http://mbbshelp.com WhatsApp +1 (402) 235-1397

* Sensory Nerve supply of the Face :⇒

is by Trigeminal Nerve through its three division :⇒

Ophthalmic ↙ | ↓ Maxillary | ↘ Mandibular

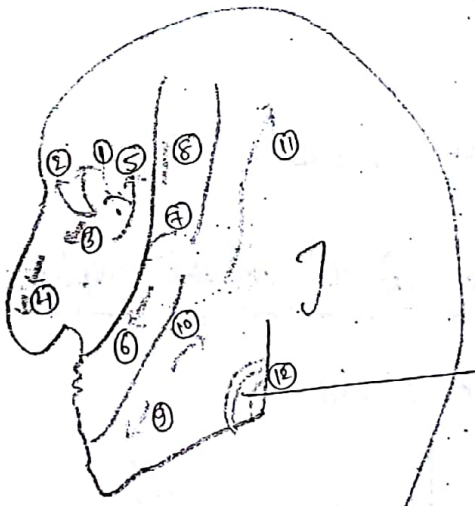
except ⇒ Skin over Angle of Mandible

⇓

Supplied by Greater Auricular Nerve

⇓

Branch of cervical plexus.



1. Supra-orbital N.
2. Supra-trochlear N.
3. Infra-trochlear N.
4. External Nasal N.
5. Lacrimal N.

"Tip of Nose & Lower part of Dorsum of Nose" are supplied by this.

6. Infra-orbital
7. Zygomatico-facial N.
8. Zygomatico-temporal N.

9. Mental N.
10. Buccal N.
11. Auriculo-temporal N.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Structure piercing Buccinator :⇒

① Parotid duct / stenson duct

② Duct of Molar gland;

③ Buccal branch of Mandibular Nerve

* Structure pierced by Parotid Ducts Are :⇒

1. Buccal Pad of Fat;
2. Buccopharyngeal Fascia;
3. Buccinator Muscle;
4. Mucous Membrane of cheek opposite to 2nd upper Molar teeth;

AIIMS QQ ⇒ Buccal branch of Facial Nerve supplies Buccinator but doesn't pierce it.

* Artery supply of Face :⇒

Anastomosis @ the Medial Angle of eye ⇒

External carotid A. → Facial A.

Internal carotid A. → Ophthalmic A. → Dorsal Nasal branch

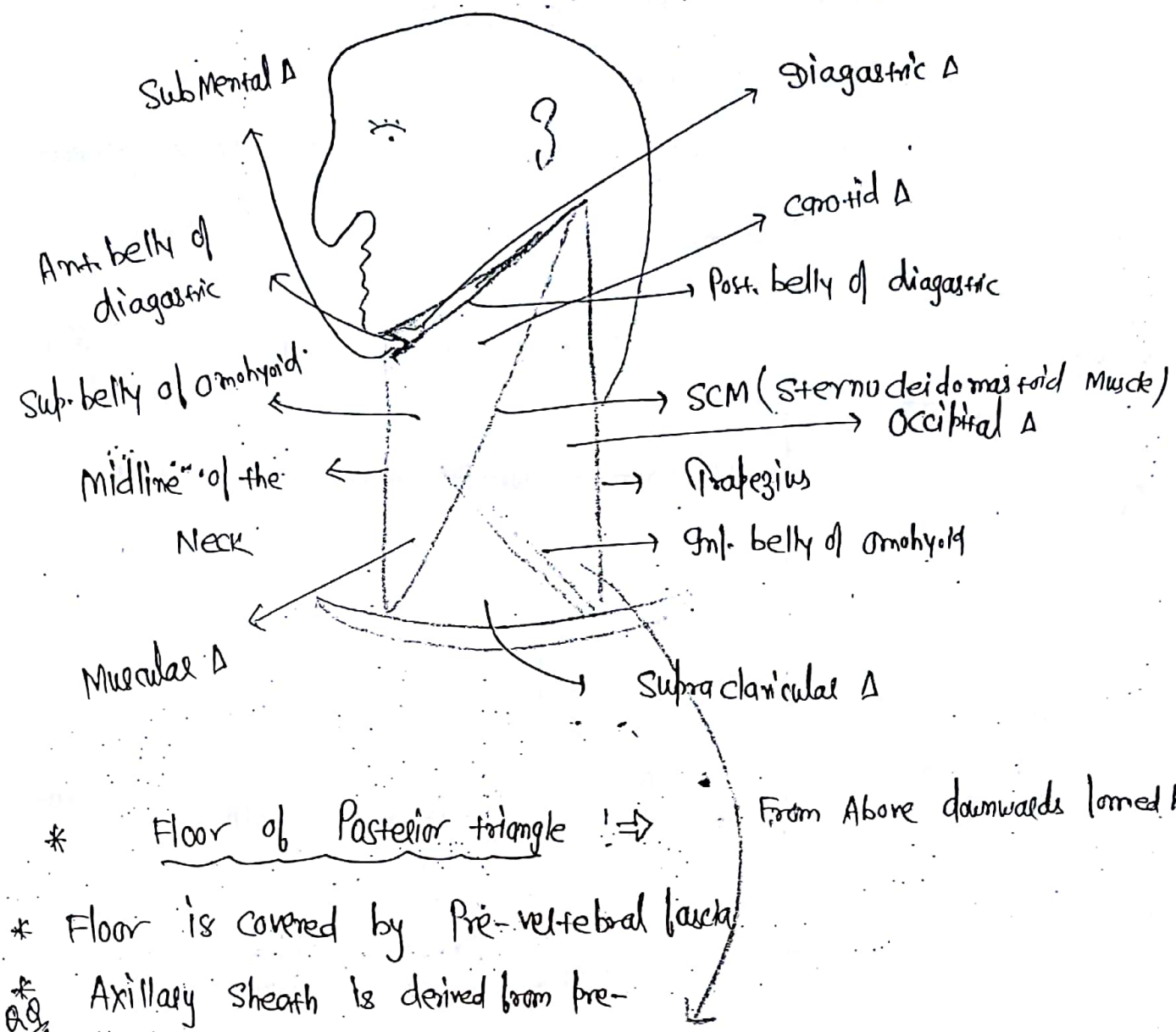
* Tortus Arteries → ⇓

This arteries are twists & winds in a "tortous" path.

1. Splenic Artery;
2. Uterine Artery;
3. Facial Artery;
4. PICA (Post. inf. cerebellar A.)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

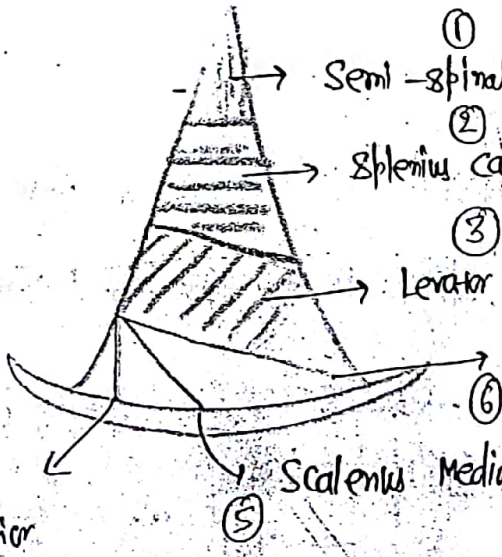
TRIANGLES OF THE NECK



* Floor of Posterior triangle :⇒ From Above downwards formed by

* Floor is covered by Pre-vertebral fascia

** Axillary Sheath is derived from pre-vertebral fascia.



AIIMS'16 * Danger space in the Neck :⇒ Superiorly ⇒ Skull Base

Anteriorly ⇒ Alar Fascia

Posteriorly ⇒ Prevertebral Fascia

http://mbbshelp.com WhatsApp: +1 (402)

Contents of Posterior A :⇒

a) Supra-clavicular part of brachial plexus;

b) Subclavian artery;

c) Spinal Accessory Nerve – Lies on the Levator Scapulae;

d) cervical plexus

- a) Lesser occipital Nerve (winds around the spinal accessory Nerve).
- b) Greater Auricular Nerve;
- c) Transverse cervical cutaneous N.;
- d) Supraclavicular Nerve
  - Medial
  - Intermediate / Middle → Pierces the clavicle
  - Lateral

Damage to it in the Posterior A of Neck leads to →

Paralysis of Trapezius

- difficulty in shruging of shoulder;
- difficulty in overhead Abduction;
- winging of Scapula).

e) occipital artery.

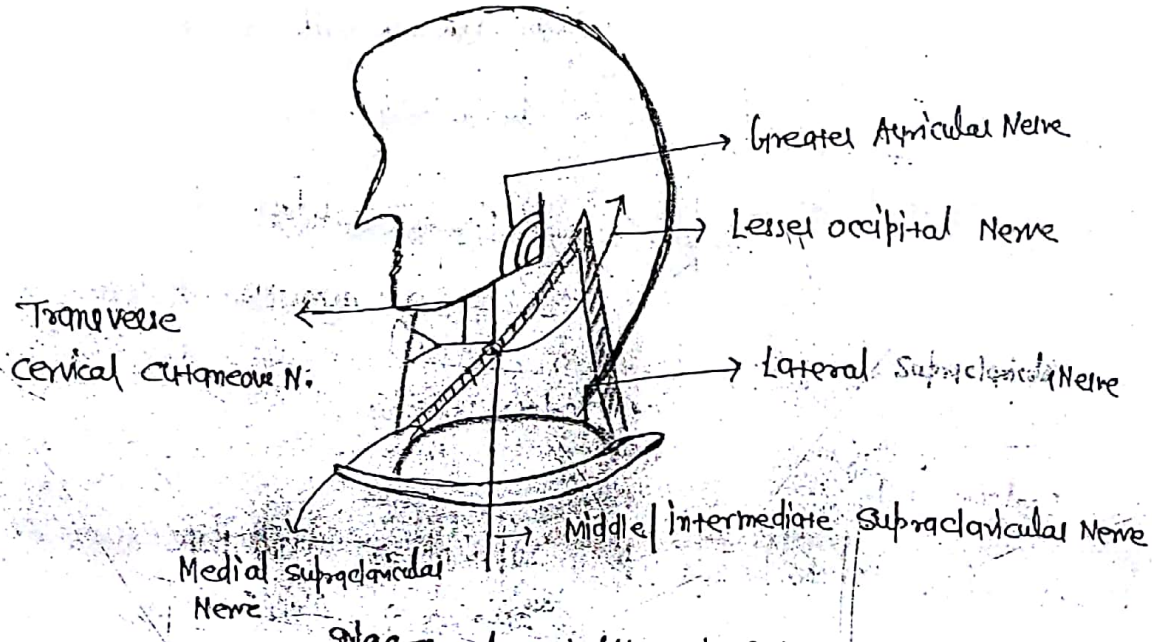


Diagram of cervical plexus in Posterior A

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Clinical sign of different Porto-systemic circulation :⇒

esophageal varices (Bleeding)

Hemorrhoids → PORTAL HYPERTENSION

Caput Medusae

NEET'16

1. TEMPORARY MUCOSAL FOLDS :⇒ Mucosal fold ; which are Obliterated by distension.
eg :- Gastric Rugae of stomach & Longitudnal fold.

2. PERMANENT MUCOSAL FOLDS :⇒ eg :- Plica circularis (valves of Kerkri of Small Intestine;
- Crescentric Mucosal folds of cystic duct (spiral valve of Heister)
- Transverse (Horizontal) Rectal folds (Houston's valve or plica transversalis);
- Permanent Longitudnal Rectal columns or folds (Found in Lower Rectum. Anal canal).

PETIT TRIANGLE (Inferior Lumbar triangle)

NEET'16

Boundaries :⇒ Base ⇒ Iliac crest.
Anterior Boundary (Abdominal Boundary) ⇒ Posterior border of External oblique Mu
Posterior Boundary (Lumbar Boundary) ⇒ Anterior border of Latissimus dorsi
Floor ⇒ Internal oblique Muscle

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

PELVIS

* Structures winding Around Ischial spine →

P → : Pudendal Nerve

I → Internal Pudendal vessels

N → N. to obturator Internus

they leave the pelvis through Greater sciatic foramen and enters the perineum through Lesser sciatic foramen

- The tendon of obturator Internus emerges out through lesser sciatic foramen.

* Blood supply of Pelvis :⇒

- Internal iliac Artery – Small terminal branch of common iliac A.

↙ ↘

Anterior division

- Superior vesical Artery
- Inferior vesical Artery (Supplies the prostate)
- Middle Rectal Artery
- Obturator Artery ; (While Accessory (Aberrant) obturator Artery is the branch of Inferior epigastric Artery ⇓ it is the branch of external iliac Artery → Inferior epigastric A. / Femoral A. / Deep circumflex iliac A.)
- Uterine & Vaginal Artery
- Inferior Gluteal Artery
- Internal Pudendal Artery

→ In female it is Replaced by " Uterine & Vaginal Artery "

Posterior division

- Superior Gluteal Artery
- Lateral Sacral Artery
- Ilio-Lumbal Artery ⇓ It supplies L5 vertebrae

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

URETER

- Length ⇒ 25 cm (10 inches)
- completely Retroperitoneal organ.

Abdominal Part -

Post. Relation → Transverse process of Lumbar process
Psoas Major
Genito-femoral Nerve

Ant. Relation of Right Ureter → 3rd Part of duodenum
- Rt. colic vessels
- ilio-colic vessels
- Root of Mesentry
- Gonadal vessels
- Terminal part of ileum

Ant. Relation of Left Ureter → Left colic vessels
Sigmoid vessels
Sigmoid Mesocolon
Gonadal vessels

Pelvic part - goes backwards along greater Sciatic Notch alo
with internal iliac vessels behind it.
- turns anteriorly at ischial spine & enters the Supralateral angle of Trigone of bladder
- In Males; the ureter is crossed by vas defer
- In Female; the ureter is crossed by Uterine a

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Blood supply of Ureter :⇒

① At its beginning → Renal Artery;

② Below it → Abdominal Aorta;

③ Little below it → Gonadal Artery;

④ At the Pelvic inlet → Internal iliac / common iliac

⑤ Near the base of bladder →
- Superior vesical
- Inferior vesicle
- Middle Rectal

Constriction of Ureter :⇒ Diameter = 3mm

① Pelvi-ureteric junction

② Crossing of the pelvic brim / bifurcation of common iliacs / crossing of external iliac

③ Crossing by the ductus differens / Broad Ligament

④ Entry into the bladder (Narrowest part of ureter)
↳ K/as "vesicoureteric junction"

⑤ Opening into the Trigone

URINARY BLADDER

QQ Retropubic space of Retzius:
↳ Lies behind the Pubic symphysis
⇓
contains vesicle venous plexus

* except→ Trigone; Rest all are derived from "Vesicourethral canal" (endodermal)
* 1st desire of Micturition usually appears @ 150–250 ml filling.

http://mbbshelp.com
WhatsApp +1 (402) 235-1397

* Base of the bladder :⇒

In Males →

- Separated from the Rectum in the upper part is by Recto vesicle pouch

- Related to vas deferences, Ampulla of vas, Seminal vesicle Ejaculatory duct.

In Females - Related to Supra-vaginal part of the cervix & vag.

Fascia of Dennonvillies ⇒ extends from Rectovesicle pouch to the perineal body

↳ Separates the Rectum from Seminal vesicle & prostate in Males.

* N. Supply :⇒ Sympathetic :⇒ $T_{10} - L_2$

↳ contracts the sphincter & Relaxes the Mus

Parasympathetic :⇒ $S_{2,3,4}$

↳ contracts the Muscles & Relaxes the sp

* epithellum of Bladder Mucosa :⇒ Transitional

URETHRA

Male urethra on section → At bulb → Trapezium

In the Penis → Horizontal slit

At base of glans → Inverted "T" shape

At external urethral orifice → vertical slit

Epithelial Lining

→ Above the opening of ejaculatory duct → Transitional

Upto middle of gland → columnar

http://mbbshelp.com WhatsApp +1(402)-235-1997

OVARY

- Suspended from posterior leaflet of broad Ligament by Mesovarium
- Attached to cornu of the uterus by Ligament of ovary and Lateral pelvic walls by Suspensory Ligament of ovary/ infundibulo-pelvic Ligament.

drains into the para-aortic Lymph Nodes.

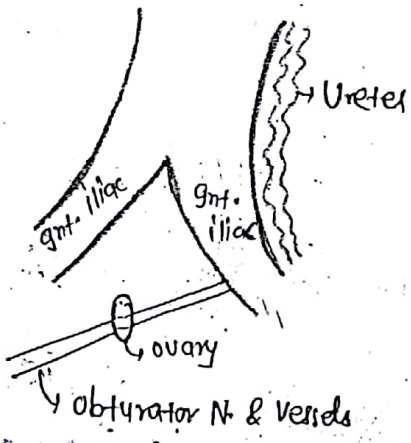
OVARIAN FOSSA

Boundaries →

Superiorly → external iliac vessels

Posteriorly → Ureter & Internal iliac vessels

Laterally & the floor → obturator Nerve & vessels



UTERUS

FUNDUS ← Body → CERVIX (2.5 cm Long)

* Round Ligament of Uterus is attached to → i) CORNU
ii) Labia Majora

↳ Principally Responsible for Maintaining Anteversion position of Uterus

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Roof of Posterior triangle :⇒

Investing Layer of Deep cervical fascia -

It encloses :⇒

2 Muscles ⇒ a) Sterno-cleido-Mastoid
b) Trapezius.

2 spaces ⇒ a) Supra clavicular
b) supra-sternal

2 Glands ⇒ a) Sub-Mandibular
b) Palotid

Form Roof for 2 triangles → Posterior
→ Anterior

Anterior Triangle

* Muscular Δ :⇒

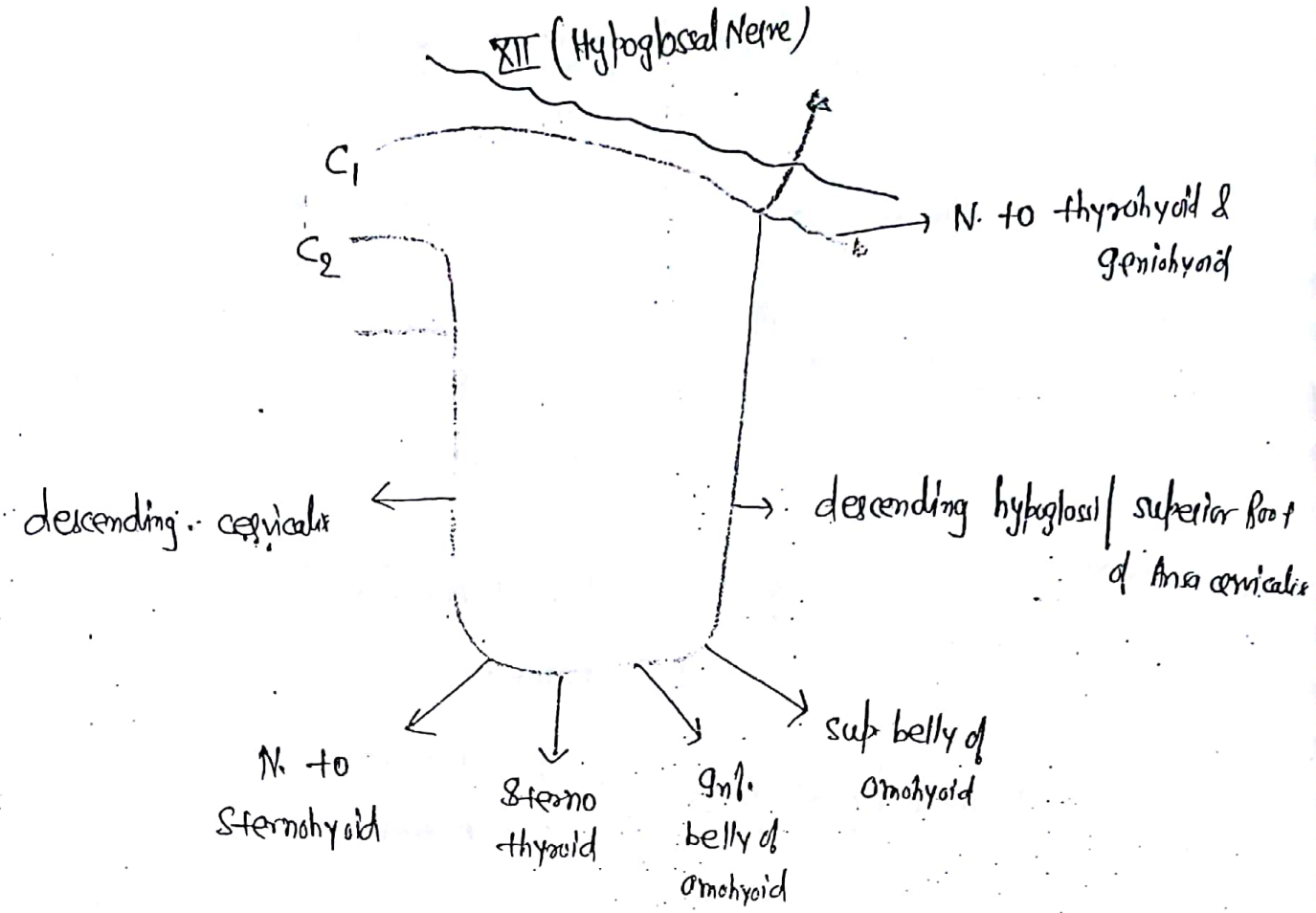
a) Sternohyoid muscle
b) sterno-thyroid muscle
c) Thyrohyoid muscle
d) omohyoid muscle

→ Infrahyoid Ribbon Muscle

ANSA CERVICALIS

* It lies on Anterior wall of carotid sheath.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397



* "Thyrohyoid & Geniohyoid" are supplied by separate branch of C_1 Nerve through hypoglossal Nerve.

THE COMMON CAROTID ARTERY

- divides at the superior border of lamina of the thyroid cartilage.

- Muscle b/w the 2 carotids ⇒ Styloglossus & stylopharyngeus

- Branches of External carotid Artery :⇒

(A) Anterior Branches ⇒ Superior thyroid
Lingual
Facial

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(B) Posterior Branch ⇒ Post. Auricular
Occipital

(C) Medial Branch ⇒ Ascending Pharyngeal

(D) Terminal Branch ⇒ Superficial temporal
Maxillary

* Carotid Pulse ⇒ Can be felt along the SCM muscle @ the Level of Laryngeal prominence QQ

MUSCLE OF MASTICATION

Masseter
Medial Pterygoid
(elevation of Mandible)

Temporalis
- Vertical fibres ⇒ elevation
- Posterior fibres ⇒ Retraction

Lateral Pterygoid
- Upper head ⇒ Depression
- Lower head ⇒ Protrusion

— N. Supply of all Muscles ⇒ Mandibular Nerve

* BOUNDARIES OF POSTERIOR TRIANGLE

Anteriorly → Posterior border of SCM Muscle.
Posteriorly → Anterior Margin of Trapezius;
Base → Superior Surface of Middle third of clavicle

* BOUNDARIES OF DIAGASTRIC TRIANGLE

Anteriorly → Base of Mandible & A line extending its Angle to Mastoid.
Below & in front → By Anterior Belly of diagastric
Below & behind → Post. Belly of diagastric

http://mbbshelp.com → WhatsApp: +1 (402) 235-1397

INTERIOR OF SKULL

① Foramen Rotundum ⇒ Maxillary Nerve;

② Foramen ovale ⇒ M → Mandibular Nerve;
A → Accessory Meningeal A.
L → Lesser Petrosal Nerve
E → Emissary vein

③ Foramen Spinosum ⇒ Nervus Spinosus / Meningeal branch / Recurrent branch of Mandibular Nerve;
Middle meningeal vessels;

④ Foramen Lacerum ⇒ Internal Carotid A

⑤ Internal Acoustic Meatus ⇒ 7th; 8th & Labyrinthine vessels

⑥ Jugular foramen :→

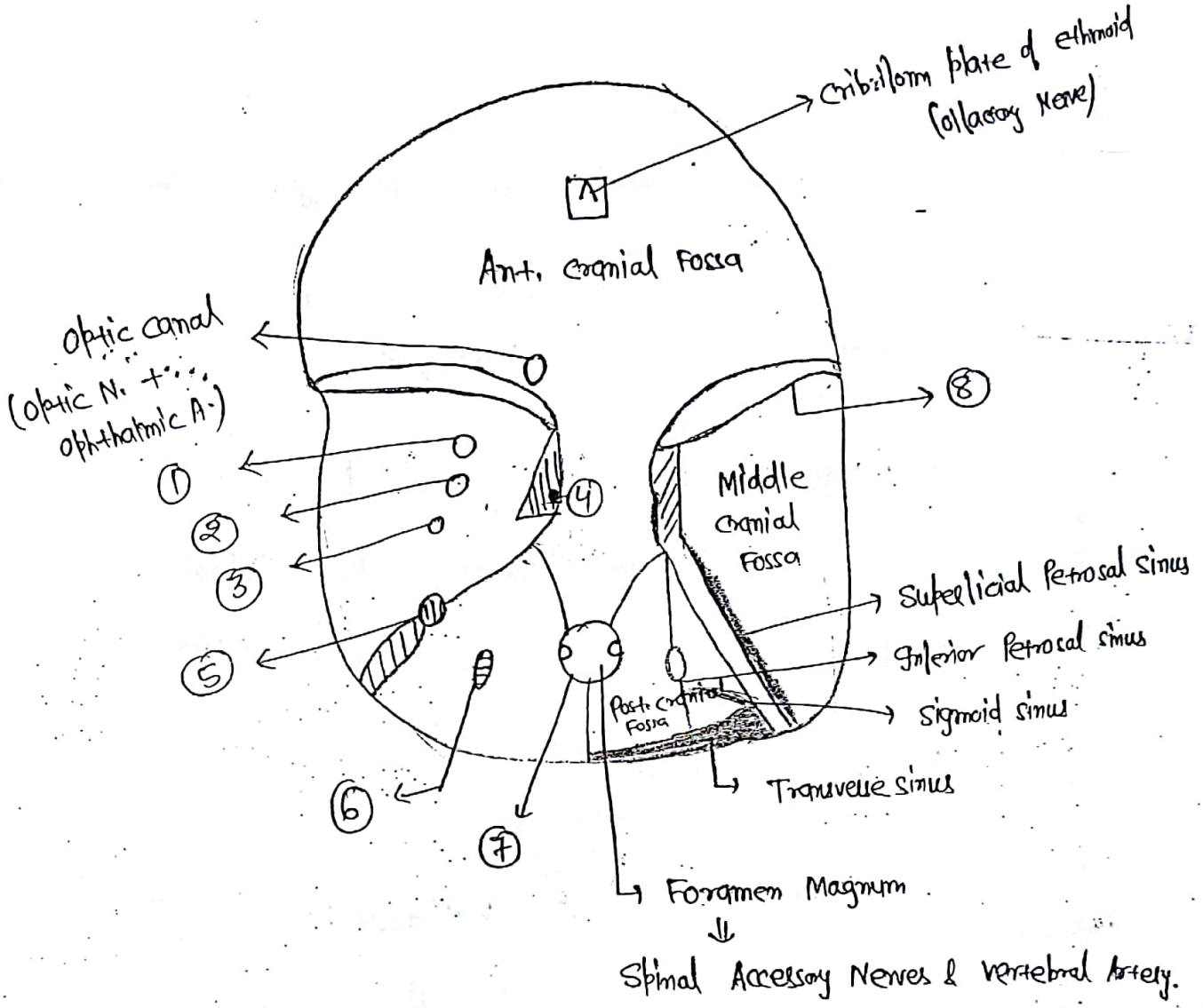
- Anterior compartment
  - Inferior Petrosal Sinus
- Middle compartment
  - 9th, 10th, 11th Cranial Nerve
- Posterior compartment
  - Sigmoid Sinus

⑦ Hypoglossal canal / Anterior condylar canal ⇒ Hypoglossal N.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

⑧ Sup. orbital fissure ⇒ 3rd; 4th; 6th C.N. & Ophthalmic Ne

⑨ Optic canal ⇒ Optic Nerve & Ophthalmic Artery.



* Meckel's Cave → Trigeminal ganglion lies in it. (Gasserian ganglion)
→ Cave like formation of duramater

* Contents of Parotid gland (superficial to deep) :→ 1. Facial Nerve
2. Retromandibular vein;
3. External Carotid Artery.

* Pterygoid canal → Vidian Nerve (N. of Pterygoid canal);
Vidian Artery (Artery of Pterygoid canal);

NEET 16 '08

* N. of Pterygoid canal is formed by the junction of the greter petrosal N.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

MANDIBULAR NERVE

-i) Branches from the trunk;

↳ ① N. Spinosus

⇊

Enters the skull through foramen spinosum & supplies the Meninges of Middle cranial fossa.

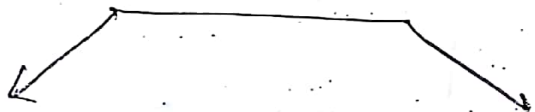
② N. to Medial Pterygoid

⇊

Supplies the Medial Pterygoid

↳ also supplies Tensor Palati; Tensor tympani

-ii) Anterior division



3 Muscular

- Masseteric Nerve
- Deep temporal Nerve
- N. to Lateral Pterygoid

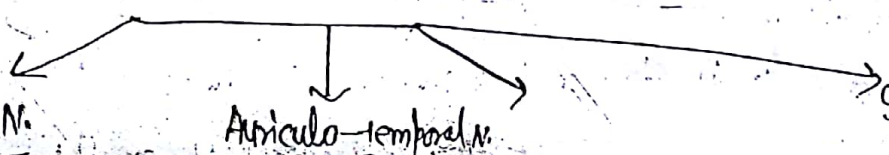
1 Sensory | cutaneous

- Buccal Nerve

⇊

Supplies the skin & Mucous Membrane over the buccinator

- iii) Posterior division



Lingual N.

Auriculo-temporal N.

Inferior alveolar N.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Lingual Nerve ⇒ Supplies General Sensation to Ant. 2/3rd of tongue
- It is joined by chorda tympani; which supplies Special sensation to Anterior 2/3rd of tongue.

Auriculo-temporal Nerve ⇒ Supplies the skin over the Auricle & temporal Region
↳ It also carries the post-ganglionic parasympathetic fibres from otic ganglia to parotid gland.

Inferior-Alveolar Nerve ⇒ Dentist Nerve
- enters the Mandibular Foramen; supplies the Lower jaw & teeth & emi out as Mental Nerve.
- Before entering the Mandibular foramen; it gives a branch - N. to Mylohyoic ⇓ which supplies Mylohyoid & An belly of digastric Muscle

MAXILLARY ARTERY

- Branch of external carotid; given in Parotid gland
- divided into 3 parts by lateral Pterygoid Muscle

(I) 1st part (↳ extends upto lower border of Lateral Pterygoid Muscles.) ⇓ (Mandibular part) ⇒
- Deep Auricular A.
- Anterior tympanic A.
- Middle Meningeal A.
- Accessory Meningeal A.
- Inferior alveolar A.

(II) 2nd part (↳ Lies in Infra-temporal fossa) ⇓ (Pterygoid part) ⇒
- Masseteric A.
- Deep temporal A.
- Artery to the Pterygoid
- Buccal Artery

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(III) 3rd Part ⇒

⇓

(Pterygopalatine Part)

⇓

Lies In Pterygo-palatine fossa.

Post. superior alveolar A.

Infra-orbital A.

Greater palatine A.

Pharyngeal A.

Artery of Pterygoid canal A.

Sphenopalatine A. (Artery of epistaxis)

AUTONOMIC NERVOUS SYSTEM

Symphathetic Nervous system ⇒

The preganglionic fibres arises from Lateral horn cells of T_1 to L_2 segments of the spinal cord,

- They Pass through ventral root; spinal Nerve & enters the Symp. ganglion through white Ramus communicans
- Thus white Ramus communicans are prt. in T_1-L_2 spinal Nerves
- The fibres goes to higher & lower ganglion.
- The Post-ganglionic fibres enters the spinal Nerve through Grey Rami communicans.
- Thus Grey Rami communicans is given to all the spinal Nerve

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Parasympathetic Nervous system ⇒

AIIMS Nov'16

Cranial outflow

- Arises in the brain stem
- Carried by 3rd, 7th, 9th & 10th C.N
- They supplies the glands

Sacral outflow

$S_{2,3,4}$ | Nervi eregentie | Pelvic Splanchnic.

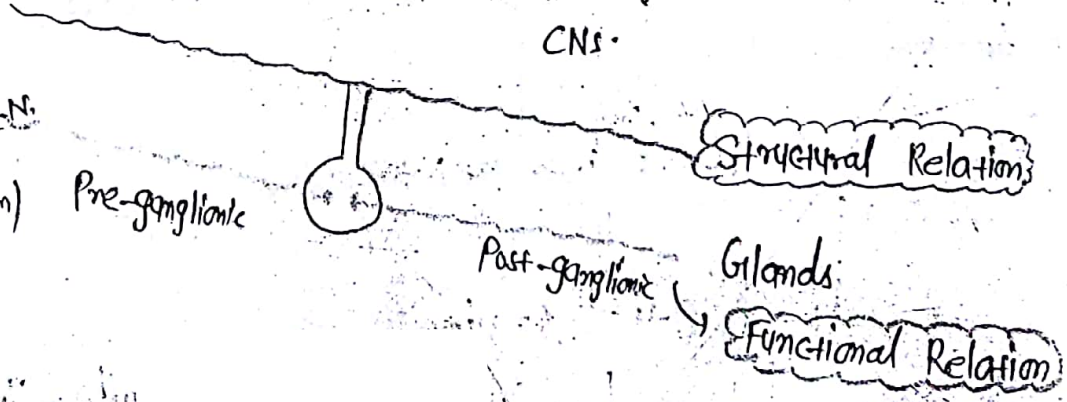
- Arises in the Lateral horn cells of $S_{2,3,4}$ segments of the spinal cord (Pre-ganglionic fibres)

* All the glands in the head & Neck are supplied by Facial Nerve except → Parotid gland
  ‖
  Supplied by glossopharyngeal Nerve

* Vagus supplies the gland of GIT

* 3rd C.N. Supplies ⇒ Sphincter pupillae & ciliaris Muscle.
  ↳ No gland supply.

GANGLION
↳ Collection of Neuronal cells body outside the CNS.



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

	Pterygopalatine Ganglion [Sphenopalatine ganglion (Largest P.S. Ganglion)]	Ciliary ganglion	Otic ganglion	Submandibular ganglion
Structural	Maxillary N.	Nasociliary N.	Mandibular N.	Lingual N.
Functional	VII	III	IX	VII

OTIC GANGLION :⇒ Relation ⇒ Superiorly : Foramen Ovale;

Laterally : Mandibular Nerve
Medially : Tensor Vali Palatini
Posteriorly : Middle Meningeal A.

* Otic ganglion usually surrounds the origin of the N. to Medial Pterygoid

NERVE SUPPLY OF PAROTID GLAND :⇒

Preganglionic:
→ Inferior Salivatory Nucleus (Nucleus of Glossopharyngeal N. which supplies Parotid gland)
↓
Tympanic br. of 9th C.N. (Jacobson's Nerve)
↓ + Symphathetic plexus
Tympanic plexus (Lies on the promontory of Middle ear)
↓
Lesser Petrosal Nerve
↓
Otic ganglion

Post-ganglionic:
Otic ganglion ← via ← Auriculotemporal N. (it carries the post. ganglionic fibres from otic ganglion to Parotid)
↓
Parotid gland

{ Supplies the Middle ear cavity; Eustachian tube; Mastoid Antrum

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

FACIAL NERVE

Superior Salivatory Nucleus (Nucleus of Facial N.)

↓

Sensory br. of Facial Nerve
(Nervus Intermedius / N. of Wrisberg)

↓ ← joins ⊂ Motor branch

Trunk of Facial N. (in the Internal ear)

↓

Geniculate ganglion (Bend / Genu of Facial Nerve)

- → Greater Petrosal N.
- → N. to Stapedius
- → Stylomastoid ⊥ Parotid Gives N. to Chorda tympani

* Chorda tympani emerges out through Petro-tympanic fissure

Joins ⊂ Lingual ← Sub Mandibular ganglion

↓ & supplies

- Sub Mandibular gland
- Lingual gland
- taste fibres from ant. 2/3rd of tongue (except Circumvallate papillae)

* Greater Petrosal Nerve joins ε deep petrosal N.

↓ Forms

Vidian Nerve | N. to Pterygoid canal NEET'16

↓

Pterygopalatine ganglion

↓ supplies

∴ ... Lacrimal; Nasal; Palatine & pharyngeal gland.

* Crocodile tears involves submandibular & Lacrimal gland.

* Vidians Nerve irritation ⇒ Symptom of Allergic Rhinitis occur.

FUNCTIONAL COMPONENT OF NUCLEUS

(1) SPECIAL VISCERAL EFFERENT / BRANCHIO-MOTOR COMPONENT :-

- Supplies the Muscle derived from the Pharyngeal arches.
- Efnt in 5, 7, 9, 10th C.N.
- Common Nucleus for 9th ; 10th & cranial accessory (11th C.N.) is Nucleus Ambiguous

(2) General visceral efferent / secreto-Motor COMPONENT :-

- Supplies the gland
- It represents the cranial outflow of the parasympathetic Nervous system
- Efnt in 3, 7, 9, 10th CNs

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

③ General Somatic element ⇒

- Supplies the Muscle derived from occipital somites | Myotome (extra-ocular & tongue Muscle)
- ⊕nt in 3rd; 4th; 6th; 12th C.N.

* Blood Supply OF Facial Nerve

① gn Facial canal → ⓐ Superficial Petrosal branch of Middle Meningeal Artery;

ⓑ Stylomastoid branch of Posterior Auricular or occipital Arteries;

② Extracranially → ⓐ Stylomastoid branch of Posterior Auricular or occipital arteries

ⓑ Tympanic branch of Ascending pharyngeal Artery.

SINUSES

* DURAL VENOUS SINUS ⇒ gt is outer to Meningeal Layer inner to endosteal Layer.

– The duramater divides into an endosteal and Meninges layers to encloses the dural venous sinus.

*

Superior Sagital Sinus

↓

Rt. transverse

↓

Rt. Sigmoid

↓

Rt. internal jugular vein.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Inferior Sagittal Sinus

↓

Straight Sinus

↓

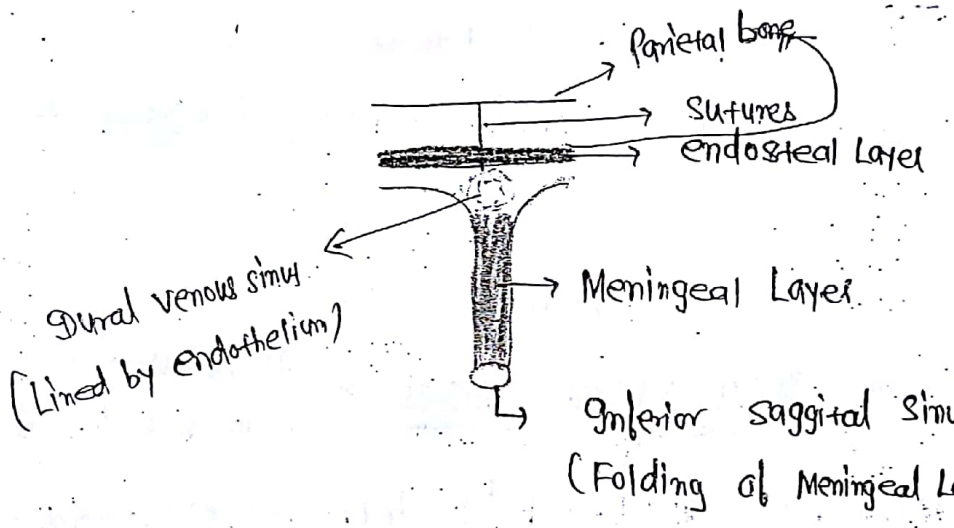
Lt. transverse

↓

Lt. Sigmoid

↓

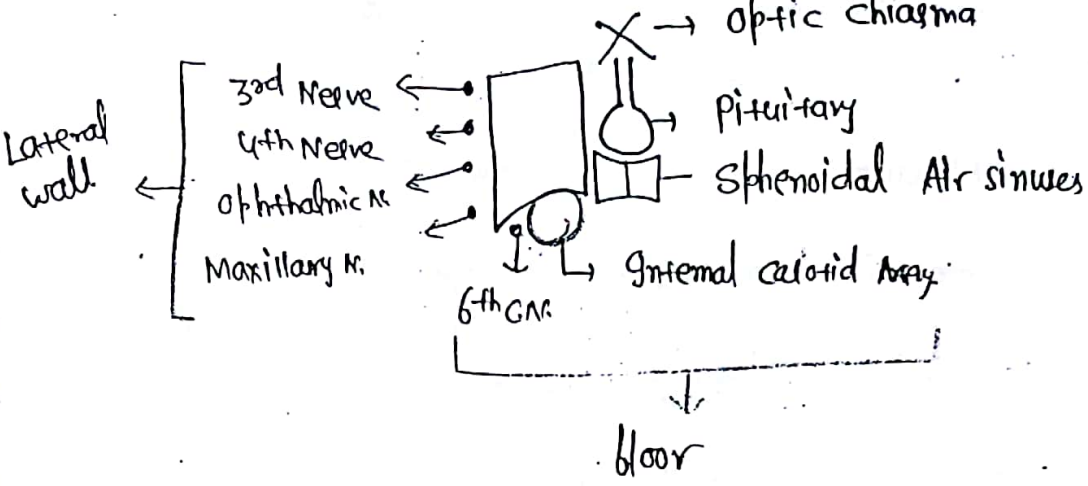
Lt. Internal jugular vein



* Falx cerebri :⇒ It contains Superior saggital sinus & straight sinus.
* Falx cerebelli :⇒ Encloses occipital Sinus.
* Great cerebral vein of Galen ⇒ It is formed by the Union of two Internal cerebral veins ; is 2 cm long & it drains into the straight Sinus.

http://mbbshelp.com (402) 235-1397

CAVERNOUS SINUS



* Tributaries of cavernous sinus (coming towards C.S.)

From the orbit
- Sup. ophthalmic vein
- Inf. Ophthalmic vein
- Central vein of Retina

From the Meninges
- Spheno-parietal sinus

From the Brain
- Superficial Middle cerebral vein
- Inferior cerebral ve

* Draining channels (Away from cavernous sinus)

① Superior petrosal sinus ⇒ drains cavernous sinus to transverse sinu

② Inferior petrosal sinus ⇒ drain cavernous sinus to internal jugula vein / sigmoid sinus

③ The two cavernous sinuses all connected by An Anterior & Posterior Inter-cavernous sinuses

④ The cavernous sinus drains into pterygoid venous plexus through Emissary veins

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

THE PHARYNX ⇒ extends from base of skull to the level of 6th cervical vertebrae.

i) Structure passing b/w the Superior constrictor & Base of skull | Sinus of Morgagni ⇒

a) Eustachian tube. Mnemonic ⇒ PALE

b) Levator palati Muscle

NEED 16 c) Ascending Palatine A.

d) Palatine branches of ascending pharyngeal A.

ii) Structure passing b/w superior & Middle constrictor ⇒

a) Stylopharyngeus Muscle;

b) Glossopharyngeal Nerve;

iii) b/w the Middle & inferior constrictor ⇒

a) Internal Laryngeal Nerve

b) Superior Laryngeal vessels

iv) Below the inferior constrictor ⇒

a) Recurrent Laryngeal N.

b) Inferior Laryngeal vessels

* Tensors of Vocal cords ⇒ crico-thyroid
  ↓ supplied by external Laryngeal Nerve
  Paralysis Results in "Loss of Timber of the voice"

* Abductor of vocal cord ⇒ Post. crico-arytenoid

* Safety Muscle of tongue ⇒ Genioglossus
  ↳ it protrudes the tongue

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* In lesions of hypoglossal N. the tongue is ~~bent~~ deviated to same side of Lesion.

* Intrinsic Muscle of Pharynx ⇒ Stylopharyngeus; Salpingopharyngeus; Palato-pharyngeus.

* Extrinsic Muscle of Pharynx ⇒ Superior constrictor; Middle constrictor; Inferior constrictor.

* Foramen of Morgagni ⇒ Located in Thoracic Diaphragm; from which Superior epigastric A. & vein & Lymphatics passes.
- It is also Klas "Sternocostal Hiatus or Larrey's Δ"

* Retropharyngeal space ⇒ Potential space of the head & Neck; bound by the buccopharyngeal fascia Anteriorly & the Alar fascia Posteriorly.

* Pharynx is Subdivided Into → Nasopharynx → Lined by ciliated columnar epithelium QQ
Lies above the soft palate
→ oropharynx
→ Hypopharynx

* Pharyngeal opening of Eustachian tube is situated 1.25 cm behind the posterior end of Inferior turbinate QQ

* Key Muscle of the oral Region ⇒ Hyoglossus

* Structure Superficial to Hyoglossus Nerve ⇒
- Lingual Nerve
- Submandibular ganglion
- deep part of Submandibular gland
- Submandibular duct
- Hypoglossal Nerve

* Structure deep to Hyoglossus Muscle ⇒ Glossopharyngeal Nerve
Lingual ~~Artery~~.

* Structure lie around Submandibular duct ⇒ Lingual Nerve

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

PHARYNGEAL ARCHES

ECTODERMAL CLEFTS ⇒

1st E.C. ⇒ Forms the external Acoustic Meatus & Pinna

2nd E.C ⇒ grows down & fuses c the last

⇓

The Neck thus become smooth;

if it doesn't fuse → Branchial Sinus / Fistula

ENDODERMAL POUCHES ⇒

First Endodermal Pouch

Dorsal
- Forms the tubo-tympanic Recess; which forms Middle ear cavity & eustachian tube.

Ventral
- Joins c the 2nd & forms the palatine tonsil.

Second Endodermal Pouch

- Joins c ventral part of 1st E.P. & forms the palatine tonsil.

Third Endodermal Pouch

Dorsal
⇓
Inferior Parathyroid

Ventral
⇓
Forms the thymus

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Fourth Endodermal Pouch

Dorsal

Superior Parathyroid

Ventral

Ultimo-branchial bodies; which forms Para-follicular "c" cells of thyroid.

⇓

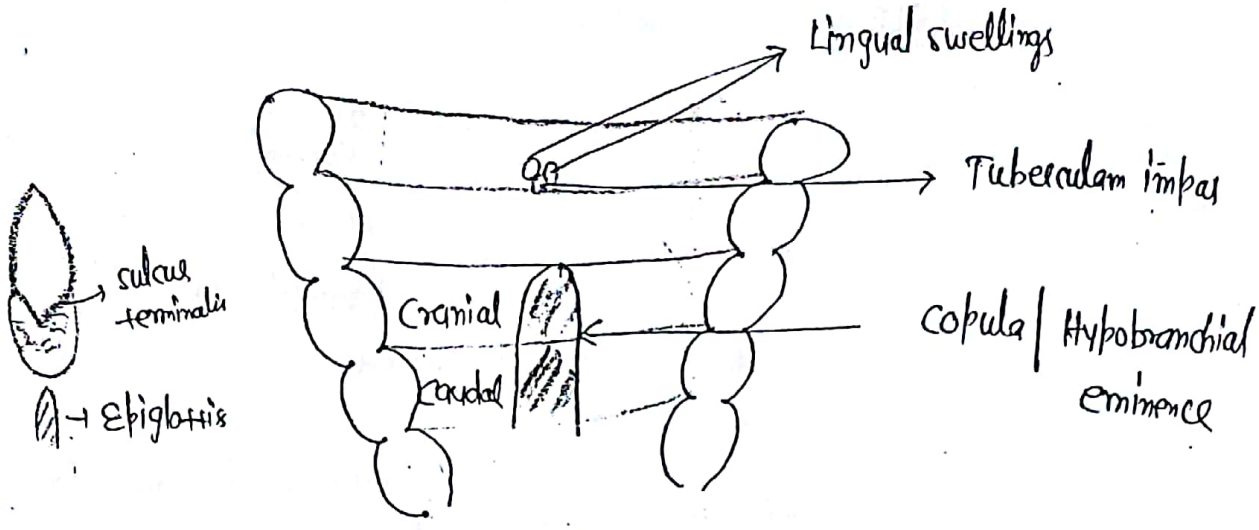
Recently discovered from "Neural crest cells" (≡)

Ultimo-branchial bodies ⇒ 4th Endodermal Pouch.

DEVELOPMENT OF TONGUE

- Ant. 2/3rd of the tongue is derived from → 2 Lingual Swellings & Tuberculum Impar.
- Post. 1/3rd of the tongue is derived from ⇒ Cranial part of hypo-branchial eminence / copula
- Post. Most. part of the tongue & epiglottis is derived from caudal part of hypo-branchial eminence.
- Muscles of the tongue are derived from ⇒ Occipital Myotomes.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397



* NERVE SUPPLY OF TONGUE :- ⇒

PART	TASTE	GENERAL (TOUCH & TEMP.)
Anterior 2/3rd (oral part) except → circumvallate papillae)	Chorda tympani (Facial Nerve)	Lingual branch of Mandibular division of Trigeminal Nerve
Posterior 1/3rd Including circumvallate papillae	Glossopharyngeal	Glossopharyngeal
Posterior Most part	Internal Laryngeal branch of vagus	Internal Laryngeal branch of vagus

* Delphian Nodes ⇒ Also "Pre-Laryngeal Nodes".

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

DEVELOPMENT OF FACE

→ 5 Processes ; which takes part in formation of Face :-

- 1 Frontonasal process
- 2 Maxillary process
- 2 Mandibular process

* Midline upper lip cleft ⇒ d/t Non-fusion of 2 Medial Nasal process

* Hare lip | cleft lip ⇒ d/t Non-fusion of Maxillary process & Medial Nasal process

* oblique facial cleft ⇒ Non fusion of Maxillary process & Lateral Nasal process

* Midline lower lip cleft ⇒ Non-fusion of 2 Mandibular process

DEVELOPMENT OF HARD PALATE

Primary | primitive palate | pre-Maxilla

⇓

Fusion of two Medial Nasal process

Secondary

⇓

Fusion of two palatine process of Maxilla

* The Incisive foramen differentiates b/w Primary & secondary palate

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

PHARYNGEAL PLEXUSES

- Formed by → a) pharyngeal branch of glossopharyngeal Nerve,
- b) Pharyngeal branch of vagus & cranial accessory
- c) A branch from superior cervical ganglion

→ The Pharyngeal plexuses lies on Middle constrictor Muscle of the pharynx.

- It supplies → ① All the Muscles of Soft palate except → tensor palati.

⇓

Supplied by Mandibular N. through the Nerve to Medial Pterygoid

② All Longitudinal Muscle of pharynx.

Stylopharyngeus — Salpingopharyngeus — Palatopharyngeus

↳ Supplied by glossopharyngeal Nerve.

③ All the circular Muscle of Pharynx except Cricopharyngeus part of Inf. constrictor

⇓

External / Recurrent Laryngeal N.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

VAGUS NERVE

Superior Laryngeal (4th Pharyngeal Arch)

Internal Laryngeal

- pierces the thyrohyoid Membrane; passes blw Middle & Inferior constrictor; to supply the Mucous membrane of the Larynx above vocal folds.
- also supplies Posterior Most part of Tongue & Epiglottis

External Laryngeal

Supplies the Crico-thyroid.

Recurrent Laryngeal (6th pharyngeal Arch)

- Lies in the tracheo-esophageal groove
- passes below Inferior constrictor to supply all Muscle of Larynx except Crico-thyroid
- Sensory supply below the vocal Folds.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

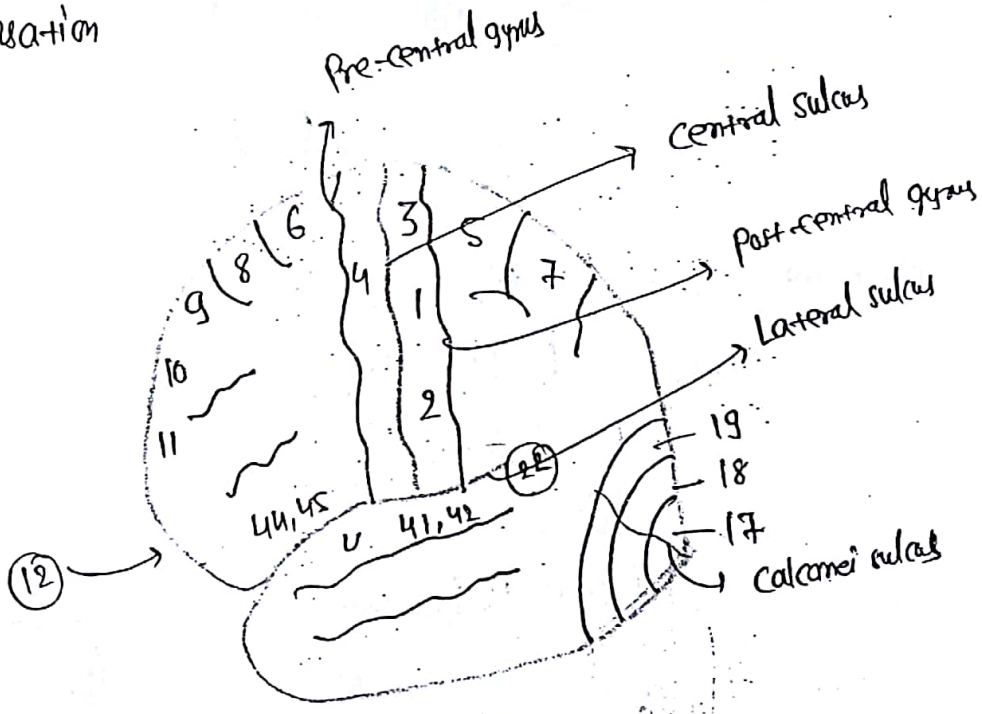
BRAIN

Central sulcus is kias ⇒ Sulcus of Rolando.

Lateral sulcus is kias ⇒ Sylvian fissure.

* Functional Areas :⇒

- Primary Area
  - Perception of sensation
- Association Area
  - Interpretation of sensation



Area 3,1,2 ⇒ 1° Sensory Area

Crude sensation ⇒ Touch; Pain; temperature

Fine sensation ⇒ Tactile localization;
Tactile discrimination;
Stereognosis;
Vibration;
Bognosthesia

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

	1st ORDER NEURON	2nd order Neuron	3rd order Neuron
Crude sensation	Dorsal Root Ganglion	• Dorsal horn cells of spinal cord (Substantia gelatinosa)	Thalamus (Ventro-posterio-Lateral Nucleus)
Fine sensation	Dorsal Root Ganglion	• Nucleus gracilis & Nucleus cuneatus	• Thalamus - (Ventro-posterio-Lateral Nucleus)

∴ ∴

Area 5, 7 ⇒ Sensory Association Area

Area 17 ⇒ Primary visual Area

Visual Pathway ⇒ Retina

↓

Optic Nerve

↓

Optic chiasma

↓

Optic tract

↓

Lateral geniculate body

↓

Optic Radiate (Retrolentiform part of Internal capsule)

↓

Area 17

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Area 18, 19 ⇒ Visual Association Areas

* Damage to Area 18, 19 leads to ⇒ Visual Agnosia / word blindn

Area 41, 42 ⇒ Primary Auditory Area

Auditory pathway ⇒ Organ of Corti

↓

Dorsal & ventral cochlear Nucleus (⊕ in Medulla oblo

↓

Superior olivary Nucleus

↓

Trapezoid body

↓

Lateral Leminiscus

↓

Inferior colliculus

↓

Medial geniculate body

↓

Auditory Radiation (Sublenticular part of Internal capsule)

↓

Area No. 41, 42 (Cortex)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Area No: 22 ⇒ Sensory speech Area / Wernicke's Area

* Damage to 22 leads to ⇒ Auditory agnosia / word deafness
* Area 41, 42 damage ⇒ Deaf.

Area No: 44, 45 ⇒ Broca's Area / Motor speech Area

* Arcuate fasciculous / Uncinate fasciculous ⇒ Connects the Wernickes & broca's Area. (connect Frontal to temporal Lobe)

Area No: 4 ⇒ 1° Motor Area

Func^{n} ⇒ Initiation of Movements

* Large Pyramidal cells is k/a ⇒ "Betz cells"

Descending fibres

Cortico spinal

↓

Area No: 4

↓

- Internal capsule (Posterior limb)

↓

Mid brain (Crus cerebri)

↓

Pons (Basilar part)

↓

Medulla (Pyramids)

↓

Spinal Cord / Anterior horn cells

Cortico-Nuclear

↓

Area No: 4

↓

Internal capsule (Genu)

↓

Brain Stem (Nuclei of the cranial Nerves)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Area No. 6,8 → Pre-Motor Area

↳ execution of Movements

Area No. 9,10,11,12 → Pre-frontal Area

↳ function ⇒ Intelligence; Memory; ego & self-Respect (Personality / social behaviour).

* Pterion ⇒ It is the Region; where the Frontal; Parietal temporal & Sphenoid joined together.
  - Also the "weakest part of the skull".
  - The Anterior division of Middle Meningeal Artery Runs underneath the pterion.

* FRONTAL LOBE ⇒ It has following functional Areas ⇒

i) 1° Motor Cortex ⇒ Broadmann's Area 4;

ii) Premotor Cortex ⇒ Areas 6, 8;

iii) Supplementary Motor Area ⇒ Area No. (6), (8)

iv) Frontal eye field ⇒ Area No. (6), (8), (9)
↳ Located in Posterior part of Middle frontal gyrus.

v) Broca's Motor Speech Area ⇒ Area No. (44), (45)
↳ Located in Posterior part of Inferior frontal gyrus.

vi) Prefrontal Area ⇒ Area No. (9), (10), (11), (12)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* PARIETAL LOBE ⇒ i) Primary Somatosensory Cortex

⇓

Area No. (3), (1), (2)

ii) Somatosensory Association Areas :→

a) Superior parietal Lobule → Area No. (5), (7)

b) Supra Marginal gyrus → Area No. (40)

c) Angular gyrus → Area No. (39)

* TEMPORAL LOBE ⇒ i) Primary Auditory Area

⇓

Area No. (41), (42)

ii) Auditory association cortex (Secondry Auditory Area)

⇓

Area No. (22)

- It includes Wernick's Speech Area & is located in Posterior part of Superior temporal gyrus.

* OCCIPITAL LOBE ⇒ i) Primary visual cortex

⇓

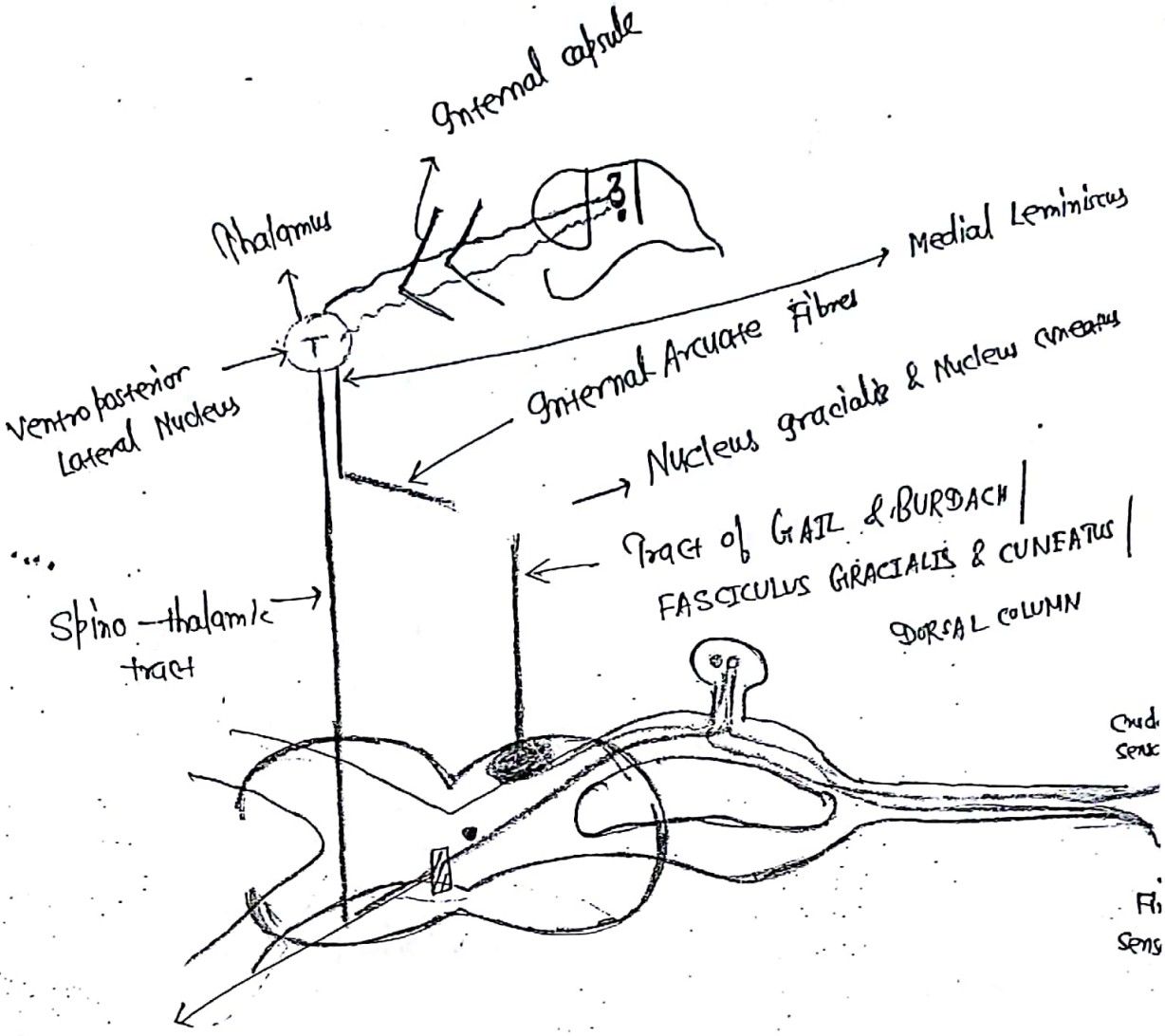
Strike Area ; Area No (17)

ii) visual Association Areas

⇓

Secondary visual Area ; Area No. (18), (19)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397



Syringomyelia

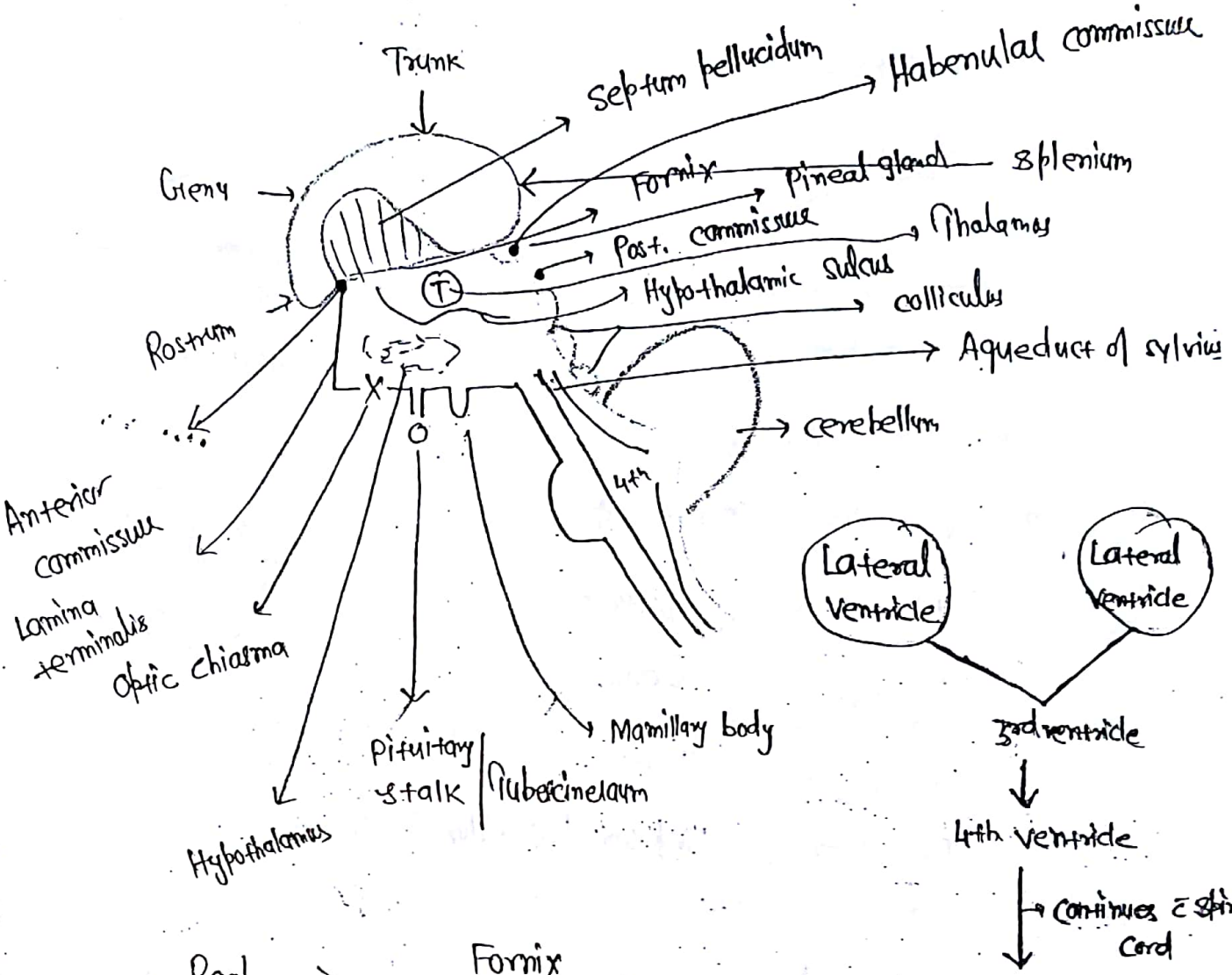
↳ Fine sensations all intact.

- All crude sensation all lost.

http://mbbshelp.com WhatsApp +1 (402) 235-1397

IIIrd ventricle

Epithalamus ⇒ Habenular commissure + Pineal gland + Post. commissure



Roof ⇒ Fornix

Floor ⇒ Optic chiasma ; Pituitary stalk ; Mamillary body

Ant. wall ⇒ Ant. Commissure & Lamina terminalis

Post. wall ⇒ Pineal gland ; post. commissure & habenular commissure

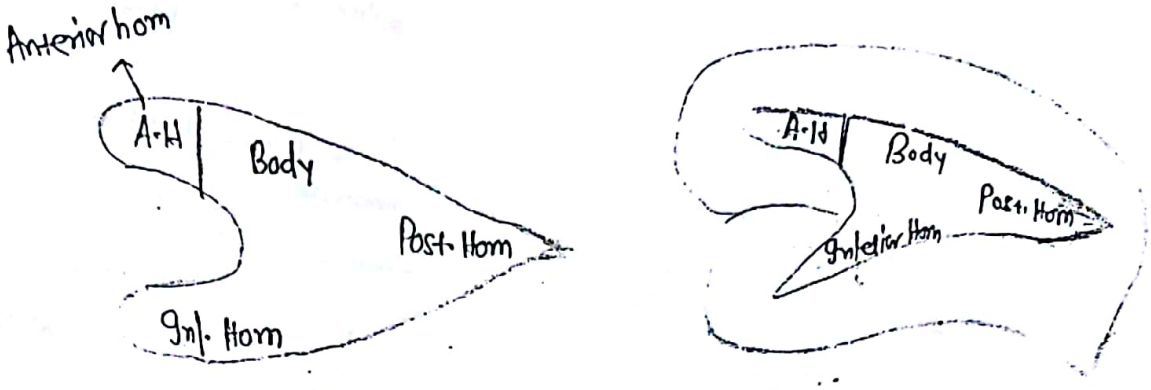
Lateral wall ⇒ Thalamus & hypothalamus

* Ventricles ⇒ These are the cavities in the brain lined by "Ependyma & filled c CSF".

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

LATERAL VENTRICLE

Parts :-



Relations of Anterior Horn :⇒

Floor ⇒ Rostrum

Anterior ⇒ Genu

Roof ⇒ Trunk

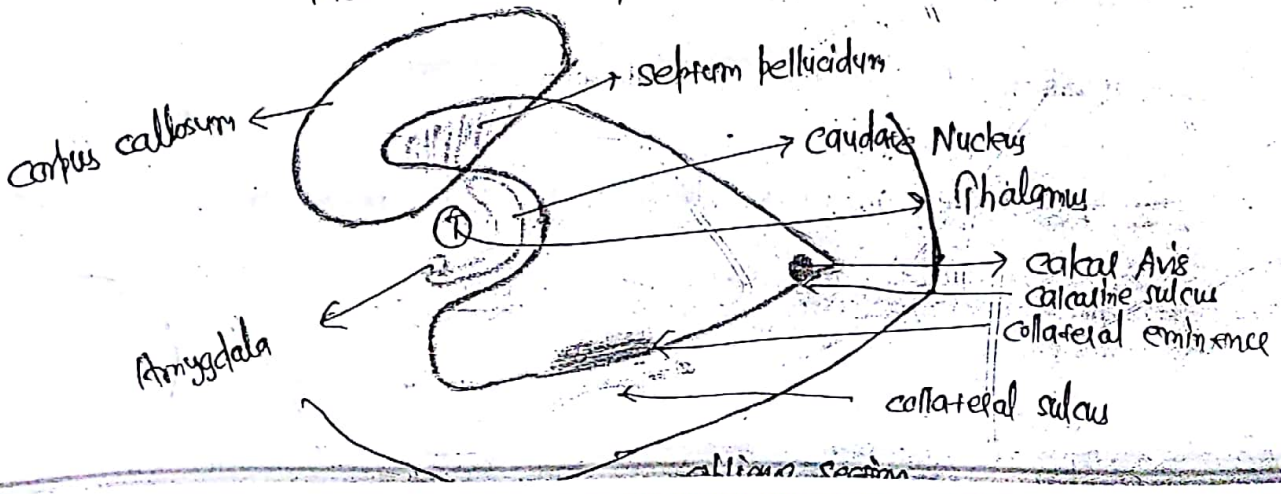
Medial ⇒ Septum pellucidum & Fornix

Body of Lateral ventricle :⇒

Roof ⇒ Trunk

Medial ⇒ Septum pellucidum & the fornix

Floor ⇒ Medially thalamus & laterally caudate Nucleus



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Posterior Horn & Ant Horn ⇒ Both has No choriodal plexus
* Body & Inf. horn ⇒ have choroidal plexus.
* Interventricular Foramina or Foramina of Monro ⇒ Connects 3rd ventricle to Lateral ventricle

COMPLETE SULCUS

- is the one which forms an elevation in the floor of the lateral ventricle

eg ⇒ Calcarine Sulcus ⇒ Forms an elevation in the floor of Posterior Horn
⇓
Calcal Avis

Collateral Sulcus ⇒ Forms an elevation in the floor of Inferior horn
⇓
Collateral eminence.

* if both all in option ⇒ collateral > calcaline

* BLOOD SUPPLY OF BRAIN

(A) Vertebral Artery ⇒ Enters into the foramen transversarium of C6 vertebral
- crosses the Arch of Atlas & enters the skull through foramen Magnum
- Two vertebral joins to form Basilar Artery

Branches ⇒ Anterior spinal Artery
Posterior spinal Artery
Posterior [illegible] cerebral Artery

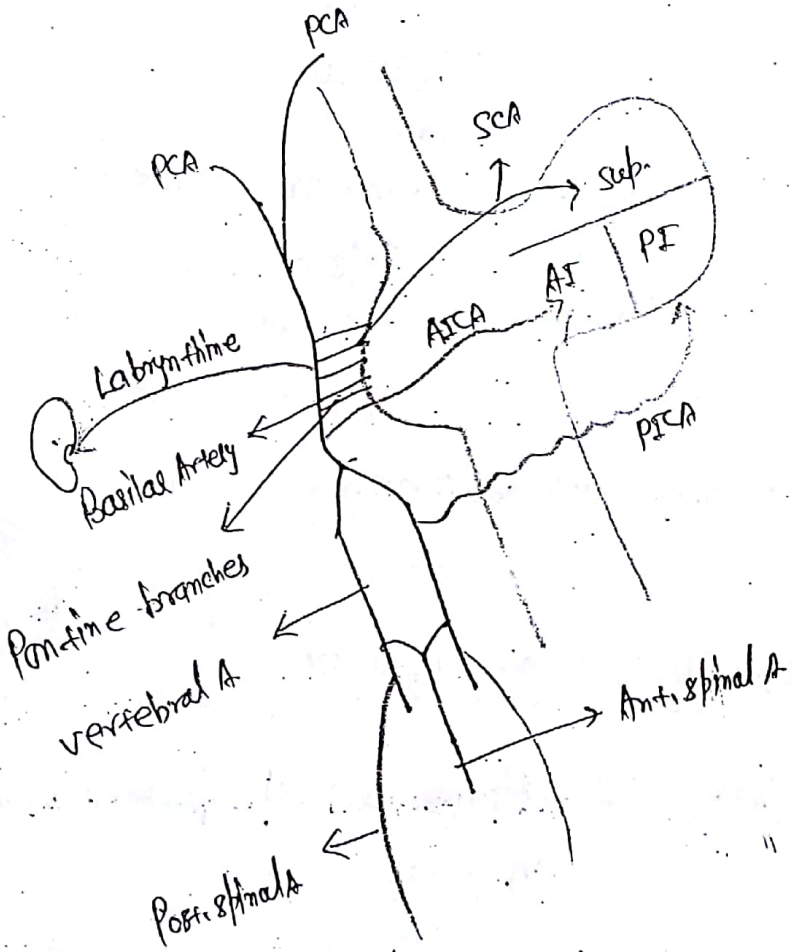
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(B) Basilar Artery ⇒ Lies In Pons

Branches ⇒ Pontine branches | Paramedian branches

supplies base of Pons ⇒ damage cause of Hemiplegia

- Labrynthine artery
- Ant. Inferior cerebellar artery
- Superior cerebellar artery
- Post. cerebral artery



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

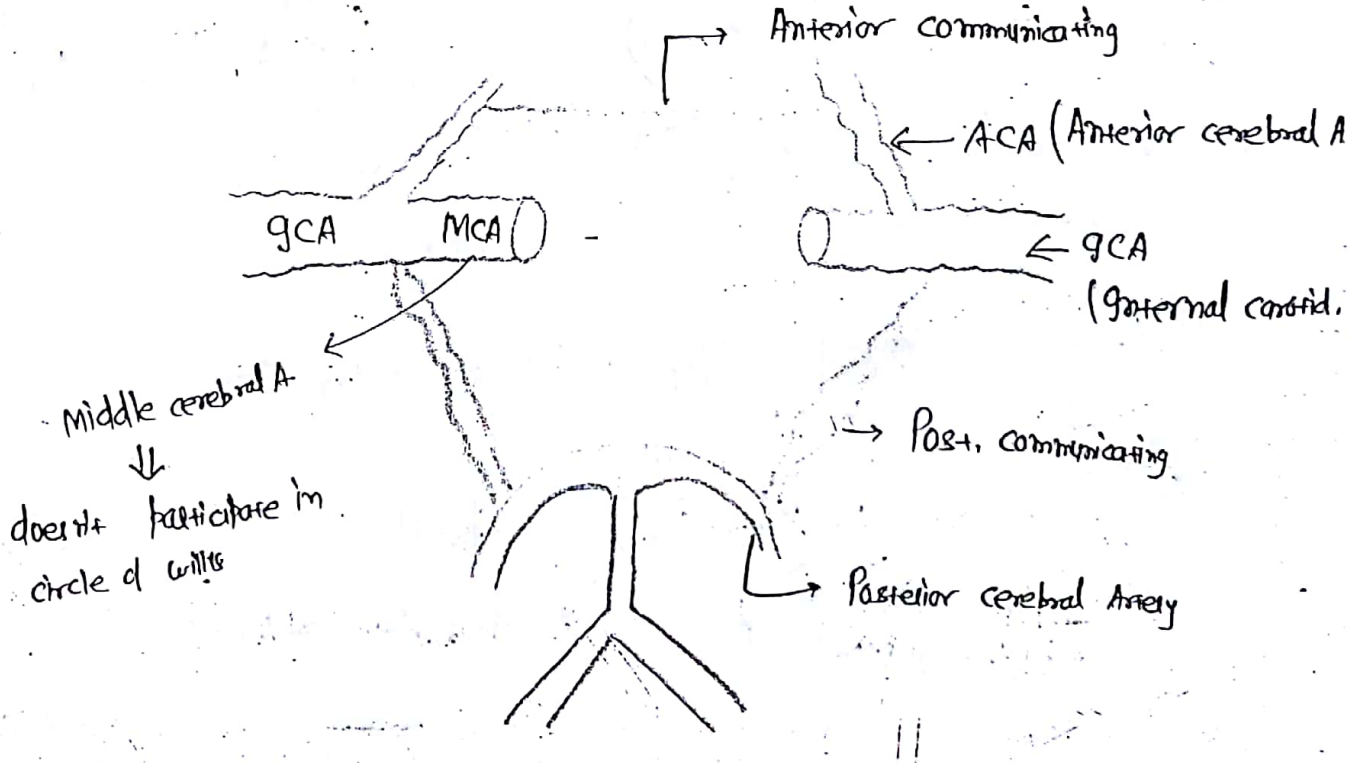
Internal carotid Artery

- enters the skull through Foramen Lacerum

Branches ⇒

1. cavernous branches
2. Hypophyseal branches (to pituitary gland)
3. opthalmic Artery (pass through optic canal ≅ optic Nerve)
4. Ant. Choroidal Artery
5. Post. communicating Artery
6. 2 terminal branches → Ant. cerebral A.
   → Middle cerebral A.
   ↳ continuation of Internal carotid

Circle of willis



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Circle of willis

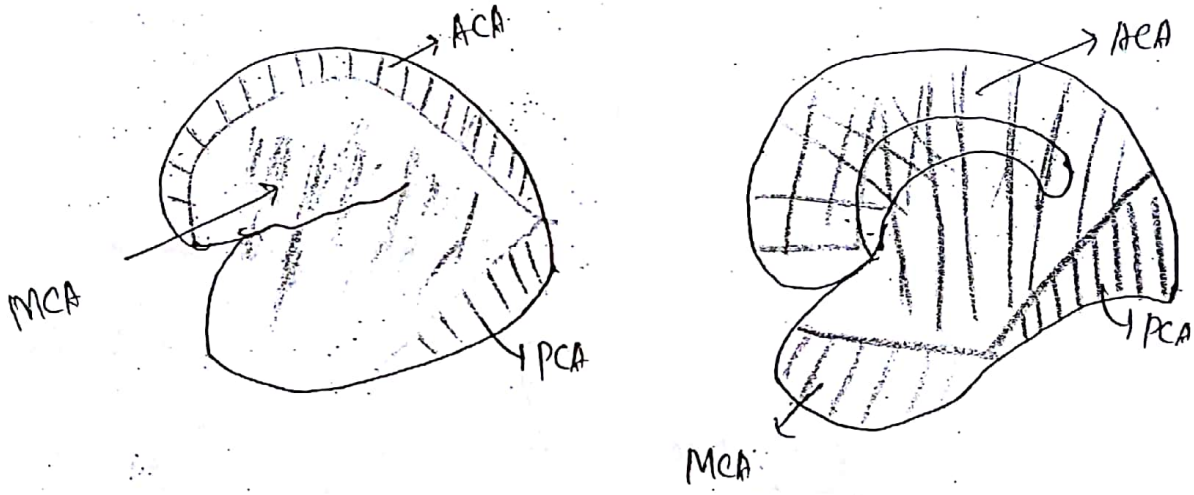
Cortical branches

- enters the sulci to supply Sulaces of the brain

Central branches

- enters the Substance of the brain to supply to deep Nuclei.

- Artery ⊕nt in Lateral Sulcus ⇒ MCA (Middle cerebral A)
  Artery ⊕nt in callosal sulcus ⇒ ACA (Anterior cerebral A)



Blood supply of Motor/sensory Area

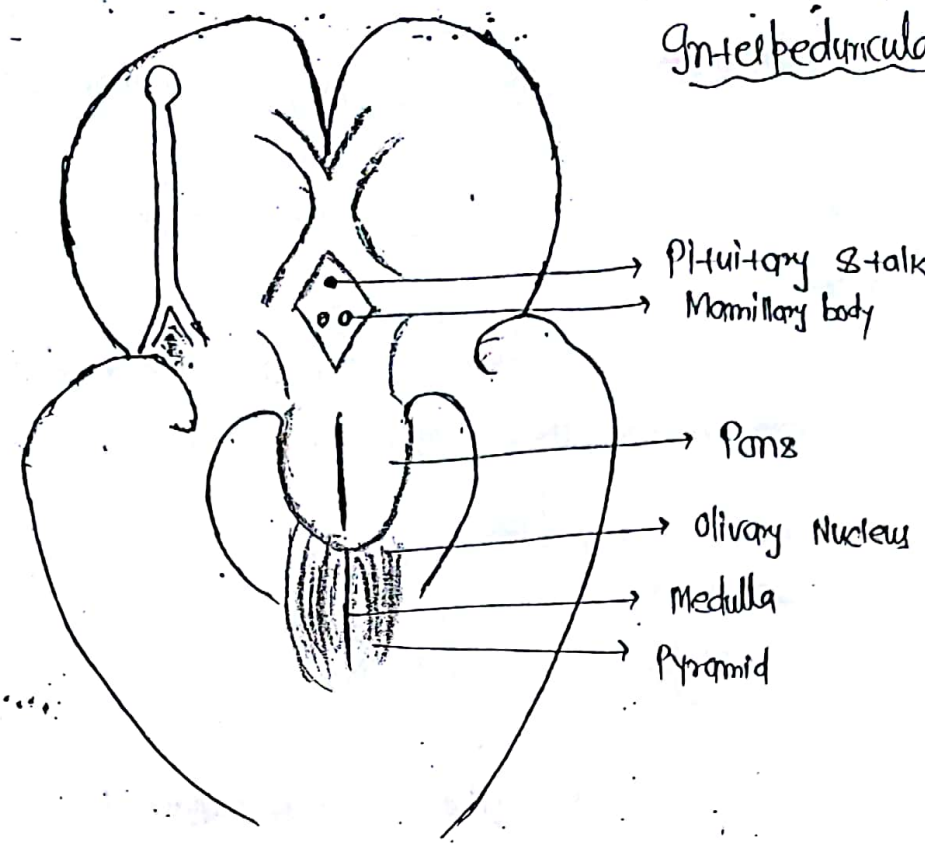
⇓

MCA + ACA both

Middle cerebral A — Anterior cerebral A

http://mbbshelp.com WhatsA

Interpeduncular Fossa



Boundaries ⇒ Anterolateral ⇒ Optic tract

Posterolateral ⇒ Crus cerebri

Floor ⇒ Pituitary stalk; Mamillary body & Posterior Perforated substance

Content ⇒ 3rd Nerve & circle of willis

http://mbbshelp.com WhatsApp:

VENOUS DRAINAGE OF BRAIN

1. Superficial vein ⇒ Superior cerebral vein

⇓

drains lateral surface of the brain & they opens into the superior saggital sinus.

Inferior cerebral vein

⇓

drains the inferior surface of the brain & they opens into the cavernous sinus & sigmoid sinus.

Anterior cerebral vein

⇓

Lies in the callosal sulcus along ⊂ Anterior cerebral Artery

Middle cerebral vein

⇓

Superficial Middle cerebral

⇓

communicates Medially ⊂ cavernous sinus & Laterally ⊂ Superior saggital & transverse sinus

Deep Middle cerebral

⇓

- Lies deep in the lateral sulcus along ⊂ MCA
- Anterior cerebral ; the deep Middle cerebral & striate veins joins to form Basal vein.

⇓

drains into Great cerebral vein of galen

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

2. Deep vein ⇒ Internal cerebral vein

⇊

- Formed @ Inter ventricular foramen by joining of T – Thalamostriatal vein
  C – Choroidal vein
  S – Septal vein

- The two Internal cerebral veins joints to form Great cerebral vein of Galen
  ↳ drains into Straight sinus

- The Basal vein drains into Great cerebral vein.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

THE BRAIN

IV th ventricle

Roof ⇒ Formed by cerebellum

Floor ⇒ Lower half of the pons & upper half of the Medulla

Facial colliculus ⇒ Formed by fibres of Facial Nerve as they wind around the Abducent Nerve Nucleus

Hypoglossal Δ ⇒ Formed by hypoglossal Nerve Nucleus

Vagal Δ ⇒ Formed by dorsal Nucleus of vagus

BRAIN STEM

- Only cranial Nerve ; which emerges from dorsal aspect of brain stem
  ⇓
  Trochlear (Thinnest cranial Nerve)

- The Nerve which undergo complete decussation before emerging
  ⇓
  Trochlear Nerve

- Pregnant Nerve ⇒ Nerve having artery within it.
  ↳ eg ⇒ Optic Nerve ⇒ contains central A. of Retina
  Sciatic Nerve ⇒ branch of inferior gluteal

* Medial Most N. attached to Ponto-Medullary junction ⇒

* Lateral Most

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Nerve attach @ the Junction of Pons & Middle cerebral Peduncle

⇓

Trigeminal Nerve.

FUNCTIONAL COMPONENTS OF NUCLEUS

① Special visceral efferent :-

Nerves		Nucleus
5	→	Motor Nucleus of Trigeminal Nerve
7	→	Motor Nucleus of Facial Nerve
9, 10, 11	→	Nucleus Ambigous

② General visceral efferent :-

Nerves		Nucleus
3	→	Edinger-Westphal Nucleus
7	→	Sup. salivatory & Lacrimatory
9	→	Inf. salivatory
10	→	Dorsal Nucleus of vagus

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

③ General Somatic efferent :⇒

Nerve		Nucleus
3	⟶	Occulomotor N. Nucleus
4	⟶	Trochlear N. Nucleus
6	⟶	Abducent N. Nucleus
12	⟶	Hypoglossal N. Nucleus

④ Special visceral Afferent :⇒

(+) in 7, 9 & 10th Cranial Nerve

⇓

Nucleus of tractus solitarius

⑤ General visceral Afferent :⇒

10th Nerve (vagus);

⑥ Special Somatic Afferent :⇒ present in

1st C.N.

2nd C.N.

8th C.N.

⑦ General somatic afferent :⇒ carried by trigeminal Nerve, its three Nuclei → a) Mesencephalic Nucleus

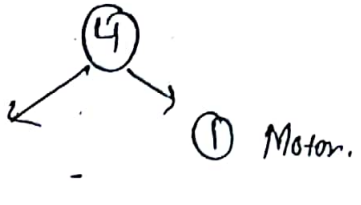
↳ prts in Mid brain

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

b) Chief Sensory Nucleus → prt. In Pons

c) Spinal Nucleus → prt. in Medulla.

No. of Nucleus of Trigeminal Nerve ⇒



WHITE MATTER OF THE BRAIN

Commisural fibres
- Connects similar areas in the opposite hemisphere

eg ⇒ Corpus callosum
Ant. commissure
Post. commisure
Hebenular commisure

Projection fibres
- they projects outside the brain

eg ⇒ Internal capsule

Association fibres
- Connects different area in same hemisphere

eg ⇒ Uncinate fasciculus

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

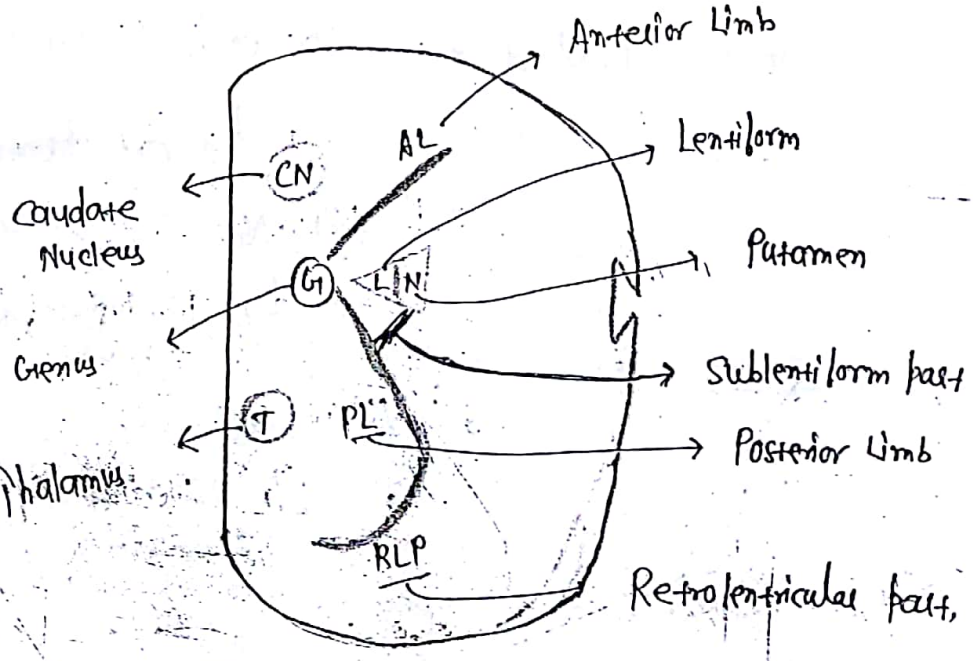
INTERNAL CAPSULE

Parts :-

- Anterior Limb (Lies b/w caudate Nucleus & Lentiform Nucleus)
- Genu
- Posterior Limb (Lies b/w the thalamus & Lentiform Nucleus).
- Retrolentiform part ; lies behind Lentiform Nucleus
- Sublentiform part ; lies below Lentiform Nucleus

	AL	G	PL	RLP	SLP
Ascending fibres ⇒	Thalamo-frontal		Thalamo-Parietal	Thalamo-occipital (Optic Radiation)	Thalamo-temporal (Auditory Radi.
Descending fibres ⇒	Fronto-pontine	Cortico-Nucleus	Cortico-spinal	Occipito-pontine	Temporo Pontine

* Main A. Supplying the Internal capsule ⇒ Middle cerebral



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Medial Medullary Syndrome | Alternating Hypoglossal hemiplegia

- Thrombosis of Vertebral Artery;
- Structures Involved → Hypoglossal Nucleus
  ↳ I/L Paralysis of Tongue
  Corticospinal tract
  ↳ C/L hemiplegia
  Medial Leminiscus
  ↳ C/L Loss of Fine sensation.

* Milard-Gubler Syndrome

- Thrombosis of Paramedian branches of basilar arteries;
- Structures Involved → Corticospinal tract
  ↳ C/L hemiplegia
  7th Nerve
  ↳ I/L Paralysis of Face
  6th Nerve
  ↳ I/L Medial squint.

WhatsApp: +1 (402) 235-1397

WEBER'S SYNDROME

- Thrombosis of Post. cerebral Artery.

Structures Involved ⇒ ① cortico-spinal tract

↳ C/L Hemiplegia

② 3rd Nerve

↳ I/L Lateral squint & Diplopia;

Ptosis;

Pupils are dilated & fixed.

CEREBELLUM

* Fibres coming to the cerebellum

Climbing fibres

⇓

arises from the Inferior olivary Nucleus

- Stimulates Purkinje cells

Mossy's fibre

⇓

arises from spinal cord; vestibular Apparatus & Cort

- Stimulates granule cells

⇓

Stimulates Purkinje cells

↓

↓ inhibits the deep cerebellar Nucleus & Lateral Vestibul Nucleus

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

INFERIOR CEREBELLAR PEDUNCLE

Afferent fibres → Posterior spinocerebellar;
Olivo – cerebellar;
Vestibulo – cerebellar;
Reticulo – cerebellar;
Cuneo – cerebellar (carries Unconscious proprioception from upper limb)

Efferent fibres → Cerebello – Vestibular
Cerebello – Reticular
Cerebello – Olivary

MIDDLE CEREBELLAR PEDUNCLE

Afferent fibres → Ponto – cerebellar

SUPERIOR CEREBELLAR PEDUNCLE

Afferent fibres → Ant. spino – cerebellar
tecto – cerebellar
Hypothalamo – cerebellar

Efferent fibres → Cerebello – Rubral
Dentato – Rubral & Dentato – thalamic

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

THALAMUS

Ventral group of Nucleus

Ventro – Anterior

⇓

Receives input from Basal ganglia

⇓

Projects to Area No. 6 & 8

Ventro – Lateral

⇓

Receives Input from Cerebellum

⇓

Project to Area No. (4)

Ventro – Posterior

Ventropostero Lateral

- Receives Medial Leminiscus & Spinal Leminiscus

↓

Projects to Area No. (3), (1), (2)

Ventropostero Medial

- Receives Trigeminal Leminiscus & Solitaro – thalamic tract (Nucleus of Tractus solitari

↓

Projects Into (3), (1), (2) Area

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* SPINAL CORD

DORSAL HORN :

Substantia Gelatinosa : 2nd order Neuron for crude Sensation :

Nucleus Proprius : Receives conscious Proprioception :

Nucleus dorsalis | clarke's columna : Receives Unconscious proprioception from trunk & Lower limbs;

Visceral Afferents : Receives sensation from visceral organs.

VENTRAL HORN :

Medial group : innervates the Muscle of the Neck & the trunk

Lateral group : present in the cervical & Lumbosacral enlargement of the spinal cord

Central group : a) Phrenic Nerve Nucleus = $C_3 - C_5$

b) Spinal Nucleus of Accessory Nerve = $C_1 - C_5$

c) Lumbosacral Nucleus

LATERAL HORN :

Intermedio Medial Nucleus (S_2, S_3, S_4)

↓

Gives origin to pre-ganglionic fibers of Parasympathetic N. system

Intermedio Lateral Nucleus

↓

Gives origin to preganglionic fibers of Sympathetic N. system T_1 to

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

REXED LAMINA

- System of ten layers of grey Matter.

1 → Posteromarginal Nucleus
2 → Substantia Gelatinosa
3 & 4 → Nucleus Proprius
5 & 6 → Base of dorsal column
7 → Nucleus dorsalis; Nucleus of Lateral horn
8 & 9 → Nuclei of Anterior grey column
10 → Surrounds the central canal.

* HEUBNER's Artery ⇒ Recurrent branch of Anterior cerebral;
* CHARCOT's Artery ⇒ Striate branch of Middle cerebral

NEET'16
* The cerebral cortex contains 5 types of Neurons ⇒

i) Purkinje cells
ii) Granule cells;
iii) Basket cells;
iv) Stellate cells;
v) Golgi cells.

* DEVELOPMENT OF BRAIN

Structures formed from Neural tube are ⇒

(A) From cranial part of Neural tube ⇒ Give Rise to "Brain":

- Prosencephalon
- Mesencephalon
- Rhombencephalon

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

i) Prosencephalon

Telencephalon
- Cerebral Hemisphere
- Cavity → (Lateral ventricle)

Diencephalon
- Thalamus
- Hypothalamus
- epithalamus
- Metathalamus
  (Medial geniculate body
  Lateral geniculate body)
- Subthalamus
- Cavity ⇒ 3rd ventricle

ii) Mesencephalon

Mid brain — Cavity ⇒ Aqueduct of sylvius.

iii) Rhombencephalon

Metencephalon → Pons & cerebellum

Myelencephalon → Medulla oblongata

Cavity ⇒ 4th ventricle

NEET'13

From caudal part of Neural tube → Gives Rise to "Spinal cord".

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Cell Nest is characterized of ⇒ Hyaline cartilage
* Largest size of chondrocytes are seen in ⇒ Elastic cartilage
* Smallest size of chondrocytes are seen in ⇒ White fibro cartilage
  eg ⇒ Intervertebral disc
  Articular disc
  Menisci

* Apocrine gland ⇒ eg ⇒ Sweat gland → Simple coiled tubular type of gland; which Unbranched duct.
  Holocrine gland ⇒ eg ⇒ Sebaceous gland
  Merocrine | eccrine gland ⇒ eg ⇒ Mammary gland

* eg of Serous Salivary gland ⇒ eg ⇒ Parotid gland
  Mucous Salivary gland ⇒ eg ⇒ Sublingual gland
  Mixed salivary gland ⇒ eg ⇒ Sub Mandibular gland

MUCOUS ACINUS

SEROUS ACINUS

MIXED ACINUS (Demilune)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Lymphoid follicles are abt. in ⇒ Thymus
⇓
Hassell's corpuscles are characteristics of it.

* Spleen contain Red & white Pulp ē eccentric Arteriole.
* Tonsil contains crypts & epithelium is "Stratified Squamous V Non-Keratinized epithelium"
* Lymph Node ⇒ Subscapular sinus
* Gall bladder ⇒ Simple columnar ē brush border.
* PCT ⇒ Lined by simple cuboidal ē brush border
Ansa Nephron (Loop of Henle) ⇒ Lined by simple squamous epithelium
* Goblet cells are abt. in ⇒ Esophagus
⇓ ⇓
plenty in colon SubMucosal glands ⊕ ⇒ Lubricates the esophagus

* Toughest Layer of esophagus ⇒ SubMucosa
* Lining epithelium of secreting thyroid follicle ⇒ Simple cuboidal
* Germinal epithelium ⇒ simple cuboidal
* Respiratory epithelium ⇒ Pseudo stratified ciliated columnal ē goblet cells
* Internal elastic Laming ⇒ Characteristics of Muscular Artery.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

TYPE OF EPIPHYSIS

↳ Part of bone which develop from 2° ossification center.

1. Pressure epiphysis ⇒ Seen @ - the ends of long bone subjected to pressure
   ↳ eg ⇒ Head of Humerus; QQ
   Head of Femur; QQ
   condyles of tibia, QQ

2. Traction epiphysis ⇒ Form d/t pull of the Muscle
   ↳ eg ⇒ Tubercle; Q
   Trochanter; Q
   Mastoid process; Q
   Tibial tuberosity.

3. Atavastic epiphysis ⇒ Functional in Lower Animals & degenerate in humans
   ↳ eg ⇒ Coracoid process of Scapula Q
   Os trigonum of Talus

4. Aberrant epiphysis ⇒ It is an extra epiphysis
   ↳ eg ⇒ Proximal end of 1st Metacarpal bone QQ

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

JOINTS

Fibrous

- Sutures ⇓ eg ⇒ SKULL
- Syndesmosis ⇓ eg ⇒ Interosseous Membrane b/w Radius & Ulna; Tibia & Fibula
- Gomphosis ⇓ Teeth fitting in socket

Cartilagenous

- 1° cartilagenous / synchondrosis ⇓ eg ⇒ joint b/w epiphysis & diaphysis; Xiphisternal joint; 1st chondrosternal junction; Symphysis Menti
- 2° cartilagenous / symphysis ⇓ eg ⇒ Pubic symphysis; Manubriosternal; Intervertebral joints

Synovial

Synovial joint

Saddle Joint ⇒ Sterno clavicular joint; 1st carpo metacarpal joint;

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

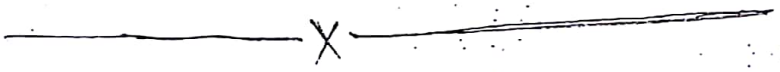
Condylar joint ⇒ TM joint; Atlanto-occipital joint; Metacarpophangeal joint

ellipsoidal joint ⇒ Wrist

Pivot joint ⇒ Superior & inferior Radio-ulnar joint; Atlanto-axial joint

Plane joint ⇒ Intercarpel ; Intertarsal; Acromio-clavicular ;

Hinge ⇒ Elbow; Ankle



http://mbbshelp.com WhatsApp: +1-(402) 235-1397

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Biochemistry

Handwritten note

MBBS Help

http://mbbshelp.com

http://www.youtube.com/mbbshelp

http://www.facebook.com/mbbshelp.com

Name: _____

Subject: **Biochemistry**

MBBSHELP.COM

Poonam Agrawal Mam

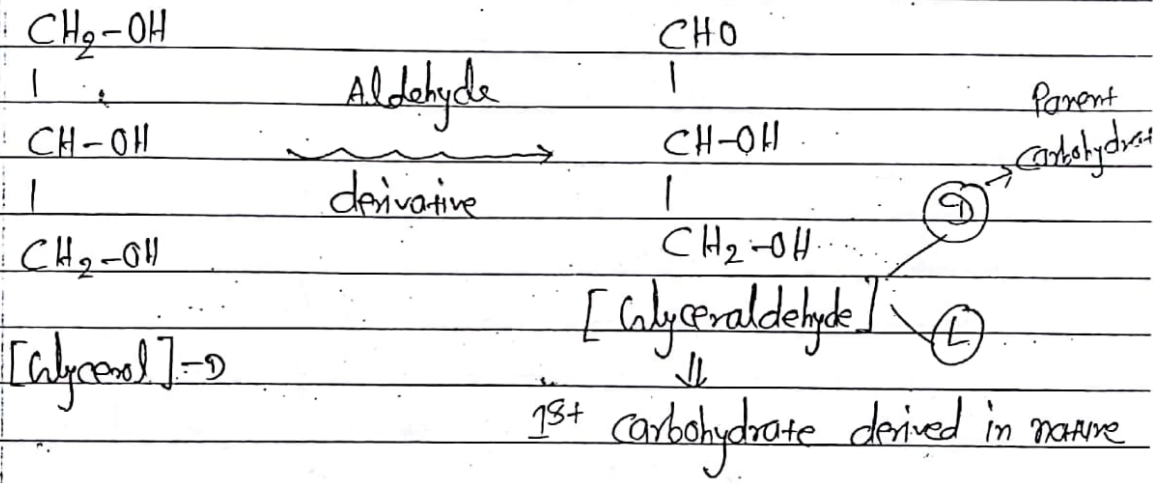
Date 18/2/18
Page 1

BIOCHEMISTRY (2)

CARBOHYDRATE METABOLISM

Carbohydrate → all compounds → aldehyde or keto derivatives of polyhydroxy alcohol

Glycerol → Parental alcohol & gives carbohydrate [3-OH] in nature



1st carbohydrate derived in nature

Hydrolysis of compound

depending on No. of monosaccharide unit left after hydrolysis of compound – is basis of classification.

- Monosaccharide (Simple carbohydrate) → Can't be hydrolysed further → Simplest monosaccharide → Glyceraldehyde
- Disaccharide (2 monosaccharide)
- oligosaccharide (3-10 monosaccharide)
- Polysaccha. (>10 Mon

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Monosaccharide → $C_n(H_2O)_n$

n → No. of C-atom

^{a}n → 3-9^{a}

n	Trivial Name	Aldose	Ketose
3	Trioses $C_3H_6O_3$	Glyceraldehyde	Dihydroxy acetone
4	Tetroses $C_4H_8O_4$	Erythrose	Erythrulose
5	Pentoses $C_5H_{10}O_5$	Ribose Xylose Arabinose Lyxose	Ribulose Xylulose X X
6	Hexose $C_6H_{12}O_6$	Glucose Galactose Mannose	Fructose
7	Heptose $C_7H_{14}O_7$	Glucoheptose	Sedoheptulose
8	Octose	X	X
9	Nannose	Neuraminic acid [NANA] (N-acetyl Neuraminic acid] also kha "sialic acid" Found in "ganglioside"	

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

ISOMERS OF CARBOHYDRATE

Same formula ε different structures
↳ Chemical / Empirical / Molecular

1. Aldose & Ketose isomerism [–CHO & –C=O]
2. Epimers
3. Pyranose & Furanose ring structures
4. α & β anomer
5. D & L type

EPIMERS → difference in structure against **one**** asymmetric C-atom

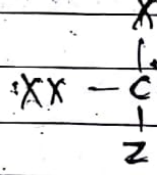
Glucose & Galactose → C_4
Glucose & Mannose → C_2

C_2M → Mannose
C_3A → Allose
C_4G → Galactose
C_5I → Idose

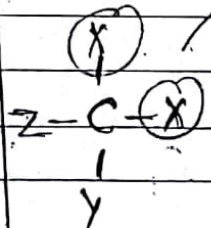
Galactose & Mannose (X)

Glucose → 2 Symmetric C-atom [C_1 & C_6]
4 Asymmetric C-atom [C_2, C_3, C_4, C_5]

Asymmetric C-atom ↓ Chiral C-atom



Symmetric C-atom (Achiral C-atom)



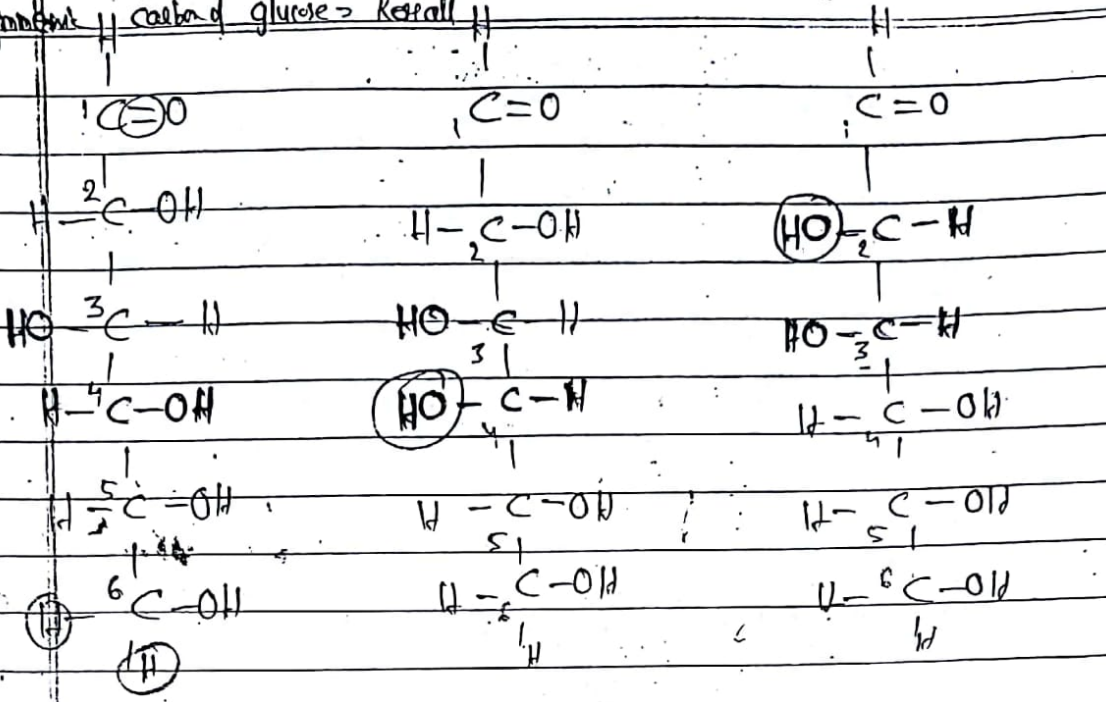
Min^m 2 valency or 2 valencies utilize
ε Same atom to add one atom

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

- Glucose also known as "Dextrose".

* Symmetric carbon of glucose = 1, 6
  Asymmetric carbon of glucose = Rest all



Glucose	Galactose	Mannose

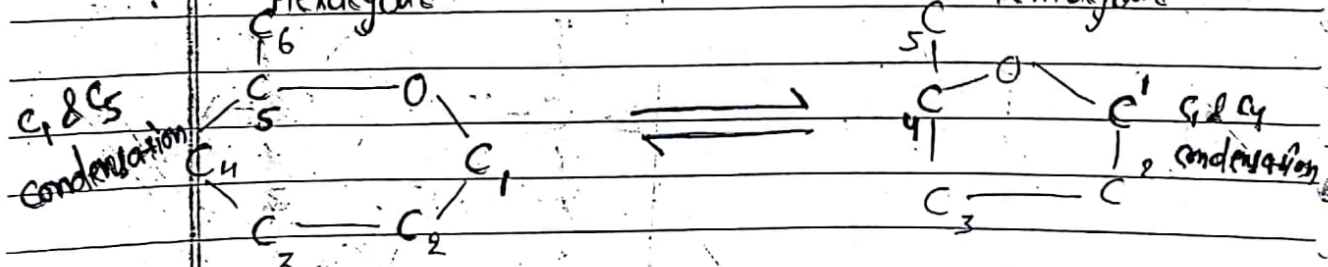
diff in 2 asymmetric C → Not epimers

Ribose – xylose } epimers
Ribulose – xylulose }

PYRANOSE & FURANOSE

PYRANOSE
Heterocyclic
(made of C & other atoms)
Hexacyclic

FURANOSE
Heterocyclic
Pentacyclic



Glucose in aq. Media can form both ring, but initially glucose is in Pyranose form; later can convert to each other

100% Glucose converted in this form in aq. Media

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Glucose – Precursor ← Pyranose, α-glucose, D-glucose

* Pyranose & Furanose form seen in Minm 6 carbon-compound.

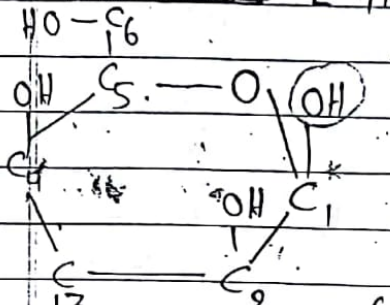
Date
Page 5

(4)

- eqm is a kind of dynamic state (Rate of Forward Rxn Equal to Rate of backward Rxn)

Q: Precursor form of glucose = Pyranose [also for Fructose]
At equilibrium predominant form = Pyranose · [For glucose] (95%)
At equilibrium predominant form of fructose = Pyranose

ANOMERS [α/β]



C1 – anomeric carbon

Glucose, Galactose, Mannose

C2 – anomeric → For fructose

Anomeric C-atom
↓
Bears the reactive group & it is involved in Ring closure by condensation c same hydroxyl group.
OR
Carbon atom which was symmetric before & becomes asymmetric after the Ring closure.

Pattern: AB

β – OH is above the plane on Anomeric carbon
↓
Beta Anomer

α – OH is below the plane on Anomeric carbon
↓
Alpha anomer.

MUTAROTATION → Exclusive for glucose solution. (Hexose solution)

Glucose solution → Fresh → check optical activity → Rotation of optical light by +112° → mean +112° on Rt. side

MR.

after 12 hrs
↳ optical activity ↓ to +52.5°

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

glucose → always dextro-rotatory

Optical activity
- $\alpha = +112^\circ$
- $\beta = +19^\circ$

∴ in fresh solution predominant form ⇒ "α"

↓ Later

↓ Precursor of glucose

$\alpha \rightleftharpoons \beta$ (Interconversion of α into β is the reason behind Mutarotation)

at equilibrium ↓ ↓

$\boxed{1/3\alpha + 2/3\beta} = +52.5^\circ$ optical activity.

↓

Predominant at equilibrium

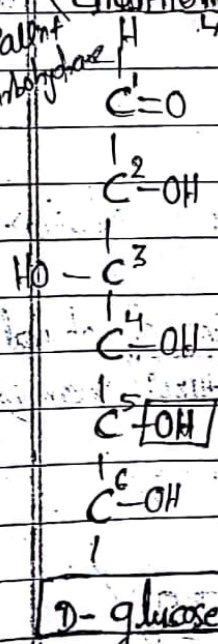
• Phenomenon of change (↓) in optical activity of time in glucose solution → Mutarotation

$\boxed{\text{D \& L ISOMERS}}$ → look for position of −OH on C_5 (Enantiomers) or Penultimate / Reference C-atom

Glyceraldehyde

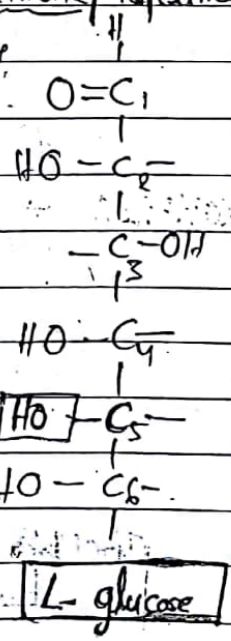
Chiral Carbon atom

H — Mirror image



D-glucose

Before Last Carbon in Compound



L-glucose

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Pancreatic amylase → acts on internal α-1,4 glycosidic bond

Lactulose → Not broken in GIT.

Date 19/2
Page 7

(5)

D & L forms → Known as "Enantiomers" | d/l → optically active

Optically inactive — Mirror image of each other.

Carbohydrate all predominent in D-form.
AA predominent in L-form

Disaccharides	Units (α) (β)	Bonds
Sucrose (NR)	Glu + Fru	α-D-glucopyranosyl β-D-fructofuranoside
Trehalose (NR)	Glu + Glu	α 1,1 glycosidic
Lactose (R)	Glu + Gal (4) (1)	β-1,4 glycosidic bond [glu is β]
Lactulose (R)	Fru + Gal	β-1,4 glycosidic bond [Fru is β]
Maltose (R)	Glu + Glu	α-1,4 glycosidic
Isomaltose (R)	Glu + Glu	α-1,6 glycosidic

* NR → Non-Reducing
R → Reducing

Reduce cupric [Cu^{+2} of $CuSO_4$] of Benedict's sol^n → Blue → Cuprous [Cu^+] → Brick Red

Semiquantitative assessment

Reducing Sugar in Urine can be detected by "Benedict's sol^n; Fehling Sol^n; glycose-oxidase test".

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page: 8

Monosaccharides → Reducing Sugar [free Reactive group]

* Criteria for Reducing tendency → Free aldehyde & free ketone group
↓
form Hemiacetal & Hemiketal

Sucrose — α-D-glucose (Pyranose ring) + β-D-fructose (Furanose Ring)

Reducing tendency of Lactose is due to "Glucose".

Reducing tendency of Lactulose is due to "Fructose".

Oligosaccharide

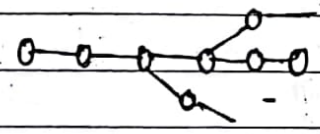
OLIGOSACCHARIDES

3-10 monosaccharides

eg → Malto-triose [glucose - glucose - glucose]

Limit dextrin [8-10 glucose & slight Branching]

end product of Starch in digestion & glycogen in human.



→ present in cell membrane as a part of
Glycolipid
Glycoprotein.

Sometimes Antigenic (usually proteins are antigenic)

Play role in Receptor activity

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Oxidase & peroxidase → used for estimation of glucose

$Glucose + H_2O + O_2 \xrightarrow{Oxidase} H_2O_2 + Gluconic\ acid$

$H_2O_2 + KI \xrightarrow{Peroxidase}$ Brown Iodide

Page 9 · (6)

POLYSACCHARIDE

HOMOPOLYSACCHARIDE

- Starch (Linear Amylose form)
  - 20% Amylose + 80% Amylopectin (Less branched than glycogen)
  - Compound: Starch — Monomer: glucose — Bonds: α-1,4, α-1,6
- Glycogen (Branched)
  - glucose — α-1,4, α-1,6
- Cellulose (Linear)
  - glucose — β-1,4
  - Animals digest it; we can't digest (we lack cellulase)
- Inulin (Linear)
  - Fructose — β-1,2 (II) cut β-1,4
  - Used to assess the GFR.
- Dextran (Branched)
  - glucose — α-1,6 | 1,4 | 1,3
  - Plasma expander in hypovolemic shock
- Chitin (Linear)
  - N-acetyl D- — β(1→4) glucosamine (NAG)
  - Found in exoskeleton of crustacean (invertebrate) eg → Insects.

HETEROPOLYSACCHARIDE

Mucopolysaccharides (GAGs) = Glycosaminoglycans

- Aldonic acid: only –CHO oxidized to –COOH
- Glucose
  - Both –CHO & 1° OH is oxidized → Glucosaccharic acid
  - only terminal 1° OH is oxidized → Glucuronic acid OR Uronic Acid

GAGs — 6 groups

1. Hyaluronic acid
2. Heparin [Most Negative]
3. Heparan Sulphate
4. Chondroitin Sulphate
5. Dermatan Sulphate
6. Keratan Sulphate — I
   - Not Keratin, it is protein

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

*** cellulose ⇒ β-(1,4) L glucose

* glucuronic acid used in the glucose estimation by GOD-POD Method

[Glucose $\xrightarrow{GOD}$ gluconic acid + H_2O_2] [$H_2O_2 \xrightarrow{POD}$ H_2O + [O]] [O] + 4 AAP ⇒ Quinoneimine complex

(4-Amino Antipyrine) (PAP)

glucose oxidase, Peroxidase

- Mucopolysaccharides all made up of Amino Sugars & Uronic acids [UA-AA-UA-AA → Random Repeat]

- QQ Lineal compound
- Highly Sulphated except → * Hyaluronic acid → No Sulphation

- Heparin → highly Sulphated.
- Heparin > Hepa. Sulphate (order of sulphation)
- Uronic acid → Oxidized form of Monosaccharides
  - ↓
  - last carbon [1° alcohol group]
  - ↓
  - CH_2-OH → COOH.
- Amino Sugar → -OH is Replaced by -NH_2 in Monosaccharides
- Kelatan Sulphate → No uronic acid.

- Iduronic acid → 5' epimer of glucuronic acid.
  - Found in: · heparin, · heparin Sulphate, · Dermatan Sulphate } Present in place of uronic Acid.

- Mucopolysaccharides all * polyanions [Negative charges]
  - ↓
  - ∴ MPs are hygroscopic (absorb H_2O)
- MPs are important Component of * proteoglycan
  - ↓
  - ⊕ in Extracellular Matrix
  - ↓
  - ∴ MPs are responsible for Turgidity of ECM

Teacher's Signature.....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

- Amino Sugars are formed from "Fructose-6-P".
- Pyruvate kinase is activated by "Fructose-1,6-Bisphosphate" & Inactivated by "ATP & Alanine"

Page 11

"EMP Pathway" | GLYCOLYSIS → Cytosolic pathway → occurs in all cells in the body.

→ Production of ATP → Main Purpose

(Mitochondria; O_2) Aerobic → End → Pyruvate (end product of glucose oxidation*) → $CO_2 + H_2O$

Anaerobic (Lack of Mitochondria or O_2 or both) → Lactate.

ATP consumed – 1st PFK

* Pyruvate – 1st formed – End form

Glucose

ATP → Glucokinase or Hexokinase (Mg++) → ADP

G-6-P

Phosphohexose isomerase

Fructose-6-P

ATP → Phosphofructokinase-I → ADP

Rate Limiting Enzyme

Fructose 1,6-Bisphosphate

Aldolase (A/B/C) → Isoenzymes

Phosphotriose isomerase

DHAP (3C) ⇌ Glyceraldehyde 3-Phosphate (3C)

Iodoacetate

2X NAD+ → 2X NADH+H+ (Pi) Glyceraldehyde 3-P dehydrogenase

Substrate Level Phosphorylation

1,3-Bisphosphoglycerate [1,3 BPG]

Arsenite

2X ADP ← (SLP) → 2X ATP (Mg2+) Phosphoglycerate kinase

3-Phosphoglycerate

Fluoride

Phosphoglycerate Mutase

2-Phosphoglycerate

Enolase, Mg2+

Anaerobic: Lactate → NADH+H+ → NAD+ → Lactate dehydrogenase → Pyruvate (Keto)

Spontaneous change

Pyruvate (End)

2X ADP → (SLP) → 2X ATP (Mg2+) Pyruvate kinase

Phosphoenolpyruvate

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Malate shuttle Required for → (1) Aerobic Glycolysis;
(2) Gluconeogenesis

Date 20/2
Page 19

Irreversible Rxn →	GlK | HK
	PFK-I
	PK

Rest all reactions are Reversible.

Substrate level phosphorylation (SLP) | oxidative phosphorylation

- Rare
- Without ETC; ↓ O_2; ↓ NADH, FADH
- only at 3 places
  - 2 glycolysis
  - 1 TCA cycle [Succinate Thiokinase]
  - Phosphoglycerate kinase
  - Pyruvate kinase

- Major
- ETC; ↓ O_2

- To get the NAD^+ back under Anaerobic glycolysis Lactate is formed. (Pyruate is converted into Lactate d/t only get the NAD^+ back).

Reduction Rxn → Pyruvate —LDH→ Lactate

NADP ← NAD+ *generated

[Aerobic Req → O_2 + Mitochondria]

Energy :-

- 2 ATP
+ 4 ATP
+ 2 NADH (5ATP) = Zero ATP in Anaerobic glycolysis

Total 4 Produced
Net gain ⇒ 2ATP.

5ATP ↓ if NADH uses MAS or if No Shuttle Mentioned ↓ Total → 9 ATP

3ATP ↓ if NADH uses GPS → Total → 7 ATP

Name & Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Anaerobic glycolysis ⇒ occurs in exercising Skeletal Muscle, RBCs, Lens, Some Region of Retina, Renal Medulla, Testis; Leucocytes

Date
Page: 13

(8)

	Aerobic glycolysis	Anaerobic glycolysis	Ans. is 7 & 5 if glycerol phosphate shuttle is used.
ATP		4	
Total	9 | 7 | 10	—	
Net	7 | 5 | 8	2	Ans. 10 | 8 → acc. to older data

* Shuttle ⇒ Set of biochemical Reactions

NADH

↓

Transferred from cytosol to mitochondria [across inner membrane of mitochondria] to form ATP.

Malate aspalate shuttle

NADH → $NADH_2$

↓

2.5 ATP

⊕ in Liver.

Glycerol phosphate shuttle

NADH → $FADH_2$ (FAD+ for H+ in Mitochondrial Matrix)

NADH ‖ it only give H+ & leave NAD+ in cytosol

$FADH_2$ ‖

1.5 ATP.

⊕ in Brain, skeletal Muscle

INHIBITORS OF GLYCOLYSIS

Fluoride ⊖ → Enolase

So, Sodium fluoride is mixed with Potassium oxalate, as an anticoagulant in Blood sample for Sugar estimation.

Iodoacetate ⊖ → glyceraldehyde 3P dehydrogenase

Arsenite → affecting the glycolysis, but all not true as this doesn't stop glycolysis.

glycolysis continues, but ATP Production is Reduced.

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Mutase ⇒ Convert one group on one atom to Another atom in Same compound.

Date
Page 14

Ip → Inorganic Phosphate

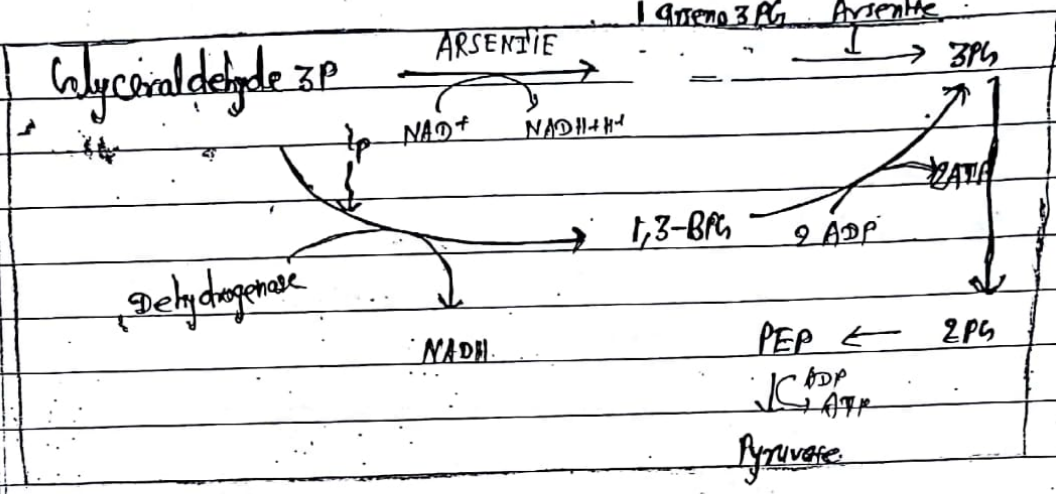
Arsenite competes with Ip to take 1st position in compound

↓

Product is 1 arseno 3P instead of 1,3 BPG

↓

- Breaks to form 3PG (∴ 2ATP is not formed)



R.L. Shunt

RAPAPORT-LEUBERING CYCLE

- Inside RBC
- Some steps of glycolysis are shunted
- There is loss of ATP (2 ATP)
- 2,3-Bisphosphoglycerate (2,3-BPG) Produced in RBC cytosol from glycolysis.

Intermediate in RBC

2,3-BPG ← Mutase ← 1,3-BPG

2,3-BPG → to Hemoglobin deoxygenation

Glyceraldehyde 3P

NAD+ → NADH+H+

1,3-BPG

Phosphatase → ATP ↑ Lost in RL shunt (2 ATP Loss)

3PG

2PG

PEP

ADP ATP

Pyruvate → Lactate

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Pyruvate Kinase & Aldolase deficiency in erythrocyte -> Hemolytic Anemia

1mmole/L = 18 mg/dl

Date
Page 15

(9)

* RL Shunt — ATP Produced = 2
ATP Used = 2
Net ATP = 0

{ Because NADH → ATP ↓ doesn't occur in RBC }

ATP comes from — glucose, FA, KB
↓
*** RBC only depend on glucose for energy.

GLUCOKINASE & HEXOKINASE :

GLUCOKINASE	HEXOKINASE
Type IV isoenzyme of Hexokinase	I, II, III types of isoenzyme
Found in Liver & β cells of Pancreas	Found in all other cells
Low affinity binding to glucose	High affinity binding to glucose
Km High [180 mg/dl = 10mmole/L] ↓ Substrate conc^n ↓ Means we need high amount (180 mg/dl) of glucose in presence of glucokinase to get 1/2 Vmax.	Km Low [0.9mg/dl = 0.05 mmole/l] [affinity ∝ 1/Km] Affinity ∝ 1/Km
Liver & Pancreas acts (i.e. glucose conc^n) when glucose is One in 1 conc^n.	Peripheral cells are able to Utilize glucose at very less conc^n [Uninterrupted supply of glucose to brain at night is due to ↑affinity of HK for glucose]
Insulin activate GK	No effect of Insulin on HK

Insulin activate GK

No effect of Insulin on HK

GLUCOKINASE

HEXOKINASE

∴ after meal GK acts on food in presence of Insulin in liver & β-cells of Pancreas
[Insulin comes in blood only in presence of ↑ glucose eg → Meal]

3 enzymes of glycolysis are activated in presence of insulin because they need dephosphorylated form for their activities

⇓

* Insulin dephosphorylates the enzyme (ID).

1. Glucokinase
2. Phosphofructokinase - II
3. Pyruvate Kinase

* Insulin activates PFK-I by allosteric Modulation

GLUCOKINASE	HEXOKINASE
G-6-P has no effect on GK	G-6-P has negative feedback on HK

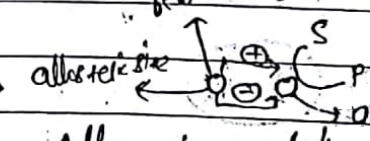
Enzymes

Covalent Modification

POLYPEPTIDES

eg → PFK-II

Allosteric Modification



• Other than active site, allosteric sites are present on which few things bind which may ⊕ or ⊖ the product production eg → PFK-I

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Multifunctional enzyme ⇒ One protein; Multiple catalytic activity

Date: 17 (10)

PFK-II & Fructose-2,6-Biphosphatase (Bifunctional enzyme) — active in Post-fasting

⇓

One protein two catalytic activity

One acts at a time (decided by Dephosphorylation & phosphorylation).

→ Liver

Insulin → dephosphorylates → ⊕ Fructose 6P → PFK-2 → Top form active

Fructose 2,6-Bisphosphate ⊕ PFK-I

F-2,6-BPase → Phosphorylated active

Fructose-6-Phosphate

Fructose-1,6-Biphosphate

GLUCAGON → Phosphorylates → PFK II ⊖, F2,6 BPase ⊕, F,2,6 BPase

F,2,6 BPase → by existing F,6BP converted into F,6P → F6,P ↑

⇓

glycolysis down Regulation

Fructose 2,6 BP (most imp. allosteric Regulator) of PFK-I

5'-AMP (Energy deficient state)

Insulin (Fructose-2,6-Bisphosphate) ⊕ → PFK-I

⊕ → Positive allosteric Modulation

⊖ → Negative allosteric Regulator

Regulator

AMP ⊖ → PFK-I

Citrate; b/c citrate Indicates the acetyl-CoA

Proton

Glucagon

Insulin ↑ synthesis of F-2,6-BP → Glycolysis ↑

Glucagon ↑ " " "

Q. Decreased glucose in hepatic cells triggers all except →

i) Glucagon ↑; ii) ⊕ of F2,6 BPase; iii) ⊖ of PFK-2; iv) F,2,6 BP ↑

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

PASTEUR EFFECT

→ Inhibitory effect of O_2 on glycolysis
⇓
It is due to ↓ AMP/ATP ratio.

AMP has +ve effect on PFK-1, So, ↓ AMP cause inhibition of glycolysis.

→ ↕ O_2 ⟶ ↕ oxidative phosphorylation → ↓ AMP (↑ ATP)

CRABTREE EFFECT

→ Relative Anaerobiosis produced; when glucose conc^n is increased in Constant (or limited) Supply of oxygen..
⇓
Lactate ↑

→ Glucose —O_2 used→ Aerobic glycolysis
↓ Later + No O_2 for rest glucose
Anaerobic glycolysis
↓
Muscle Pain ← Lactate ↑↑ [Anaerobiosis]

CONVERSION OF PYRUVATE TO ACETYL CO-A

Pyruvate — Cytosol
→ Pyruvate-proton symport system
Proton Pyruvate — Mitochondrial matrix
Pyruvate Dehydrogenase complex
⇓
CO_2 ← ⇓ → 3 Enzymes
this always give ↓ ATP ; No shuttle required for this
(NADH) ← Pyruvate DH (PDH)

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

→ Pyruvate is transported to mitochondrial matrix via Pyruvate – proton Symporter

PDH Complex → Pyruvate Dehydrogenase complex

Enzymes	Co-Enzymes
→ Pyruvate dehydrogenase / carboxylase	→ Thiamine (B_1) Phosphate
→ Dihydrolipoyl transacetylase	→ Lipoic acid
→ Dihydrolipoyl dehydrogenase	→ CoA (B_5 / Pantothenic acid)
	→ FAD (B_2 / Riboflavin)
	→ NAD (B_3 / Niacin)

← Pyruvate dehydrogenase

↓ 1st enzyme

↓ active in Dephosphorylated form.

It's deficiency

↓

Most common cause of congenital LA – Lactic acidosis

Regulation of Pyruvate dehydrogenase

PDH ⊕ → Active

PDH Kinase ⊕ → PDH (P) Inactive ⊖

Ca++, Mg++, insulin ⊕

Acetyl Co-A / Co-A , NADH / NAD+ , ATP / ADP Ratio ⊕

Acetyl Co-A, NADH, ATP, Glucagon ⊖

if > 1 ⇒ PDH kinase ⊕ ⇒ PDH complex will not act

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

eg. → NADH↑ (>1) in Mito matrix

↳ PDH complex will not act

→ each acetyl Co-A produces ⇒ 10 ATP.

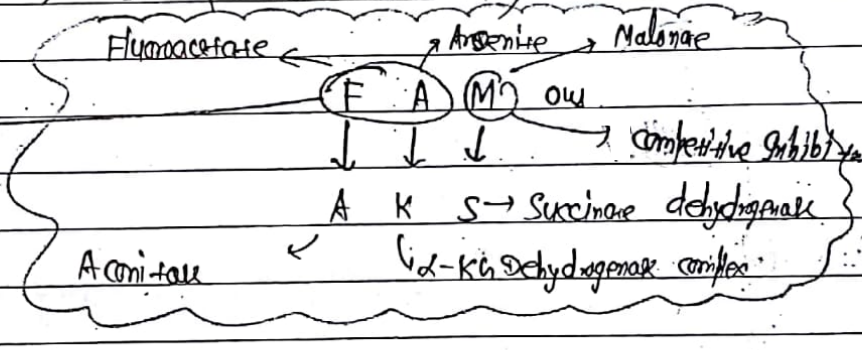
→ Total No. of ATP formed by complete oxidation of glucose in aerobic condition

⇓

→ 32 (9+5+20 −2)

- 9 → glycolysis
- 5 → Link Rxn
- 20 → TCA

→ 38 (older calculation) [10+6+24]−2



Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Vitamins in TCA cycle → ① Riboflavin → FAD
② Niacin → NAD
③ Thiamine → α-Ketoglutarate dehydrogenase
④ Pantothenic acid → Acetyl Co-A

TCA CYCLE

Mitochondrial Rxn

Pyruvate

RBC → No mitochondria → No TCA

Source of 1st substrate

Coenzyme of TCA → NAD^+

Acetyl Co-A (2C)

Co-ASH

Citrate Synthase

Citrate (6C)

OAA

$NADH+H^+$

NAD^+

Malate dehydrogenase

L-Malate (4C)

Competitive inhibitors

Aconitase

H_2O

Fumarase

H_2O

Malonate

cis-aconitate (6C) ← Transient intermediate

Fumarate (4C)

$FADH_2$

Succinate dehydrogenase

Aconitase

Fluoroacetate

FAD

H_2O

Succinate (4C)

Isocitrate (6C)

GTP

Succinate thiokinase NEET!!!

(Succinyl Co-A Synthetase)

GDP

Substrate Level Phosphorylation

NAD^+

Isocitrate dehydrogenase

$NADH+H^+$

Succinyl Co-A (4C)

Oxalo Succinate (6C) ← Transient

α-Ketoglutarate dehydrogenase

Arsenite

CO_2

NAD^+

α-Ketoglutarate (5C)

Isocitrate dehydrogenase

$NADH+H^+$

CO_2

- Two irreversible Rxn → ① oxaloacetate to citrate; ② α-KG to Succinyl Co-A

Two irreversible Reactions

TCA cycle

Isocitrate dehydrogenase → Rate limiting enzyme.

Citrate Synthase → As such No Rate limiting Enzyme

Total ATP = 3 NADH
1 FADH
1 ATP

10 ATP ← 1 cycle

In older calculation = 12 ATP

Derived from Tyrosine & Phenylalanine.

Teacher's Signature .....

Hemolytic Anemia → due to deficiency of → Pyruvate kinase
Aldolase A

Page No. 22

Allosteric Regulation in TCA cycle

	Enzyme	Positive allosteres (↓ Energy state)	Negative allosteres (↑ Energy state)
1.	Citrate Synthase	ADP	ATP
			NADH
			Succinyl CoA
			Fatty acyl CoA
2.	Isocitrate dehydrogenase	ADP	ATP
		Ca^{2+}	NADH
3.	α-Ketoglutarate dehydrogenase	Ca^{2+}	ATP
			GTP
			NADH
			Succinyl CoA

TCA cycle → Amphibolic pathway → Catabolism + Anabolism

→ Final common pathway of Fat, carbohydrate & protein Metabolism → TCA cycle.

→ Total (4) Dehydrogenase enzymes in TCA cycle.

→ Mitochondrial matrix → site of all enzyme except → Succinate dehydrogenase

Inner Mitochondrial membrane

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Urea formed in → Liver) Selective Non-carbohydrate Precursor
Brain) Pyruvate; Lactate; Propionyl-A; Fumarate; glycerol)
Kidney → New glucose formation from Non-carbohydrate Precursor
Date 21/2 Page 23
A acids (glucogenic Amino acid)

Mainly in Liver → GLUCONEOGENESIS
↳ In Liver; kidney; GIT
mainly in cytosol, Some precursors are produced in mitochondria.

Acetyl CoA, Fatty acids, Ketone bodies → are not substrate for gluconeogenesis
(Substantial Role)

Role of Insulin on carbohydrate metabolism [↓ glucose in Blood]

— i) ↑ glycolysis (liver);
— ii) ↓ gluconeogenesis;
— iii) ↑ glucose uptake by cell;

GLUT4 receptor on these organs ↓ on starvation

GLUT4 → depends on insulin for its activity
↳ ⊕ on Skeletal muscle, Adipose tissue, Heart } depend on insulin for glucose uptake

— iv) ↑ glycogenesis
v) ↓ glycogenolysis.

* Insulin Repress the gene of Pyruvate carboxylase

GLUCONEOGENESIS ⇒ Glucose is synthesized from Non-carbohydrate precursors

Should be part of TCA cycle / glycolysis; or

— gluconeogenic AA [Alanine Q] (18 AA)
Pyruvate Q
Lactate Q
Fumarate
Propionic acid [Propionyl CoA] Q
glycerol [alcohol] Q

*** Q All AA Except Leucine & Lysine all glycogenic AA (have property of converted to TCA cycle intermediates)

* By Pyruvate to produce glucose in gluconeogenesis; Reversible steps of glycosis are used in Reversed Manner & Irreversible steps of glycosis are by-passed by different & dedicated enzymes of gluconeogenesis

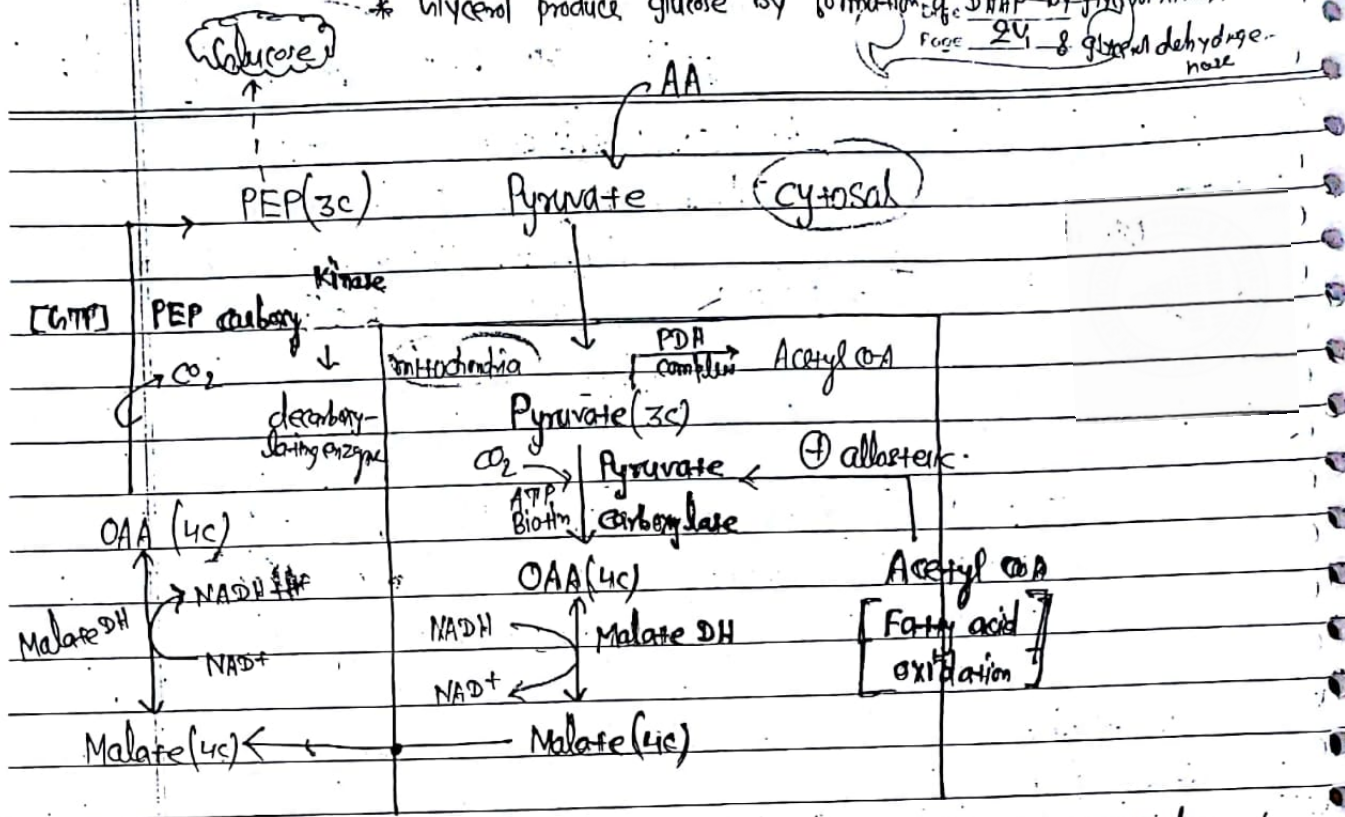
∴ Acetyl Co-A & Substrate giving acetyl coA [FA & KB] → can't make glucose

* add no. C-atoms give; Propionyl-CoA → Succinyl-CoA → TCA intermediate
comes from valine

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Glucose-6-Phosphatase
* Glycerol produce glucose by formation of DHAP by glycerol kinase & glycerol dehydrogenase Page 24



Here, Reducing equivalents from mitochondria to cytosol are transported by Malate &

→ In gluconeogenesis →

PFK-1 counter part → Fructose 1,6-Bisphosphatase &

GK|HK counter part → Glucose-6-Phosphatase &

Pyruvate kinase counter part → Pyruvate Carboxylase &

→ organs involved in Gluconeogenesis → Liver (most imp);
Kidney;
GIT.

Chemical Rxn that form intermediate of Metabolic Pathway.

eg If Anaphylatic Reaction [Killing up reaction] ----> Filling TCA intermediates

V.V.G. ATML-May (17)

L-methyl malonic Aciduria
or
L-methyl malonyl coA

Valine
↓
Propionic acid (3C) [Propionyl CoA]
Biotin, ATP | Propionyl CoA carboxylase
↓
D-methyl malonyl coA (4C)
↓ Racemase
L-methyl malonyl coA (4C)
Mutase|Isomerase (B12)
Succinyl CoA

def: B12 enzyme

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Succinyl CoA comes from → V → Valine
I → Isoleucine
M → Methionine

eg:- α-KG + NH_3 → Glutamate

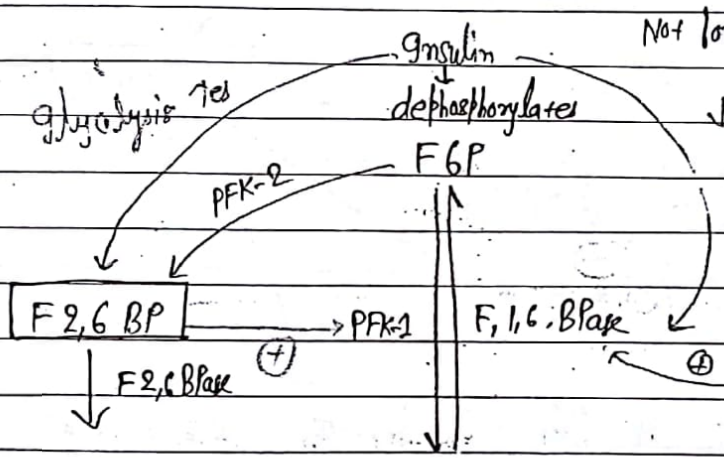
Citrate → FA synthesis

→ Cataplerotic rxn all kiaa "Emptying Rxn".
↳ TCA Intermediate → Non-TCA Intermediate

→ Most imp. Anaplerotic rxn in human

Pyruvate → (Pyruvate carboxylase) → OAA → TCA intermediate

Pyruvate carboxylase → under Repression in presence of Insulin → Not formed



Glucagon
↓
↓ Glycolysis
↑ Gluconeogenesis

Human brain consumes about 120gm of glucose/day out of the 160gm needed by the body.

NEET'16

* Rate Limiting enzyme of gluconeogenesis ⇒ Fructose 1,6-Bisphosphatase
* Starvation / Diabetes } 2nd rxn where gluconeogenesis takes place; b/c of Lack of Insulin.
* Regulating enzyme of gluconeogenesis ⇒ ① Pyruvate carboxylase
② PEP carboxykinase
③ Fructose 1,6-Bisphosphatase

FRUCTOSE METABOLISM

2 Part of F-1-P goes to Ketose (DHAP)

FK | HK not isoenzymes
but GK | HK are isoenzymes

Fructose

Liver (Major) — Skeletal muscle, Adipose

ATP, ADP — Fructokinase — Hexokinase

Fructose-1-P — Fructose-6-P

Aldolase B

DHAP (3C) (Ketose) — Glyceraldehyde (3C)

ADP — Triokinase — ATP

Glyceraldehyde 3P

GLYCOLYSIS

The phosphate of Fructose-1-P goes to Ketose side.

PFK-1 ⇒ No Role of fructose metabolism in Liver

↓

Insulin has no role in fructose metabolism

↓

Diabetic Patient will very well utilize Fructose

↑↑ Fructose (Excess fructose diet) → ↑ glycolysis → ↑↑ Pyruvate

↓

↑↑ Acetyl CoA

↓

↑↑ Fatty acid Synthesis in liver

↓

Fatty Liver

↑VLDL in Blood ← LDL in Blood ← Atherosclerosis

Teacher's Sig.....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Highest conc^{n} of Fructose Among biological fluids is found in → Seminal fluid.

Date Page 27 (15)

∴ Excess fructose diet is "Atherosclerotic"

⇓

Not advisable to (N) Person also.

→ Deficiency of Fructokinase

↳ Essential/Benign Fructosemia

→ Aldolase B deficiency

↳ Fructose 1-P accumulate in liver

⇓

Kn as "Hereditary fructose intolerance" [HFI]

⇓

Baby ⇒ Lethargic

→ Vomiting, diarrhoea after fructose rich diet;

Death c/in the 5years

→ Hypoglycemia (episodic)

→ ↑ Uric acid in blood

→ ↑ Lactic acidosis

→ Hepatomegaly

⇒ Fructose 1 P —⊖→ Glycogen phosphorylase

⇓

Maintains blood glucose level

[∴ Baby will have hypoglycemic episodes as rate limiting enzyme of glycogenolysis is deficient]

⇒ Excess fructose 1 P is formed (blc it sequestrate the Inorganic phosphate); which leads to consumption of ATP in liver ↓. [↓ATP ⇒ ↑glycolysis]

↑ Glycolysis & limited O_2 → Crabtree → Lactic acidosis

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Alcohol $\xrightarrow{\text{Alcohol dehydrogenase}}$ Acetaldehyde $\xrightarrow{\text{Acetaldehyde dehydrogenase}}$ Acetic acid

Hyperuricemia ↑ Lactic acidosis ↑ Lactate

Gluconeogenic is also decompensated (bc Pyruvate is not available) Fasting Hypoglycemia

NAD+ → NADH

NAD+ (NADH) → it converts Pyruvate → Lactate

↑ Lactic acidosis leads to ↓ Uric acid excretion from the kidney

⇓

Hyperuricemia

⇒ ATP ⊖ ↓

"de novo Purine Nucleotide Biosynthesis"

⇒ In hereditary fructose intolerance → ATP ↓

⇓

∴ ↑↑ Purine nucleotide

⇓

↑ Uric acid.

⇓

It is a lethal condition

⇓

Baby doesn't survive >5yrs

⇓

Early death seen

POLYOL [SORBITOL PATHWAY]

→ doesn't occur in liver.

→ Seen in → Lens

Peripheral Neurons

Basement membrane of glomerulus

Testis; sperm → Hygroscopic alcohol

⇓

Absorb water

→ GLUCOSE $\xleftrightarrow{\text{Aldose Reductase}}$ Sorbitol $\xrightarrow{\text{Sorbitol dehydrogenase}}$ Fructose

* → Occurs when blood glucose level is very high (eg: DM)

→ Excessive sorbitol pathway is one reason for

- Diabetic Cataract; Glomerulonephritis
- Diabetic Neuropathy etc

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

↑ Sorbitol → ↑ water absorption [hygroscopic]

↳ Causes "Blurring of vision".

→ Aldose Reductase → Target enzyme to ↓ DM complications.

↓

If inhibited → No Sorbitol formed.

GALACTOSE METABOLISM

Galactose ⇒ Dietary Non-essential. (Not to)

ATP Ganglioside

Almost all galactose is utilized in → Liver.

Galactose

ATP → Galactokinase ← ADP

Galactose 1-P

UDP-glucose → Galactose-1-P uridyl transferase ← UDP galactose

Glucose-1-P

Phosphoglucomutase

Glucose 6P → Glycogen

↓ → HMP-shunt

glycolysis → Uronic acid

- At some steps epimerization takes place.
- Galactose is converted to glucose.
- * UDP-glucose is Must for Galactose Metabolism.

⇒ In the case of galactokinase deficiency

↳ **Benign Galactosemia**

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

→ In galactokinase deficiency

↓↓

Galactose ↑↑

↓

Aldose Reductase → Galactitol / dulcitol

NADPH + H⁺ → NADP⊕

Hygroscopic

↓

accumulates in lens

↓↓

Baby born ⊂ Cataract. Cataract

→ Galactose 1P uridyl-transferase deficiency

↓↓

Classical galactosemia

Rare congenital disease

Autosomal Recessive disorder

↓

Galactose 1P accumulated → Hepatotoxic

↓

Baby has → Cataract
organomegaly
Hypoglycemia
Mental Retardation
Lactic acidosis
Hyperuricemia

** → Phosphorylated Sugar [glucose, galactose] can't cross the cell membrane → accumulate in same cell

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

→ energy consumed in its formation → ↓ ATP ⇔ ↑ glycolysis → LA ↓ Hyperuricemia

Date: 22/2
Page: 31

→ accumulates in liver → [Hepatomegaly]

(17)

Galactose 1P ⊖ → Glycogen phosphorylase

↓

Episodes of hypoglycemia

↓ Repeated Steps

↓

Leads to Mental Retardation.

Rx of Galactosemia → Galactose free diet (complete Restriction)

→ Galactose is dietary Non-essential (i.e. can be formed in Body) ↓ from glucose

↓

Required for ganglioside formation (Nerve sheath)

** ATIMS Nov-16 Presense of Reducing material (galactose) in urine ⊖ Negative glucose oxidase test Suggests diagnosis of galactosemia

→ GLUCOSE

↓

GLUCOSE-6P.

↓ Phosphoglucomutase

GLU-1-P

↓ UDP-glucose Pyrophosphorylase

UDP-glucose

↓ 4 epimerase

UDP galactose

Used for ganglioside synthesis

Glucose + Galactose

in Nerve sheath

** Lactase

↓

Lactose

↓

enzyme of β-galactosidase group.

Lactose synthase

glucose

if 4-epimerase deficient

↓

Dual galactosemia

↓

in Liver can't be treated,

↓

Not told to take galactose free diet; b/c Nerve sheath formation

• Before advising diet restriction ⊖ galactose we need to check for intact 4-epimerase. ***

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

"HMP shunt doesn't Produce energy".

Date
Page 32

→ Galactosemia ē 4 epimerase deficiency can't be treated as galactose can't be synthesized in body for ganglioside Synthesis

• Cytosolic | HMP PATHWAY | → No ATP Production

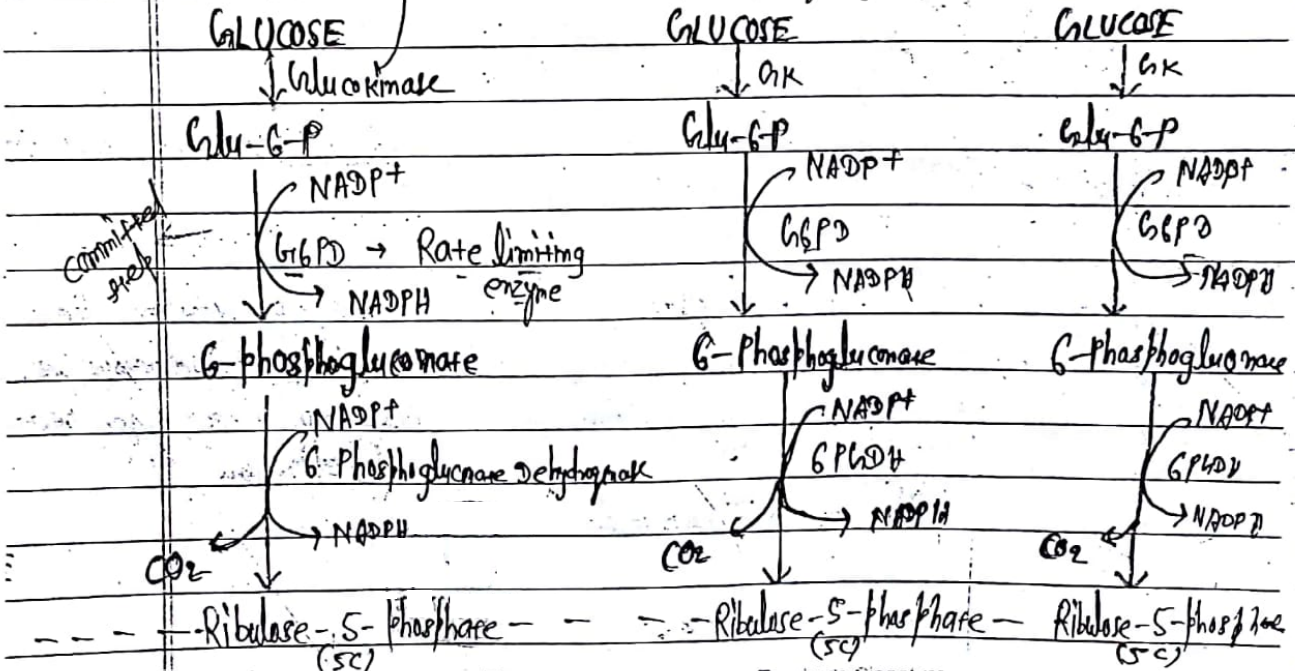
① → NADPH Produced ; ② → Ribose 5P for Nucleotide Synthesis

∴ Hexose monophosphate Pathway / Pentose phosphate Pathway [PPP]

→ Occurs in → Liver
Adrenal gland
Mammary gland (Lactating not the Non-lactating)
RBC → To Protect RBC
Placenta
Testis, ovary
Adipose tissue

glucokinase is not a committed step. committed step → irreversible
committed step = Irreversible Phase
→ born product for / pathway

→ Starts with 3 molecules of glucose

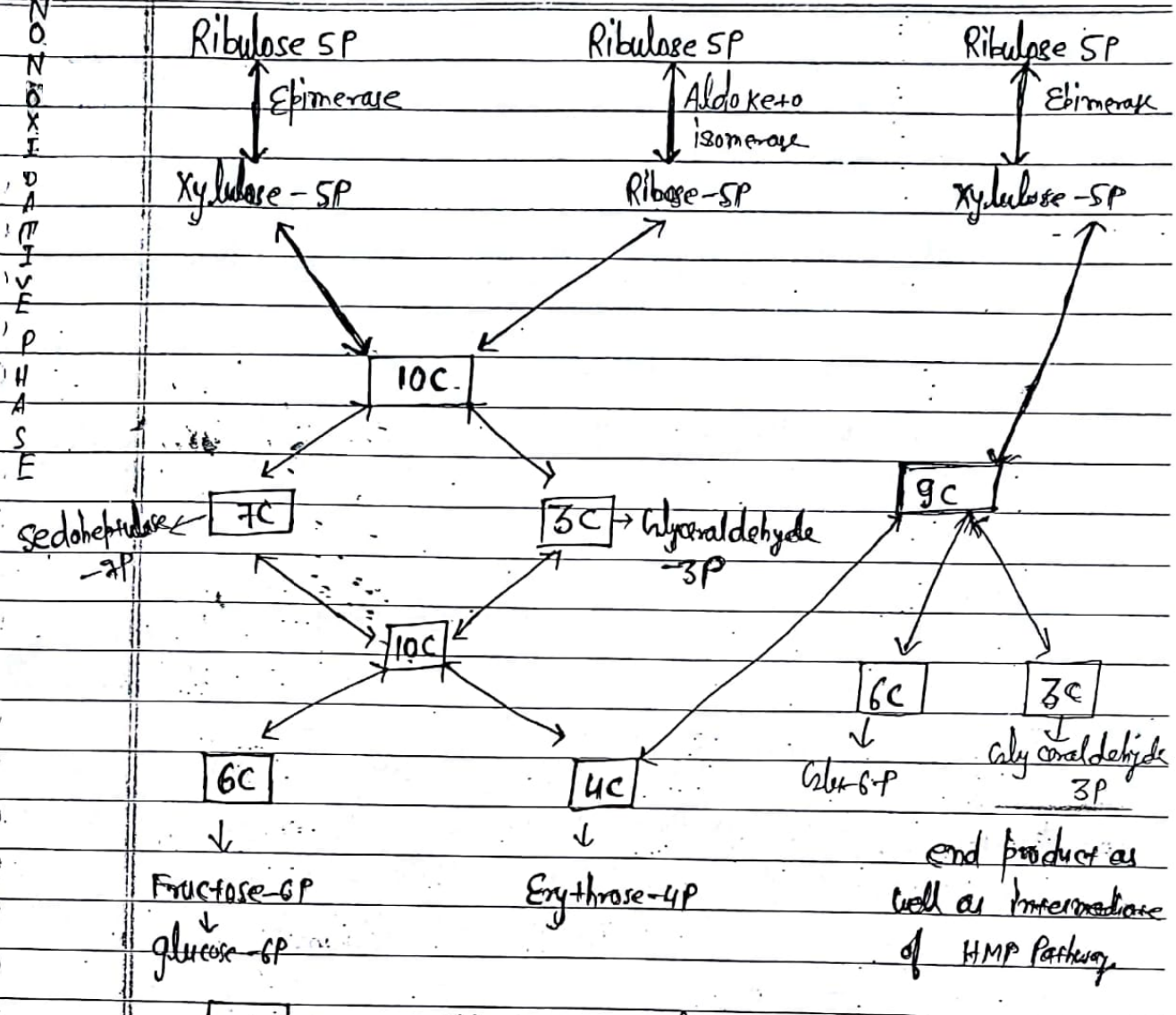


Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

NON OXIDATIVE PHASE

Reversible Rxn



end product as well as intermediate of HMP Pathway.

5C → Ribose – 5P ⇒ having biologically imp. to form Nucleotide synthesis
— Ribulose – 5P
— Xylulose – 5P

Intermediates → Glyceraldehyde -3P (3C)
Erythrose -4P. (4C)
all 5C compound
Fructose -6P
Sedoheptulose -7P

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Pyruvate $\xrightarrow[(TPP)]{PDH}$ Acetyl Co-A ⇒ Pyruvate utilized in presence of (B_1)

Date
Page 34

Thiamine deficiency causes ↓ energy production as it is coenzyme of PDH (Required for glucose breakdown).

3 Glucose-6P + 6NADP+ + 6H+

↓

2 Glucose-6P + 6NADPH + $3CO_2$ + Glyceraldehyde-3P

→ Continuous condensation & dissociation in HMP Pathway is catalysed by → Transaldolase, Transketolase → Req in Reversible phase
PLP (vit. B_6) → B_1

Pyridoxal phosphate (PLP) → Req for Transaldolase activity

→ To find out vit B_1 deficiency → Transketolase activity in (RBC) is assessed

* Hemolytic Anemia is dlt ⇒ G6PD (96%) ↓
deficiency of : Pyruvate kinase (4%)
Phosphoglucomutase (~1%) earliest manifestation
↓
↓ Transketolase activity

ROLE OF NADPH → (1) Reductive Biosynthesis of fatty acids & steroids [Pathway requiring (H+)] → For Reduction
Source → NADPH

(2) Tackle the oxidative stress in a cell via Reduced GSH

(3) Maintain the Reduced form of glutathione [GSH]
(+) at active site of enzyme
→ Co-enzyme activity
→ AA transport across Memb. zone
→ Tackle oxidative stress

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

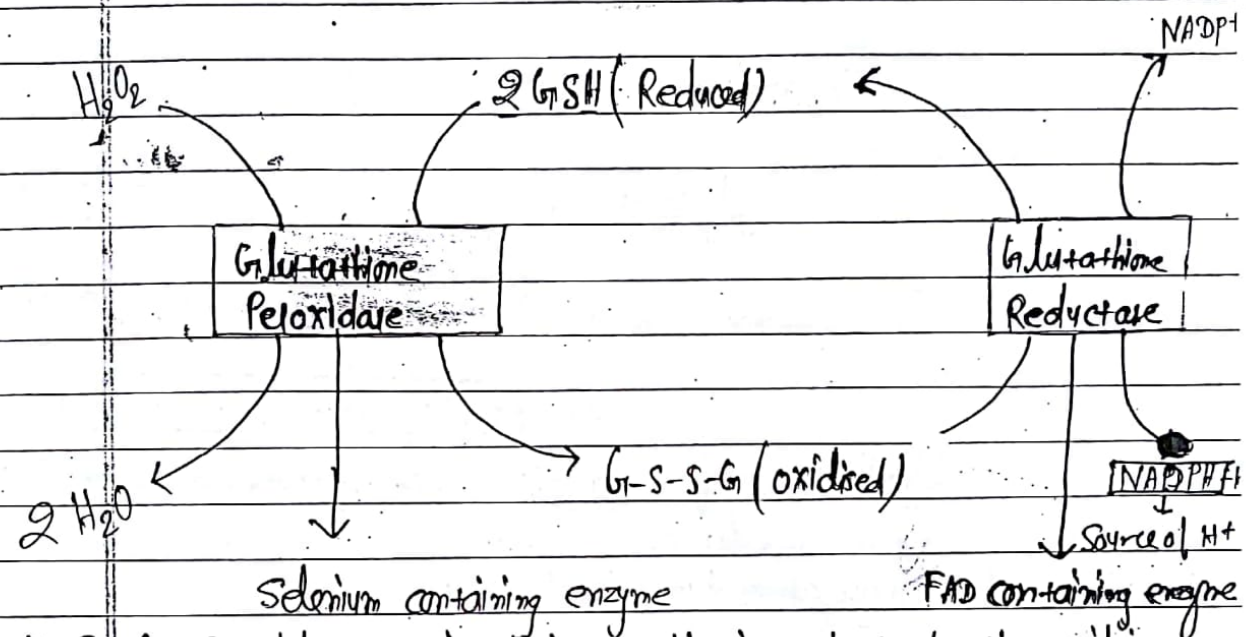
O_2^- (superoxide) (More toxic) —Superoxide dismutase (SOD)→ H_2O_2 (Less toxic) —Glutathione Peroxidase / catalase→ H_2O

H_2O_2 —Fenton's Rx (Fe++)→ OH^- (Most potent free Radical)

Date Page 35

Source of NADPH → ① HMP Shunt (Major > 90%);
② Malic enzyme
③ Isocitrate dehydrogenase (cytosolic)

→ Role of NADPH as an Antioxident (free-Radical Scavenging) reactions →



* In G-6-PD deficiency: hemolysis seen b/c it can't tackle the oxidative stress.
∴ Reduced GSH converts $H_2O_2 \rightarrow 2H_2O$ by giving its H+ & NADPH maintains GSH in Reduced state.

H_2O_2 → Free Radical → Needs to be Scavenged.

AIIMS

ENZYME	ACTIVATOR	COVALENT MODIFICATION INACTIVATOR	ALLOSTERIC MODIFICATION STIMULATOR	INHIBITOR
• GLYCOGEN SYNTHASE →	Insulin	Glucagon (in Liver) Epinephrine (in Liver & Muscle	Glucose-6-Phosphate	
• GLYCOGEN PHOSPHORYLASE →	Glucagon (in Liver) Epinephrine (in Muscle)	Insulin	AMP (in Muscle) Glucose (in Liver) Ca++ (in Muscle)	ATP (Liver & Muscle) Glucose-6 (in Muscle)

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Not Random; eccentric Molecule

GLYCOGEN METABOLISM

- Storage form of glucose In Animals.
  - Liver ⇒ 4% of Liver mass → 72 gm
  - Muscle ⇒ 0.7% → 245gm
  - Extracellular ⇒ 0.1% → 10 gm
- Max^m glycogen → acc. to % or c/w → Liver
  - acc. to total weight → Muscle

GLYCOGENESIS → In cytosol

Synthesis of glycogen from glucose is "GLYCOGENESIS".

Nucleotide, glucose essential for
↓
UDP-glucose

Glucose
ATP → ADP (GK)
Glucose-6-P
Phosphoglucomutase
Glucose-1-P
UTP → PPi (UDP-glucose Pyrophosphorylase)
UDP Glucose
Nucleotide glucose*
- Glycogen synthase
- Branching Enzyme

GLYCOGEN

Combine to G-1-P from UDP glucose

Pyrophosphate

Glycogenin ← Receive glucose from the glucose

Protein

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

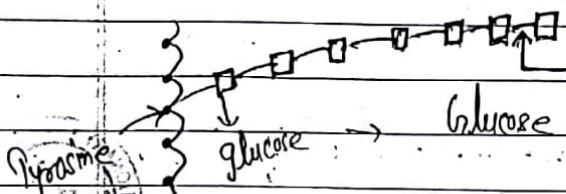
Date
Page 37

Q

Glucose 1P + UMP → UDP-glucose

↓

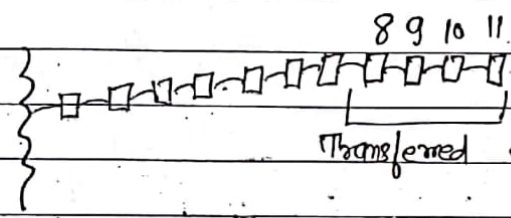
Comes from UTP.



→ glucose transferred to form a linear chain of 7 glucose by

↓

glucosyl transferase [α 1,4 Bond]



↳ Rate Limiting enzyme

Transferred by glycogen synthase [α 1,4 Bond]

Glycogen Primer [Glycogenin + 7 glucose residues]

↓

Branching enzyme → cleaves outer 6 glucose Residue

↓

Now hexasaccharide is transferred in a Branch form

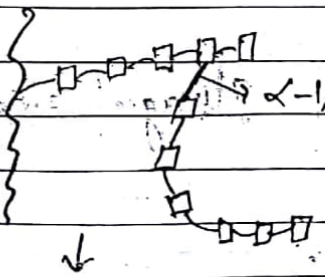
↓

Breaks 1,4 bond & forms α 1,6 Bond

** [Amylo(1,4→1,6) transglucoside activity]

or

** [Amylo(1,4→1,6)/glucan transferase activity]



↓

Breaks 1,4 bond & forms Alfa 1,6 Bond

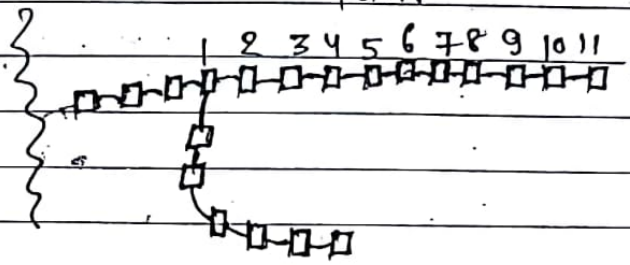
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

↓

Glycogen Synthase further acts to add glucose residues to form Linear chain (α-1,4 Bond)

↓

'Add 11 Residues of glucose from Branching point.



GLYCOGEN SYNTHASE → active in Dephosphorylated form

↓

∴ Insulin is needed.

GS (active) —Protein kinase (CAMP dependent)→ GS (P) (inactive)

**

Glucagon ⊕ → CAMP ⊖ Insulin
Epi, Nor-Epi

ATP —⊕ Insulin→ Adenyl cyclase —⊕ Glucagon / Epinephrin / NE→ CAMP

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

→ Most enzymes all → Monofunctional (1 active site)

Date Page 39

(21)

GLYCOGENOLYSIS → cytosolic

Important Enzymes →

GLYCOGEN PHOSPHORYLASE

- Rate limiting enzyme of glycogenolysis.
- Active in phosphorylated form
- AIIMS Nov '17 ★★ Needs (PLP) for action [B_6]
  - ↳ co-enzyme
  - [Major PLP is present for muscle glycogen phosphorylase]
- Needs Inorganic Phosphate for its activity.
- a/k/a "α-1,4- glucosidase"
  - ⇓
  - Cuts 1,4 Bond
- Release : glucose-1-P

BIFUNCTIONAL ENZYME

- 2 catalytic activity
- 2 active sites

Trisaccharide transferase activity	Debranching activity
↓	↓
a/k/a "Amylo[1,4→1,4] glucan transferase" or (1,4→1,4)-transglucosidase	a/k/a "α-1,6-glucosidase"
	⇓
	Cuts 1,6 Bond
	• Release free glucose

AI→OP Glycogen is degraded to "glucose-6-phosphate" in muscle & to glucose in liver; b/c Glucose-6-phosphatase is absent in Muscle therefore, Glucose-6-phosphate can't be degraded to free glucose in Muscle.

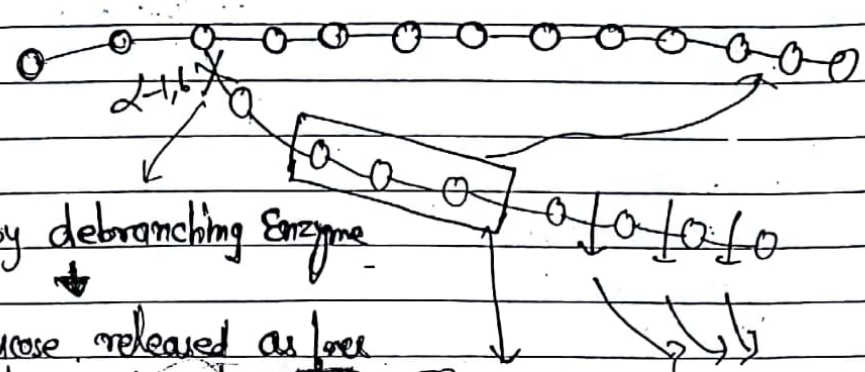
AI→OP ★ Liver glycogen (Glycogenolysis) & gluconeogenesis serve to Maintain blood glucose levels during overnight fasting.

blood glucose levels during overnight fasting.

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Liver glycogenolysis ⇒ during starvation & exercise
* Muscle glycogenolysis ⇒ during exercise



③ cut by debranching Enzyme
↓
glucose released as free glucose in blood

② cut & transfered by Trisaccharide transferase
↓
transfer the trisaccharide at terminal end & added in linear fashion.

① cut by glycogen phosphorylase
↓
to give glu-1P
↓
acts till 4 glucose remains in Branch
↓
Glucose-1-P can't cross membrane
↓
needs to be converted to glucose to maintain Blood glucose.

→ Glycogenesis & glycogenolysis is a Cyclical process.

Reversible enzyme
↳ common to both glycogenesis & glycogenolysis

Glucose 1P ⇌ Phosphoglucomutase ⇌ Glucose 6-P

Glucose-6-P translocase
↓
encoded by "SLC37A4" gene
↓
transfers G6P to ER*

Glucose-6-Phosphatase
↓
ER**
↓
Glucose
↓
in blood

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Liver glycogen → Instant Source of Blood glucose.

G-6-P → Common to Many Pathways

Date 23/2
Page 41

→ GLUCOSE-6 PHOSPHATASE → deficient in "Von-Gierke disease"

↳ Mainly prt. in liver, kidney & intestine

↳ abt. in Muscle & Brain;

⇓

So; end product of glycogenolysis in muscle

⇓

glucose-6-phosphate

⇓

Muscle use it for energy via glycolysis.

→ due to lack of glu-6-phosphatase

↳ Muscle glycogen is not responsible to maintain Blood glucose.

↳ PK(a) → active phosphorylated form.

→ Glycogen phosphorylase [Inactive] - GP(b) ⟵ Phosphorylase Kinase ⟶ [active] - GP(a)

Phosphorylase Kinase ↓ needed in active form

GP (P)

↓ Insulin → Dephosphorylated

↓ Phosphorylated ↑ Glucagon

PK(b) Inactive phosphorylated ⟵ CAMP dependent Protein Kinase ⟶ PK(a) active phosphorylated

⊕

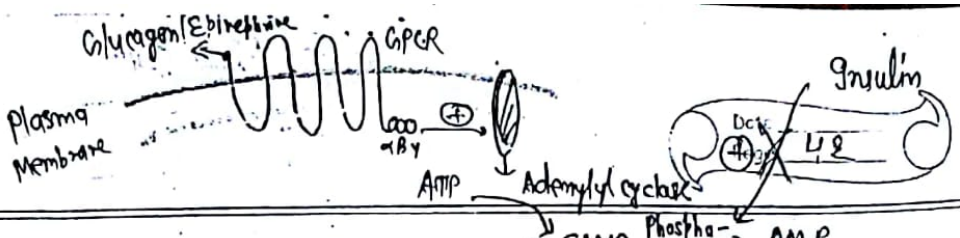
⊕ → CAMP ← ⊖

Glucagon; Epinephrine; Norepinephrine

Insulin.

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397



⇒ Phosphorylase kinase — Tetramer [4 Subunits]

↓

$\alpha\beta\gamma\delta$ → Bind to Ca^{+2}

↙ ↓ ↘

Bind with PO_4^- | Catalytic subunit | Calmodulin like subunit

ATTACK NOW!!

⇒ Glycogen phosphorylase

↙ ↘

Liver

↓

Monomeric

↓

needs 1 PLP

affected by Insulin, glucagon, epi, nor-epi

↓

Maintains Blood glucose level

Muscle

↓

Tetrameric

↓

needs 4 PLP

affected by epi; Nor-epi

↓

Q doesn't maintain blood glucose

AI-99

Stress → epi, Nor-epi ↑ → Liver } glycogenolysis ↑

muscle }

↓

↑ Blood glucose due to Liver glycogenolysis

r's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

GLYCOGEN STORAGE DISEASE

Date
Page 43

TYPE	NAME	ENZYME Def.	C/F
0	—	Glycogen Synthase	Hypoglycemia; Hyperketonemia; early death.
Ia	Von Gierke's disease	Glu-6-Phosphatase	Hypoglycemia; Lactic acidosis; Ketosis; Hyperlipidemia.
Ib	—	ER Glucose-6P transporter (Glu-6P-translocase)	as type Ia Neutropenia; Recurrent infection
II	POMPE's disease	Lysosomal 1,4 and 1,6 glucosidase (Acid maltase)	• Glycogen accumulates in lysosomes in almost all tissue ① Juvenile onset variant - "Muscle hypotonia" (death from Heart failure by age of 2 yr). ② Adult onset variant - Muscle dystrophy. (No death)

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

VON-GIERKE'S DISEASE → Hepatocytes

Glycogen

glycolysis

HMP → Ribose 5P → Purine Nucleotide ↑

Glucose-6P

Uric acid ↑

Glucose

Hyperuricemia

↓ No Blood glucose → Hypoglycemia

Excess glycolysis & limited O_2 → Lactic acidosis

Hypermia

Hypoglycemia → glucagon secreted → Phosphorylation of many enzymes

also "Hormone Sensitive Lipase"

active in phosphorylated form

Adipose cell

Triacylglycerol → Fatty acid release in Blood

Hyperlipidemia

Excess β-oxidation in liver

Ketosis → Ketone body formation

Ketosis

HSL → Mobilize fat from adipose tissue to Blood

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Liver disease → $\frac{AST}{ALT} < 1$; II, V, VII → Muscle disease

Muscle disease → $\frac{AST}{ALT} > 1$;

Date: Page: 45

(24)

IIIa	Limit dextrinosis, Forbe's or cori's disease	* Liver & Muscle debranching enzyme (Amylo α 1,6-glucosidase)	• Fasting hypoglycemia • Hepatomegaly in infancy • accumulation of limit dextrin. • Muscle weakness
IIIb	Limit dextrinosis	* Liver debranching enzyme	As type IIIa, but no muscle weakness
IV	Amylopectinosis (Anderson's disease)	Glucosyl 4-6 transferase (Branching enzyme)	• Hepatosplenomegaly • accumulation of polysaccharide ~ few Branch points.
V	McArdle's disease (type V glycogenosis)	Muscle glycogen phosphorylase	• Poor exercise tolerance • Muscle glycogen accumulate → abnormally high (2.5-4 %) • blood lactate very low after exercise
VI	Hers disease	Liver glycogen phosphorylase (Hepatic)	• Hepatomegaly • accumulation of glycogen in liver • Mild hypoglycemia

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Lactose intolerance → Lactase deficiency (β-galactosidase)

Date
Page 46

VII	Tarui's disease	Muscle & erythrocyte Phosphofructokinase-1 ↓ No glycolysis ↓ ↓ glycogenolysis (Gn-6-P blocks the glycogenolysis) (Muscle fatigue)	Same as V; also hemolytic anemia; Muscle fatigue
VIII	—	Liver phosphorylase kinase	• Hepatomegaly • accumulation of glycogen in liver • Mild hypoglycemia • Good prognosis
IX	—	Liver & Muscle phosphorylase kinase	• Same as VIII • Muscle also involved
X	—	CAMP dependent protein kinase A	• Hepatomegaly • accumulation of glycogen in liver

Mnemonics :-

Vo	Physics	Chem	Aur	Mads	Hadiqa	Thi
Von	Pompe's	Cori	Anderson's	McArdle	Her's	Tarui's
I	II	III	IV	V	VI	VII

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 47

↳ In Liver.

URONIC ACID PATHWAY (cytosolic)

Glucose
↓ GLK
Glu-6P
↓ PGM
Glu-1P
↓ UDP-Glu Pyrophosphatase
UDP glucose
↓
UDP-Glucuronic acid → Utilized as a Conjugating agent
• MPS Synthesis
↓
L-Gulonate &
L-Gulonolactone oxidase → abs in human
↓ ↓
L-Xylulose — Vit.C [Not in human]
↓
Xylitol dehydrogenase [X-D] → Essential Pentosuria
↓
L-Xylulose in urine
Xylitol
↓ Xylulose Reductase [X-R]
D-xylulose → PP Pathway

Block in essential Pentosuria.

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

LIPIDS

↳ Heterogenous groups of compounds — Separate Lipid from non-lipid mixture

Date
Page 48

↳ eg: Benzene, ether, chloroform, Acetone, Formalin

- Compounds which all soluble in Non-polar Solvent but Insoluble in polar Solvent.
  ↳ eg: H_2O; Alcohol; Blood plasma
- Modified Bloor's classification :⇒

Simple lipid	Compound lipid	Miscellaneous / complex
alcohol + Fatty acids	[Simple + few groups]	① Fatty acids
① Triacylglycerol (glycerol + 3FA)	① Aminolipid	② cholesterol
② ceramide / wax (Sphingosine + Fatty acid)	② Sulfolipid	③ Bile acids
	③ Glycolipid	④ Steroid hormone
	④ Lipoprotein	* Fatty acid is precursor of cholesterol.
	⑤ Phospholipid	derived lipid ⇒ derived from cholesterol
		both derived & precursor lipid

- Aminoalcohol having double bond
- No branching init (Linear Molecule)

PHOSPHOLIPID → Plasmalogen

Glycerophospholipid (Major)

Base linked to phosphate

Phospholipase A1 cut here

Fatty acids

Phospholipase B cut here

glycerol

Phosphatidic acid

Structure except Base

Phospholipase A2 cut here

Phospholipase "D" cut here

Phosphate

Phospholipase C cut here

Sphingophosphalipid (Rare)

↳ having choline base

eg → Sphingomyelin

Sphingosine + FA + PO_4^- + Base

Very huge, high M_W

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Barth Syndrome

→ "BARTH SYNDROME" → due to deficiency of Cardiolipin.

→ "Niemann-Pick disease" → due to "Sphingomyelinase deficiency."

Date 11/49

Component of glycerophospholipid
→ glycerol + 2 FA + PO_4^- + Base

Base
- C Nitrogen
- C ou + Nitrogen

Base in Sphingomyeline
↳ choline
Sphingomyelin = ceramide + PO_4^- + choline
↓
acts as Second messenger by regulating apoptosis, cell cycle & cell differentiation.

Depending upon the presense of Nitrogen :→

GLYCEROPHOSPHOLIPID

Base (Myoinositol)

N_2 – containing Base

① Phosphatidyl choline [Lecithin]
Most abundant phospholipid of Membrane
choline has "labile Methyl group".

② Phosphatidyl ethanolamine [Cephalin]

③ Phosphatidyl Serine

choline, ethanolamine, Serine are N_2 containing Base

Non-N_2 containing

① Phosphatidyl Inositol
↳ [Base → myo-inositol]
↳ Precursor of Second messenger in cell (IP_3 + DAG)
(PIP_2 —Phospholipase C→ IP_3 + DAG)
↳ Protein kinase "C" in Nucleus
↳ Ca++ in ER Release

② Diphosphatidyl glycerol [Cardiolipin]
↓
Two molecules of phosphatidic acid held by an additional glycerol through phosphate group.
↓
- Found in inner mitochondrial Membrane
- Antigenic Nature
- Receptor activity (play a Role i

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

"Glycolipids" are formed in "Endoplasmic Reticulum".

Date
Page 50

PLASMALOGEN → It is a phospholipid.... $-O-\overset{O}{\overset{\|}{C}}-R_1$ abt,
→ Fatty acid is not present at C_1
→ Unsaturated alcohol present at C_1 through ether linkage
→ also k/a "Phosphatidalethanolamine"

formed when a fatty acid is attached by an ether linkage at C_1 of glycerol of glycerophospholipid

→ present in - Brain Parenchymal cells } → only 10% of total phospholipid is plasmalogen.
- white fibre muscle

eg → (1) Choline plasmalogen
(2) Ethanolamine plasmalogen.
(3) Platelet activating factor

SPHINGOGLYCOLIPID / GLYCOLIPID → alcohol → always sphingosine

(1) cerebroside (ceramide monohexoside);
↳ Galactose > Glucose
(2) Globoside (ceramide oligohexoside);
globoside . . ↳ oligosaccharide attached to ceramide
(3) Ganglioside → ceramide + glucose + galactose + NANA
ceramide + glucose + glalactose + NANA
(Sialic acid)
Simplest ganglioside (GM3)
Most common
Smallest
Smallest

↑ structural complexity

r's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Tay-Sach's disease → due to deficiency of "hexosaminidase" (α-subunit)
Sandoff disease → due to deficiency of "Hexosaminidase" (β-subunit)
→ In both disease "GM_2 ganglioside" is accumulated.

→ ceramide + glucose + Galactose — N-Acetyl galactose
|
NANA
↓
GM_2

→ ceramide + glucose + galactose — N-acetyl galactose
| |
NANA Galactose
↓
GM_1 → Biggest

Ganglioside + Monosialic acid
$GM_{1/2/3}$ → is the chromatographic migration on size exclusion chromatography
↓
• Separation of any mixture into their components based on physical property of compound
eg:- charge, solubility, weight, size.

GM_3 → fastest migration.

GM_1 → slowest
↓
Heavier

• Ganglioside → doesn't have phosphate

• Galactocerebroside more common than glucocerebroside

• Krabbe's disease → due to deficiency of enzyme β-galactosidase
↳ galactocerebroside accumulate in brain.

NEET'16 Gaucher's disease → due to deficiency of β-glucosidase

• Extracted lipids are separated into individual class by "chromatography" NEET

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Fatty acids liberated from adipose tissue by Lipolysis are not water soluble.
attached to albumin to be transported in Blood or Any Plasma protein.

Date
Page 52

FATTY ACID → Aliphatic carboxylic acid

$-RCOOH$ (including C-atom of COOH)

- Short chain FA → 4-6 C-atom;
- Medium chain FA → 8-14 C-atom
- Long chain FA → 16-22 C-atom
- Very long chain FA → > 24 C-atom

Numbering System
↓
Delta system

$CH_3 - CH_2 - CH_2 - CH_2 - CH_2 - COOH$ (6, 5, 4, 3, 2, 1)

ω → Last carbon

ω δ γ β α → adjacent to carboxyl

Omega system

ω_1 ω_2 ω_3 ω_4 ω_5 ω_6

* "ω" family denotes the position of 1st double bond from last C from "ω" end.

Position of double bond in FA chain
↓
1st double bond from ω end

eg → C-C-C=C-C-C
ω_3
↓
ω_3 fatty acid

Chain Name → 6:1 (Δ3)
- No. of "C"
- No. of double bond
- Position of double bond acc. to delta system

eg → $CH_3 - CH = CH = CH - CH_2 - COOH$
ω_3 family
Chain Name → 6:2 (Δ3 & Δ4)

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Most active Plasma lipids → Free fatty acids.

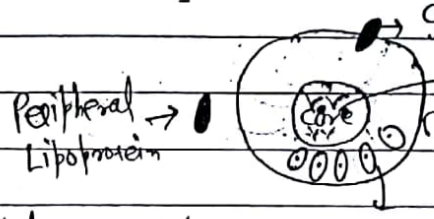
↳ Metabolized in Plasma.

LIPOPROTEINS

Lipid + Proteins (Remnants particle)

→ five types of lipoprotein → LDL, HDL, VLDL, chylomicron, & free fatty acid-albumin complex

→ Structure →

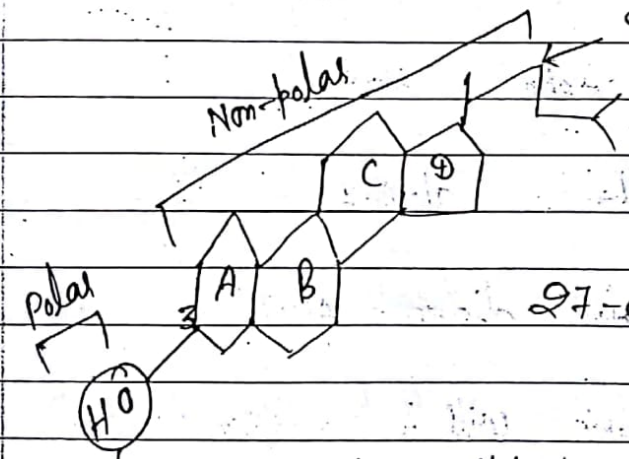


Both polar & Non-polar ← Amphipathic shell

↓

Phospholipid & free cholesterol

→ Free cholesterol →



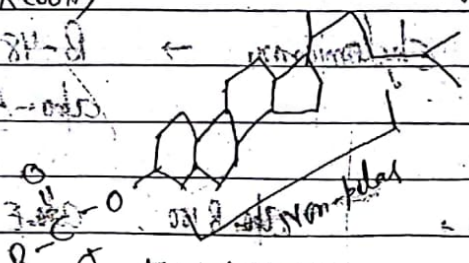
27-carbon compound & 4 rings.

* Polar surface towards sulpha

→ Makes it amphipathic & Res towards core

attached on G

Free cholesterol + FA (RCOOH) → Non-polar esterified cholesterol



Cholesterol Ester

↓

FA + cholesterol

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

CETP ⇒ cholesterol ester transfer protein.

Date 24/2
Page 54

- Protein of lipoprotein is known as "Apolipoprotein/Apoprotein".

→ Structural component of lipoprotein.
→ Enzyme cofactor – Apo CII & Apo CI ⊕→ Lipoprotein lipase
Apo A-1 ⊕→ LCAT*
→ Enzyme inhibitor ⇒ AII & CIII ⊖→ Lipoprotein lipase Lecithin cholesterol acyl transferase
Apo CI ⊖→ CETP*
→ helps in recognition of lipoprotein by their Receptors.

Ligand for lipoprotein Receptors ⇒

- LDL receptor = apoB100 & apoE
- LRP = apoE
  ↳ LDL Receptor related Protein
- Remnant Receptor ⇒ Apo E
- HDL Receptor = apo A-1
- Neurodegenerative disorder = Apo D.
- apoE lipoprotein will be identified by LDL, LRP, Remnant Receptor
- LDL particle has only 1 apoprotein → apo B-100

Ligand of LDL ⇒

- Chylomicrons → B-48
  apo-A

Q: Which Receptor is present on the liver for LDL uptake
Ans → apo-B 100, apo E

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

→ Chylomicrons all synthesized in intestine & transport exogenous triglyceride to various tissue.

Date
Page 55

Q: Ligand of LDL ⇒	Site of Synthesis	Apoprotein
1. apo-B100	Liver & Intestine →	A-I, A-II
2. Apo-E	Liver →	A-I, B100, C, E
3. Apo-48	Intestine →	A-I, B-48
4. Apo A-II	Spleen, brain, Testis, Adrenal →	∅

"Serum appeared "milky white" in Tes. chylomicrons."

CHYLOMICRON METABOLISM

Post prandial → Chylomicrons ↑ in Blood

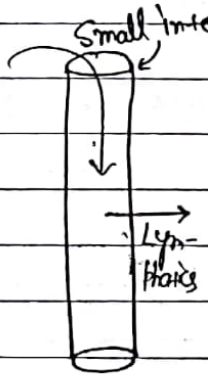
↓

Comes from GIT mucosal cell.

↓

via lymphatics enter blood.

* chylomicrons → Principal form in which dietary lipids (exogenous lipids) are carried from intestine to liver



ApoB-48 Shell → Phospholipid + Free cholesterol

Chylomicrons apo-A

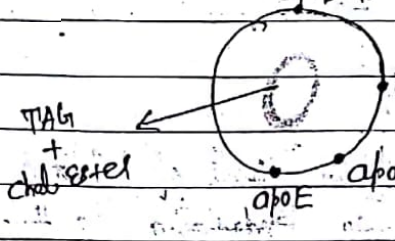
Core → TAG + cholesterol ester [dietary] (exogenous → dietary)

Nascent chylomicrons (Non-functional)

apo C (from HDL)

apo E

Maturation in plasma



Mature chylomicrons

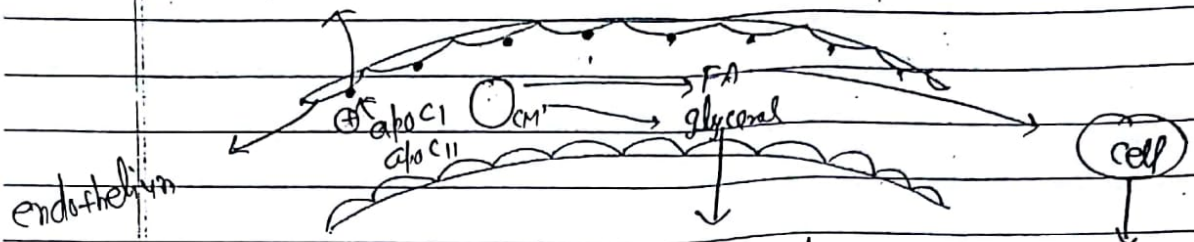
Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 56

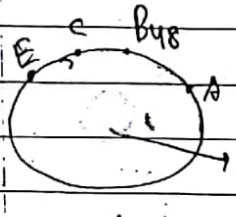
Lipoprotein lipase ↓ enters capillary lumen

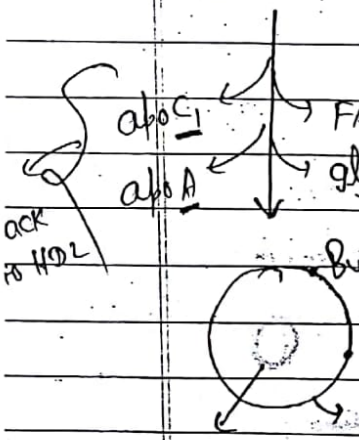
⊕ Ant on wall of the capillary endothelium acts on TAG of CM core



Remains in Blood → goes to liver finally → formed glucose

Receives fatty acids





→ Size of chylomicron ↓ after this

20% TAG Reaches Liver from chylomicron Remnant.

Chylomicron Remnant is identified by apoE

*** CETP-Movie

Chylomicron distributes FA to different cells & then cleared from circulation

Lipoprotein lipase → Located on walls of blood capillaries
- Adhere to endothelium via Heparan Sulphate
- Heparin release it.

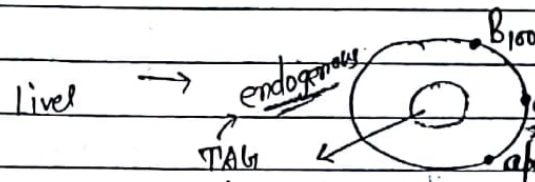
Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

VLDL → TG Rich Particles & transport endogenous TG from Liver to peripheral tissue
LDL → Cholesterol Rich Particles & are the Major source of cholesterol to Peripheral tissue;
HDL → Transport cholesterol from Peripheral tissues back to Liver

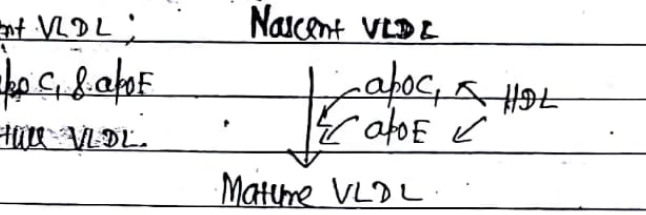
VLDL TRANSPORT → distributed FA & cholesterol to cells endogenously

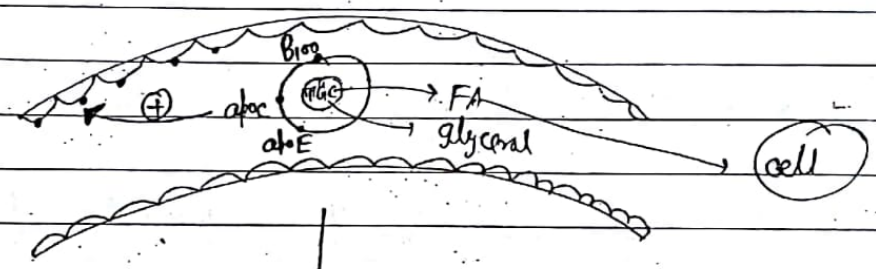
→ VLDL all produced in liver & intestine.



VLDL
↓ FA
LDL
↑ cholesterol
LDL

Liver form Nascent VLDL; after adding apoC, & apoE they form Mature VLDL.





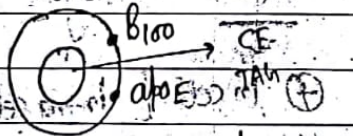
LL degrades TAG → FA + Glycerol

after giving FA into cells & glycerol to Blood

↓

VLDL remains in Blood (5 hr.)

↓ Apo C] Back to HDL



VLDL remanant or Intermediate density lipoprotein [IDL]

VLDL remanant or intermediate density lipoprotein [IDL]

50%

50%

apoE released in plasma rich "Arginine Rich"

arginine rich

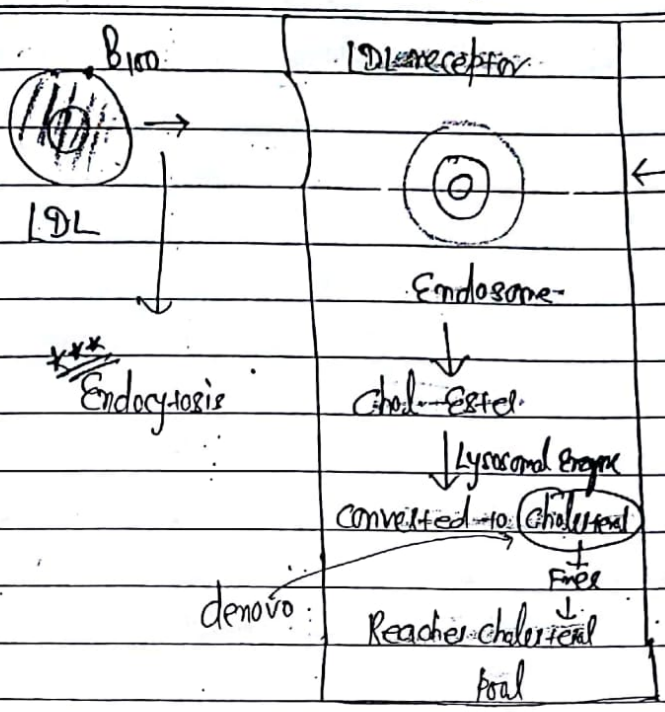
LDL particle

Search for cell requiring cholesterol (cells ↑ LDL receptor)

Teacher's Signature

• LDL contains only one apoprotein ⇒ ApoB100

Date
Page 58



→ Source of cholesterol in cholesterol pool –
  i) LDL
  ii) denovo cholesterol synthesis.

→ LDL receptor does not during Endocytosis is Resynthesized

→ If cholesterol ↑es in Pool →
  • LDL Receptor Synthesis down Regulated;
  • ↓ denovo Synthesis ;
  • ACAT enzyme stimulated
  ↓
  ⊕ In cell [Intracellular ACAT (intracellular ACAT) involved in cholesterol regulation (Involove in cholesteral)]

→ ACAT → Acyl CoA cholesterol acyl transferase
  ↓
  Substrate → Free cholesterol
  Free cholesterol ⊕ → ACAT
  Free cholesterol → Cholesterol Ester

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

HDL → good cholesterol
LDL → bad cholesterol

Aerobic exercise ↑s the level of HDL

- oxidized LDL is more atherogenic b/c it accumulates in Macrophage

LDL Receptor → prt. on hepatic & Extrahepatic cells,

→ Identify B-100 & apoE

→ Taken by Endocytosis

→ Clathrin coating ⊕

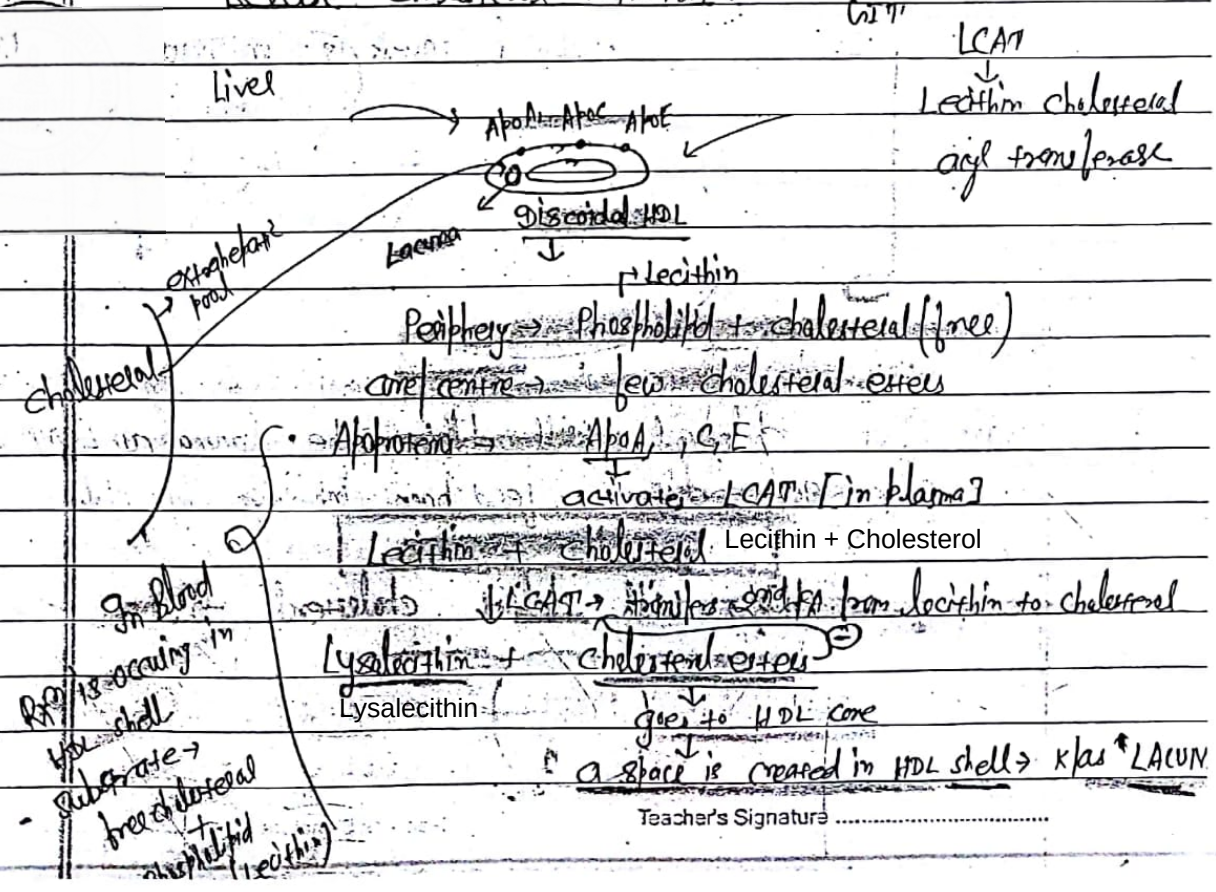
AIIMS ↑ cholesterol downregulates LDL Receptor

HDL METABOLISM

HDL → Removes extracholesterol from cells & gives it back to liver.
↳ Mostly synthesized in Liver.

Reverse cholesterol transport.

Reverse Cholesterol transport :-



Lecithin + Cholesterol

Lysalecithin

Teacher's Signature .....

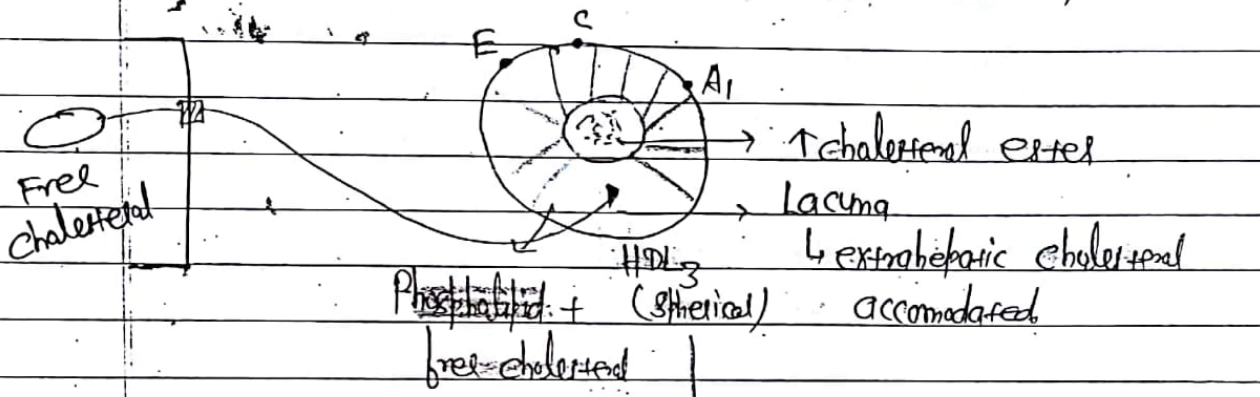
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

→ free cholesterol comes to lacuna & due to LCAT forms cholesterol ester
↳ goes to core

→ LACUNA → accomodates the free cholesterol coming from different cells (extrahepatic cells)

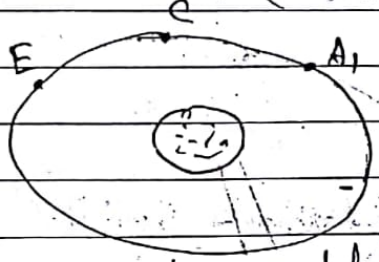
↓

Now discoidal HDL will become "spherical HDL"



↓

HDL_2 (Process is continous
↳ more chol. ester in core
∴ Big size



if HDL_2 is saturated ∵ cholesterol Ester increase, the last free cholesterol will block the lacuna as LCAT will no more act due to feed back inhibition by chol. ester

HDL_2 will deliver cholesterol to liver

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 61

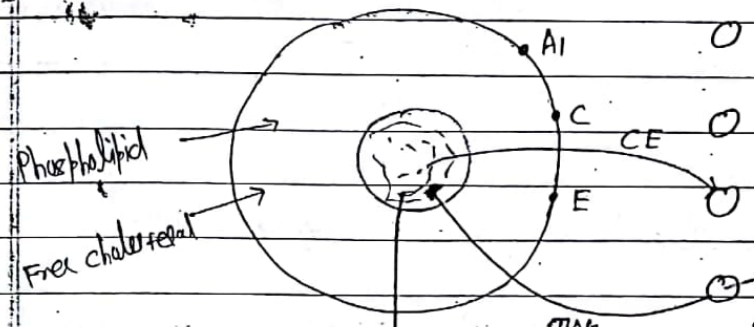
While going to liver, HDL2 encounters Remnants;

⇓

HDL gives → Some amount of cholesterol esters to Remnants & in Return Remnants transfers TAG to HDL.

⇓

This exchange of CE for TAG is mediated by CETP (Chol. Ester transfer protein)



Chol ester

↓

as chol ester ↓ in core

↓

LCAT becomes functional

↓

lacing created

↓

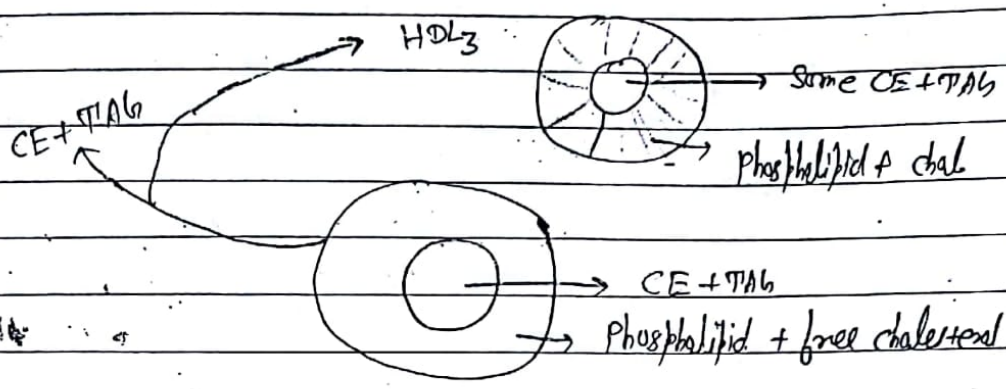
again free cholesterol comes to HDL2 from peripheral cell

again free cholesterol comes to HDL2 from peripharal cell

Function of CETP → To the Scavanging action of HDL Remnant particles help in Reverse cholesterol transport.

Teacher's Signature .....

In case of fast circulation no exchange is possible & HDL_2 reaches Liver.



→ Fate of HDL in Hepatocytes [Liver] :-

① Some amount of CE & TAG is taken by liver & Remaining HDL is send back to circulation in a smaller form known as "HDL_3".

↓

Converts to HDL_2 in plasma

↓

again it will reach liver

HDL_2 → HDL_3 in liver surface
HDL2 HDL3 in liver surface

HDL_3 → HDL_2 in plasma
HDL3 HDL2 in plasma

} HDL cycle

② Each & Every component of HDL will be tackled by hepatocytes except → ApoA1

↓

escape to circulation

↓

filtered in urine (max^n)

or

$ApoA_1$ becomes a component of pre-β HDL

↓

formed in plasma

Teacher's Signature ...

PreP HDL

- Dietary cholesterol is transported from Intestine to Liver → By Chylomicron – chylomicron Remnant system,
- From Liver cholesterol is incorporated into VLDL & is distributed to extrahepatic tissue through LDL

HDL transport cholesterol from extrahepatic tissues to liver

Pre β HDL → empty core

→ Shell → Phospholipid + free cholesterol

- Apo A_1

[Flat, Small structure]

- Apo C & E may be borrowed from mature HDL [2,3]
- very Raw form of HDL.

- due to presense of Apo A_1 → LCAT activity is also present

∴ cholesterol is again converted to cholesterol

Lacuna formed

little large in size → finally discoidal HDL is formed

Reverse cholesterol transport continues

- Only loss of HDL is loss of A_1 in the urine.
- HDL ∵ max^m Scavenging Capacity → Pre β HDL

core empty

Source of discoidal HDL → Liver, GIT, Pre β HDL

→ Transporters of cholesterol on extrahepatic cells →

- ABC – A_1 [ATP Binding Cassette]
- ABC – G_1
- SR – B_1 [Scavenger receptors]

give cholesterol to HDL$_3$ & discoidal HDL.

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Apo E → E_1 → Good ligand action
→ E_2 → Bad → Not easily recognized by Receptor
→ E_3 → Good

HDL → α-Lipoprotein

Date
Page 64

- SR-B, plays double role in HDL metabolism
  - ↳ (+)ve on Extrahepatic & hepatic cell

function is different on both cells.	gives free chol. from cell to HDL	gives chol-ester from HDL to hepatic cell

Q

Max^m TG →	Chylomicrons	Min^m lipid content & Max^m protein content → HDL.
Max^m exogenous TG →	"	* Largest Lipoprotein ⇒ Chylo-microns
Max^m endogenous TG →	VLDL	* Least density ⇒ Chylomicrons
Max^m cholesterol →	LDL	

NEET

Max^m Lipid content, Min^m protein content → Chylomicrons

HYPERLIPOPROTEINEMIAS

- also K/a "hyperlipidemias or dyslipidemias"
- Elevation of one or more lipoprotein in the plasma
- Fredericksons classification ↳

Type	Primary disease	Basic defect	Sr. Cholesterol	Sr. Triglyceride	Elevated lipoprotein
I	Familial Lipoprotein lipase deficiency	LPL deficiency	(N)	↑	Chylomicrons > VLDL
IIa	Familial Hypercholesterolemia	LDL-receptor Mutation / Apo B-100 Mutation	↑	(N)	LDL
IIb	IIa + Hyper-secretion of VLDL	Overproduction of apo-B	↑	↑	

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Type	Primary disease	Basic defect	Sr. cholesterol	Sr. Triglyceride	Elevated lipoprotein
III	Familial dys-β-lipoproteinemia / Broad β-disease / Remnant Removal disease	Abnormal Apo E → turn into (Apo E2) → Not easily detectable	↑	↑	VLDL Remnant, CM Remnant (IDL)
IV	Familial hypertriglyceridemia	Not known [a/w hyperinsulinemia (N); develop chronic Pancreatitis]	↑↑	—	VLDL
V	F. combined hyperlipoproteinemia	deficiency of apo C	(N)	—	CM & VLDL

F. hyperalphalipoproteinemia hyper → only ↑ lipoproteinemia; which are good for health. ↑ HDL

Hepatic lipase deficiency — HDL & TG rich VLDL remnant

Familial LCAT deficiency — HDL remains as Nascent discoidal

Familial Lipoprotein(a) excess — — Premature atherosclerosis

Teacher's Signature .....

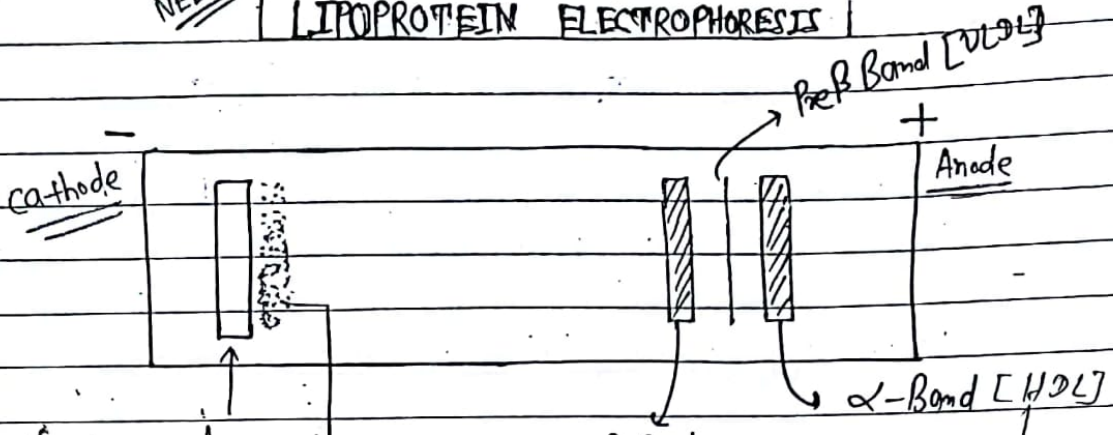
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

• LDL is Smaller than VLDL.

* Density of Lipoproteins in rising order → HDL > LDL > IDL > VLDL > Chylomicrons

NEET'16

LIPOPROTEIN ELECTROPHORESIS



γ-Region
[Chylomicron]
↓
Least moving
Least density

Farther mobility
↓
Maxm density

Criteria of motility → Charge : Mass Ratio

Higher Ratio → Higher mobility

HDL → α- Lipoprotein
LDL → β- Lipoprotein
VLDL → Pre-β Lipoprotein

• Lipoprotein (a) → (N) → 5 mg/dl
→ if level ↑ → premature atherosclerosis.
↳ it is LDL particle ± Apo(a)
↓
Similar to plasminogen

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Lipoprotein	Source of origin
Chylomicrons →	Intestine
Chylomicrons Remnants →	Chylomicrons
VLDL →	Liver
IDL, LDL →	VLDL

Date: Page: 67 (35)

Plasminogen —TPA→ Plasmin

Apo(a) ↓ fibrinolysis

↓

if apo(a) also present

↳ plasminogen

↳ Level of plasmin ↓ → Fibrinolysis ↓

↓

Small clots accumulate

↓

Atherosclerosis starts.

HYPOLIPOPROTEINEMIA

NEET'16

(1) Abetalipoproteinemia → Rare disorder due to defect in synthesis of apo B protein.

↓

Also "Bassen-Kornzweig Sy".

NEET'16

Caused by defect of Microsomal Triglyceride transfer protein

- Fat absorption is affected & the affected child presents with Steatorrhea.
- All fat soluble vitamin (A, D, E, K) affected. Vit. E deficiency presents as Retinitis Pigmentosa & Subacute combined degeneration.

No CM/VLDL/LDL

HDL → (N); only α-band seen; there is No β-Band

NEET'16

(2) Familial alpha-lipoprotein deficiency → Total or Near-total absence of HDL

↓

Also "Tangier disease"

Fish-eye disease

ApoA deficiency

↳ Caused by ATP Binding cassette transporter I (ABC-I)

Caused by "Partial" Lecithin cholesterol Acyl transferase (LCAT).

- Complete LCAT defect cause "Hemolytic Anemia & Renal failure.".

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

FATTY ACID OXIDATION

β-Oxidation	α-oxidation	ω-oxidation
↓	↓	↓
Lots of ATP Produced	No ATP	No ATP
↓	↓	↓
Acetyl CoA produced	CO_2 produced	CH_3 converted to COOH.
ω γ β α $CH_3-CH_2-CH_2-CH_2-COOH$ ↳ Last carbon	↓ α-oxidation	↓ Rarely seen in Brain Parenchymal cell & white fibre muscle
		↓
		Dicarboxylic acid produced
		↓
		Seen for medium chain fatty acid oxidation
		↓
		Max^m steps occur in Endoplasmic Reticulum.

"ω-carbon"

α-OXIDATION

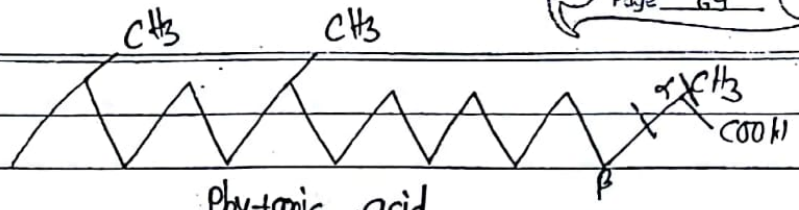
- Occurs in "Peroxisome"
- For oxidation of Branched chain fatty acids
  - ↓
  - eg → Phytanic acid
- Refsum's disease → accumulation of phytanic acid
  - ↓
  - defect of α-oxidation ⇒ which impaired β-oxidation of Phytanic acid.
  - ↓
  - Neurological disorder
- Source of Phytanic acid → Dairy products; cereals, plant food
  - Source ov Phytanic acid — Dairy products; — cereals, plant food
- Phytanic acid → high Mw, Branched chain fatty acids
  - Phytonic acid — high Mw, — Branched chain fatty acids

Teacher's Signature .....

Stearic Acid ⇒ 18-C

Date 25/2/18
Page 69

36



Phytanic acid

→ Major oxidation here also → β-oxidation but for removal of CH_3 on α-C, → α-oxidation occurs.

→ ATP is produced during Phytanic acid oxidation

→ Refsum's disease is due to defective α-oxidation enzyme [Phytanic acid α-hydroxylase] ; which impairs β-oxidation to proceed OR Phytanic acid α-oxidase

Brain & RBC doesn't utilize Fatty acid ⇐ [β-OXIDATION] → Mitochondria (majority)
→ Peroxisomes

β-oxidation occurs in DM & Starvation.

: lack of effective Insulin
↓
So, β-oxidation occurs
[Insulin prevents β-oxidation]
Prevents

TAG — Adipose cell

↓ Hormone sensitive lipase → active in phosphorylated form (⊕ in adipocytes)
Fatty acid (in Blood) ⊕
L Long chain fatty acid (eg Palmitic acid) · Glucagon · Epinephrine
Stored β-oxidation
enter diff cells if > normal
Mitochondria ↓ Fatty acid → Liver · activated form of FA
Mitochondrial Matrix ↓ Acyl CoA
CELL

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Synthetase – ATP req. → class VI enzyme

Synthase – ± ATP req → Any class.

Date
Page 70

FA is not permeable to outer or inner mito. membrane

↓

So, Shuttle Sys. required

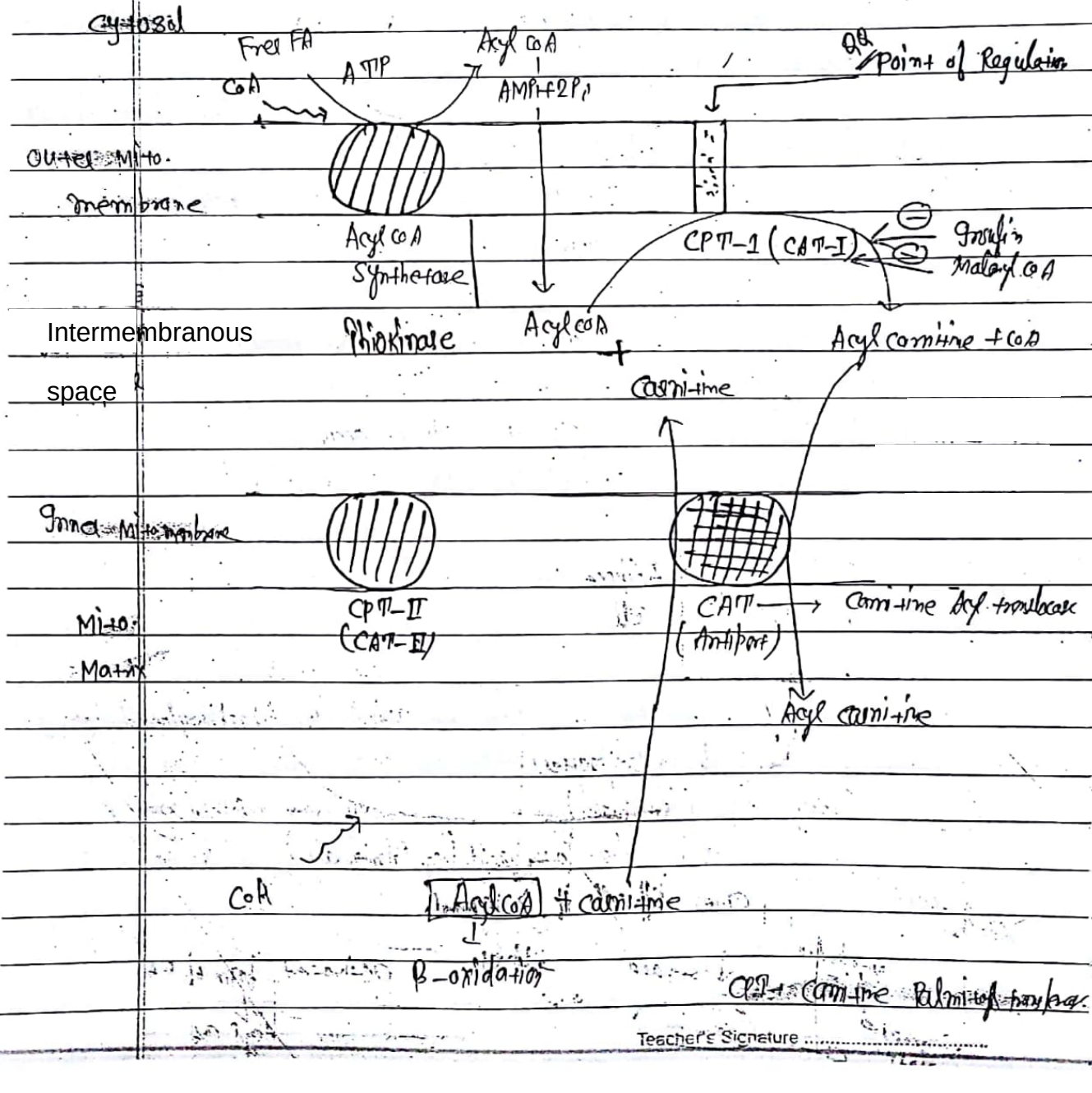
↓

Carnitine Shuttle

↓

transfer FA to mitochondrial matrix

CARNITINE SHUTTLE



Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

- In infants carnitine is not present, So, β-oxidation is affected - Baby may become hypoglycemic

→ • Point of Regulation → CPT-I

• Insulin inhibits (Blocks) → CPT-I

↓

due to formation of malonyl CoA → Block CPT-I

→ FA → if 16C → 7 cycles of β-oxidation

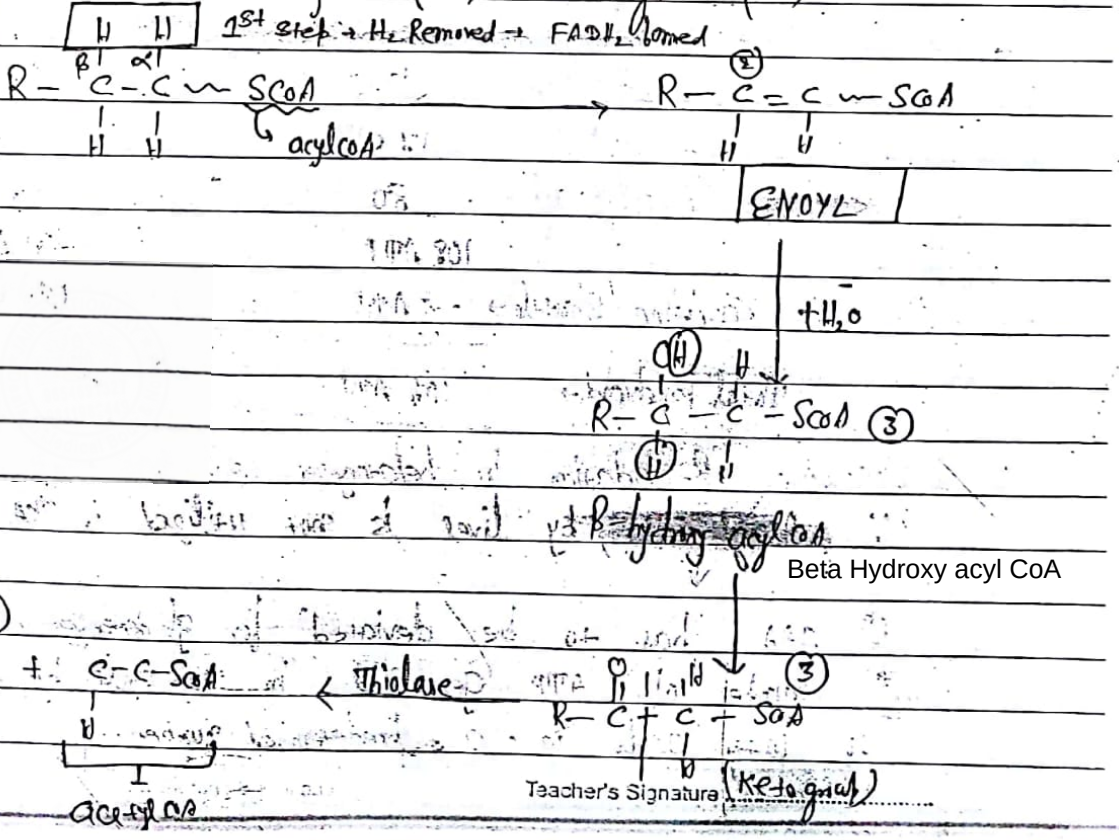
Acyl Co-A (16C)

1st cycle of β-oxidation

- Acyl CoA dehydrogenase [$FADH_2$] + Co enzyme → FAD (remove H⊕)
- Hydratase (Enoyl Co A Hydratase enzyme)
- β-hydroxy acyl co-A dehydrogenase [NADH] (Coenzyme = NAD)
- Thiolase

Acyl Co-A (14C) + Acetyl Co-A (2C)

1st step → H_2 Removed → $FADH_2$ formed



Teacher's Signature .....

Acyl CoA (14C) + Acetyl CoA (2C)

↳ $FADH_2$
↳ NADH
↳ H_2O

Acyl CoA (12C) + Acetyl CoA (2C)

⋮

Acetoacetyl CoA (4C)

↓

2 Acetyl CoA

No. of cycles = $\frac{\text{No. of C} - 2}{2}$

i) if 16C & zero double bond
= 7 $FADH_2$; 7 NADH & 8 Acetyl CoA

ii) if 16C & x No. of double bond ; Reduce x from 7 $FADH_2$.

eg → 20C → $\frac{20-2}{2}$ = 9 cycles

	New ATP	old calculation
→ 16C → 7 cycles		
7 $FADH_2$	10.5	14
7 NADH	17.5	21
8 Acetyl CoA	80	96
	108 ATP	131 ATP
Carnitine Shuttle →	−2 ATP	−2 ATP
Total produced →	106 ATP	129 ATP

Excessive β oxidation in hepatocytes will result in ketogenesis →
∵ Acetyl CoA ↓ by liver is not utilized in TCA cycle;

① OAA has to be deviated for gluconeogenesis

② Number of ATP generated in final cycle by acetyl CoA of fatty acids is a predetermined number

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 73

Ketogenesis

Liver mitochondria Matrix

Acyl CoA

Rhidak
↓
Reversible enzyme

(4C) Acetoacetyl CoA ⟷ Thiolase ⟷ Acetyl CoA ↑↑

HMG CoA synthase

Rate limiting enzyme

HMG CoA (6C)

HMG CoA Lyase

Acetoacetate (4C) + Acetyl CoA

1st Ketone body generated [Precursor of other KB]

if acetyl CoA ↑↑ ↓ then acetoacetyl CoA forms

Acetoacetate

β hydroxy butyrate dehydrogenase

CO_2

β-hydroxybutyrate

Acetone [irreversible & spontaneous process] ↓ No enzyme req.

β-hydroxybutyrate : Acetoacetate = 10:1

Predominant Ketone bodies in Ketosis

Volatile gas ↓ Exhaled, So, not present in plasma

↓

Lack of insulin is req.

eg. DM, Starvation

Utilization & synthesis of kB its require Mitrochondria

Synthesis of FA ----------> Cytoplasm

Utilization of FA ----------> Mitrochondria

Insulin inhibits both → both → β-oxidation, Ketogenesis

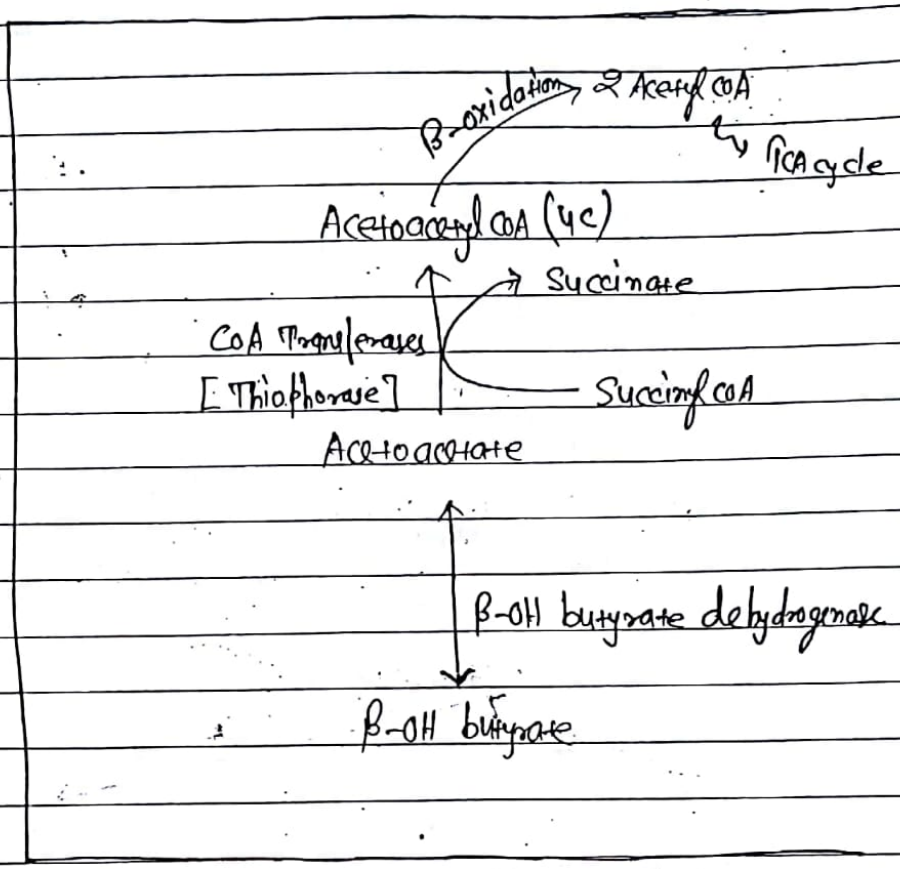
Insulin inhibits boths Teacher's Signature .....

* - Minm 48hr of Starvation Required if Ketogenesis is to takes place

Utilization of KBs :- in peripheral cell

↓

all cells can we except → RBC & liver



→ • Liver lacks Thiophorase enzyme
• RBC → No mitochondria
} So, can't utilize ketone bodies

So, can't utilize ketone bodies

→ only fuel for RBC → for energy → glucose

⇓

Lack of mitochondria → can't utilize KB & FA

→ FA can't utilized by → Brain & RBC

• Common enzyme for Ketogenesis & ketolysis

⇓

β-hydroxy butyrate dehydrogenase

Beta Hydroxy Butyrate dehydrogenase

Teacher's Signature

* Short chain Fatty Acid = 4-6 carbon
* Medium chain Fatty Acid = 8-14 carbon
* Long chain Fatty acid = 16-22 carbon
* Very Long chain fatty acid = ≥ 24 carbon

Date 75

Chain length (≥ 24 carbon)

Peroxisomal β-oxidation

- Seen only for ~~very long chain FA β-oxidation~~ very long chain FA Beta oxidation
  - ↓
  - Can't enter mito. matrix
- Similar cycle as that of mito. β-ox occurs in peroxisomes; occurs.
  - but complete oxidation is not taking place in peroxisomes.

End product → Octanoyl CoA (8C)

↓

will reach mito. matrix

↓

Complete β-oxidation occurs here.

ATTENTION!!

Less ATP production in each cycle as compare to Mitochondrial β oxidn.

Zellweger Syndrome / cerebro hepato Renal syndrome

↓ Also accumulated in Muscle

~~Very long chain fatty acid~~ are accumulated.

→ No. of peroxisomes are Nil or Normal

↓

~~Coat enzyme~~ without enzyme

i.e. ~~Empty peroxisome~~ empty peroxisome

~~or ghost peroxisome~~ or ghost peroxisome

b/c of $FADH_2$ → SOD → O_2^- → H_2O_2

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

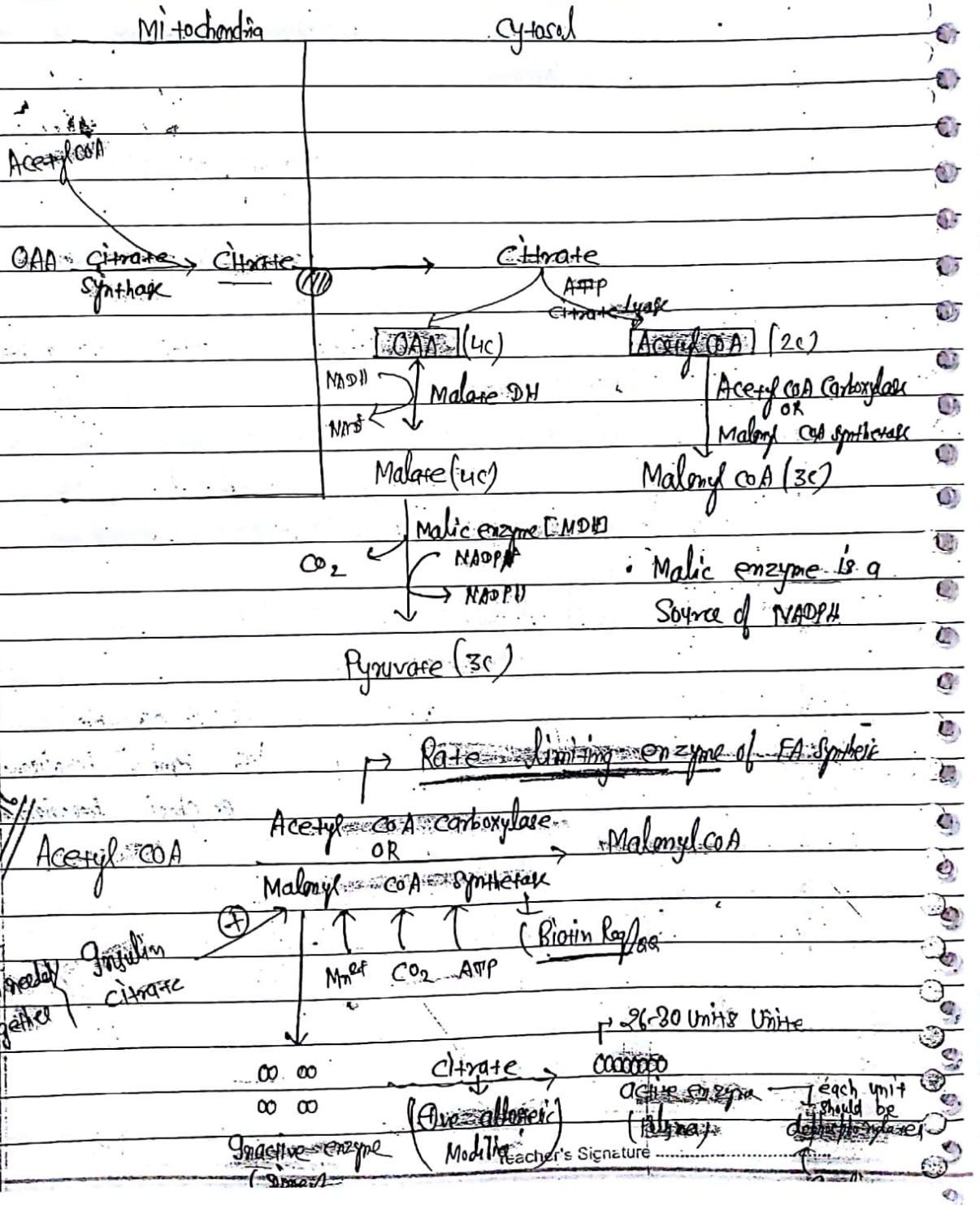
Liver & Lactating Mammary glands are the main organs for lipogenesis.

Date
Page 76

↑

Fatty Acid Biosynthesis → ~~cytosalic~~ Cytosalic

- Precursor → Acetyl CoA from glucose/Fructose
  ⊕ in mitochondria
- occurs in Hepatic & Extrahepatic cells.



Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

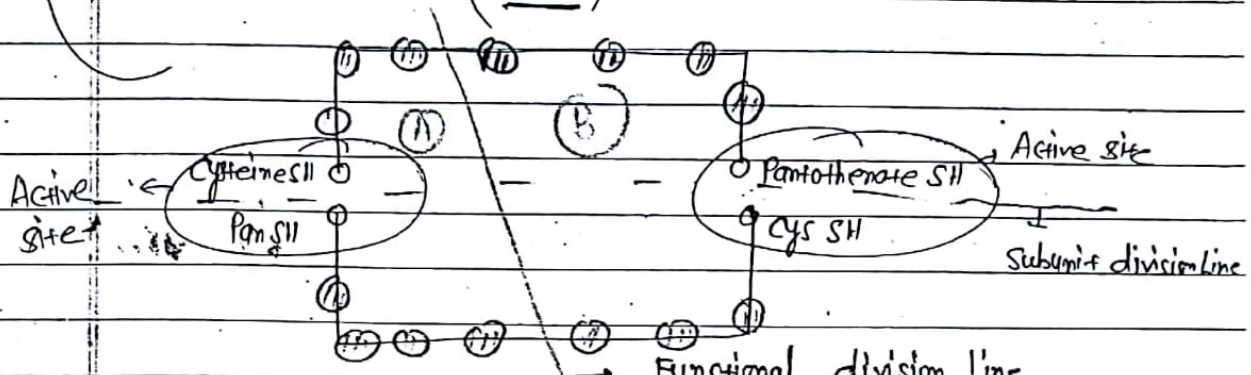
* There is No loss of enzyme Unit in this arrangement ; b/c there is 2 Product ② formed @ different sites.

Malonyl CoA

↓

Reaches FAS Complex [Fatty acid Synthase complex] ① in cytoplasm

(Dimer)

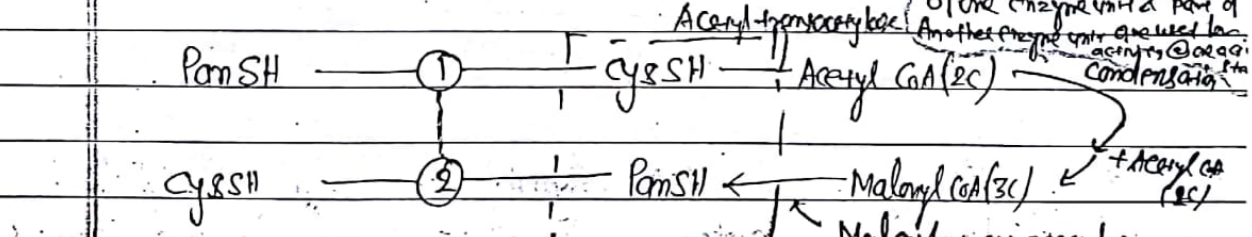


→ 2 enzyme of FAS complex present in Antiparallel fashion.

→ 2 cycles are going together on FAS → due to presence of 2 active sites.

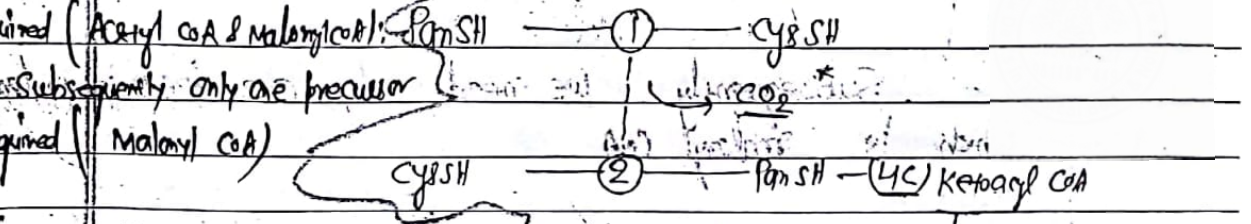
→ Never all the catalytic domains of one Polyketide is used for catalytic activity

→ In each unit of FAS → Catalytic activity ↓ Rather than of one enzyme unit 2 part of Another enzyme unit are used for activity @ condensation



1st cyclical Rxn differs from Subsequent cyclical Rxn ∵ ① Two Precursor are Required (Acetyl CoA & Malonyl CoA) but Subsequently only one precursor Required (Malonyl CoA)

Ketoacyl Synthase



② Gain of 1st cycle is 4-C Acyl chain; but Subsequently only two carbon is added on elongating FA chain

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Elongation of Pre-existing Fatty Acids →

Date
Page 78

(A) Microsomal (Endoplasmic Reticulum) → elongation of Palmitic acid into Longer chain FAs.

(B) Mitochondrial → elongation of short & Medium chain fatty acids containing fewer than 16 carbon atoms

↓ occurs in "Anaerobic cond^n"

Favoured by high NADH/NAD+ ratio in cells.

↓

PanSH — ① — cysSH

cysSH — ② — PanSH – acyl CoA (4C)

} Keto Removed

by help of the enzyme elongase & desaturase

PanSH — ① — cysSH – acyl CoA (4C) ← New cycle

↓ Malonyl CoA come

cysSH — ② — PanSH – Malonyl CoA (3C) → acyl displaced CoA to cys-SH

↓ Keto acyl synthase – adds acetyl CoA

Pan–SH — ① — cys SH

↳ CO_2

cys SH — ② — PanSH – Ketoacyl CoA (6C)

→ 1st cycle of FA Synthesis differs slightly from subsequent cycles, in the sense in first cycle we need two precursor molecules

a) Acetyl-CoA

b) Malonyl CoA

but Subsequently we need only one precursor molecule which is malonyl CoA

Mnemonic

PM
AC

Prime Minister travel in AC

PanSH ← PM → Malonyl CoA

acetyl CoA ← AC → cysSH

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 79

→ We get the final product at PanSH.

→ Mammalian cell can only form "Palmitoyl CoA (16C chain)"

→ [Fatty acid Synthase enzymes]

① Acetyl transacetylase;
② Malonyl transacetylase; } Part of enzyme MAT (Malonyl acetyl transferase)

③ Ketoacyl Synthase; (involved in condensation)
↳ decarboxylating enzyme

Removes the Keto group.

④ ~~Ketoacyl Reductase~~ (uses NADPH to convert Keto to Hydroxyl)

⑤ Hydratase enzyme (Remove water)
dehydration

⑥ Enoyl Reductase (Need NADPH & add H_2 to remove double bond

↓

We get Acyl CoA (4C)

⑦ Thioesterase
↳ to remove the final product [Palmitoyl CoA 16C] from Pantothenate site

Processive Enzymes

→ Those enzyme complexes which are involved in cyclical reaction and where the gain of previous cycle is not dissociated from the active site and enzyme complex along with the gain of previous cycle as such is going to enter in subsequent cycle

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Like Insulin; Somatomedin (Insulin-like growth factor) has antilipolytic effect.

Date
Page 80

Eg. → FAS Complex;
Glycogen Synthase;
DNA Polymerase;
RNA Polymerase;
Peptidyl transferase

FATTY LIVER

- Factors Causing Fatty liver :- Puromycin
Ethionine
CCl4
Chloroform
Phosphorus
Lead
Arsenic
Orotic acid
Protein deficiency
Vitamin deficiency
EFA deficiency
Alcohol.

- Lipotropic factors → Substance the deficiency of which Cause fat (Triacylglycerol) to accumulate in liver.
(Prevent fatty liver)

Eg → Choline; Inositol
Lecithine Betaine.
Methionine;
Vit E;
Cobalamin;
ω3 fatty acids
Vit B12;
Folic acid;

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Thiolase — Box, Ketogenesis } Mito
Chol. Synthesis → Cytoplasm

NEET Progesterone (Steroid Hormone) Requires HDL to Synthesized

Date Page 81

QA "Mg^{+2}" Require.

CHOLESTEROL SYNTHESIS → cytosolic

- Acetyl CoA (from glucose, Fatty acids)
  - Mitochondrial

* Double bond in cholesterol is found in "Ring B"

(Mito) | (cytosol)

Acetyl CoA
OAA → Citrate → Citrate

citrate transporter | Tricarboxylate transporter

ATP citrate Lyase

OAA + Acetyl CoA (2c) ← Acetyl CoA (2c)

Thiolase

Acetoacetyl CoA (4c)

HMG CoA Synthase

Activated in Dephosphorylated form ← HMG CoA (6c)

NADPH → NADP+

HMG CoA Reductase (Rate limiting enzyme)

Mevalonate (6c) → CO_2

Isoprenoid (5c) X2

Geranyl Pyrophosphate (10c)

Isoprenoid

Farnesyl Pyrophosphate (15c) X2

Squalene (30c)

Lanosterol (30c) → gst compound which gives ringed structure of cholesterol

Zymosterol (27c)

Desmosterol (27c)

Cholesterol (27c)

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

- Cholesterol is the Imp. precursor for Synthesis of → Steroid hormone; vit. D; Bile acids

NEET Pg Products of HMG CoA :⇒ • Cholesterol; • Heme A
• Bile Acids; • Prenylated protein
• Ubiquinone; • Ketone bodies
• Dolichol;

Progesterone, Estrogen, Acetic acid, Sage, 82, etc

HMG CoA Reductase → active in dephosphorylated form

(+) Insulin, Thyroid

(−) Glucagon, Glucocorticoids, Statins, Bile acids, Mevalonate, Cholesterol

BILE ACIDS

- Extra Cholesterol is converted to Bile Acid

Cholesterol —(7α hydroxylase, Rate limiting enzyme)→ 7-hydroxy cholesterol [Peroxisome of liver]

Multiple steps

Primary Bile acid → Chalic acid → Deconjugation & 7α dehydroxylation → Deoxycholic acid

Chenodeoxycholic acid → Lithocholic acid

Cause emulsification of lipids & breakage of large molecule into smaller

Terminal Ileum

Secondary Bile acid [due to Bacterial action]

Deoxycholic acid → absorbed in Enterohepatic circulation

Lithocholic acid → Non absorbable → excreted from GIT

Bile acids gets conjugated (in) cytosol of (glycine & Taurine) 3 : 1 while going to Gall Bladder

Glycochenodeoxycholic acid

Her's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

↑↑ Homocysteine → 1. associate ⊂ Thrombosis, coronary artery disease, stroke
2. Osteoporosis & #
3. Neuropsychiatric disease
4. Developmental delay

Date: Page: 83 (43)

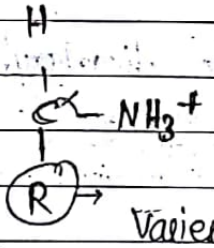
AMINO ACIDS ⇒ 20 Standard Amino Acids

→ They all a group of organic compounds containing two functional groups → Amino & Carboxyl.

Basic Acidic

→ 21st AA → Selenocysteine → coded by UGA (stop codon)
↓ L Modified serine (-OH Replaced by Selenium)
→ Structure similar to cysteine → Antioxidant
→ Present active site of - ① glutathione peroxidase
② Deiodinase;
③ Thioredoxin Reductase
④ Glycine Reductase

→ 22nd AA → Pyrrolysine → coded by UAG

→ 

Varies in diff AA
[-H or -CH₃] ⇒ 7

"It ↑es the flexibility of the protein" ⇐ glycine ⇒ Optically inactive (b/c of symmetric carbon)

→ Classification of AA ⇒ 1. Based on structure;
2. Based on side chain character;
3. Based on Metabolic fate
4. Based on Nutritional Requirements

Teacher's Signature

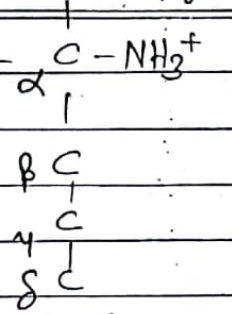
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Gamma Amino Butyric Acid (GABA) is formed by "Decarboxylation of L-glutamate".

Enzyme involved is "glutamate decarboxylase (GAD)

Pyridoxin dependent enzyme

Date
Page 84



1. BASED ON STRUCTURE

(A) ALIPHATIC AMINO ACIDS :-

1. Monoamino carboxylic acid :-

Simple → Glycine, Alanine;
Branched → Valine, Leucine, Isoleucine (VIL)
Hydroxyl → Serine (on β-c), Threonine (on γ-c)
Sulphur containing → Cysteine (on β-c), Methionine (on γ-c)
Amide group containing → Glutamine, Asparagine

Monoamino dicarboxylic acid

2. Monoamino dicarboxylic acid :-

Aspartic acid (COO⁻ α+β-c)
Glutamic acid (COO⁻ α+γ-c) ← Most Acidic

Dibasic monocarboxylic acid

3. Dibasic Monocarboxylic acid :- ∵ both have the Max^m buffering capacity at Physiological pH.

Arginine, Lysine, Histidine
↓ ↓
Most Basic Least Basic

Aromatic Amino acids

(B) AROMATIC AMINO ACIDS :- ∵ it AA absorbs Light (UV).

Phenylalanine, Tyrosine, Tryptophane, Histidine
∵ Max^m absorption of UV Light.

Heterocyclic amino acids

(C) HETEROCYCLIC AMINO ACIDS :-

Histidine, Tryptophan

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

→ Modified (Non-Standard) AA → Cystine; Hydroxyproline; Hydroxylysine, Desmosine & Selenocysteine.

Date: Page: 85

(D) IMINO AMINO ACIDS :→ Proline. (NH_2^+)

(E) DERIVED AMINO ACIDS :→ Hydroxyproline, citrulline, Homocysteine, hydroxylysine, ornithine

AMINO ACIDS	SPECIAL GROUP
Arginine (identifies "Guanidium")	Guanidinam-δ (α-atom)
Tryptophan	Indole-β
Histidine	Imidazole-β
Proline	Pyrrolidine-α
Tyrosine	Phenol-β
Phenylalanine	Benzene

"Sakaguchi test" is done for Arginine.

→ Function :→

1. Tyrosine — Catecholamine → Epinephrine, Norepinephrine, Dopamine
   - Thyroxine
   - Melanin
2. Tryptophan — Niacin
   - Melatonin, Serotonin
3. Arginine — NO
4. Glycine — Purines, Bile
5. Histidine — Best buffer at Physiological pH

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Absorption of light → By Aromatic AA (Maxm Tryptophan)
↓
→ Responsible for UV absorption in protein (250–290 nm)

Date 27/2
Page 86

2. BASED ON SIDE CHAIN CHARACTER

↳ Location → Lipid Bilayer (Transmembrane) QQ

(A) NON-POLAR :→ PPTTMILAV (HYDROPHOBIC) → When for on sulfate; polar in Nature

Phenylalanine; Proline; Tryptophan; Tyrosine; Methionine; Isoleucine; Leucine; Alanine; Valine.

↳ Methyl group

(B) POLAR :→ Hydrophilic (out/inside membrane)

Uncharged → Glycine, Serine, Threonine, Cysteine
↳ May be Non-polar

Acidic → Aspartic acid, glutamic acid

Basic → Histidine, Lysine, Arginine

3. BASED ON METABOLIC FATE

(A) Purely Ketogenic → * Leucine > Lysine

NEET 16'

Ketogenic & glucogenic → Phenylalanine
Isoleucine
Tyrosine
Tryptophan
(PITTy)

(C) Glucogenic AA :→ Rest 14 AA all purely glucogenic

QQ

Amino Acids		Keto acids
Glutamate	→	α-KG
Aspartate	→	OAA
Alanine	→	Pyruvate

Glutamate --> Alfa-KG

Aspartate ----> OAA

Alanine ---------> Pyruate

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Acetyl choline ⇒ Synthesized in the cytosol of Nerve terminal from Acetyl Co-A & choline.

Acetyl Co-A + choline $\xrightarrow[\text{acetyl transferase}]{\text{choline-O-}}$ Acetylcholine + CoA

↳ Not synthesized from Any AA.

Date Page 87

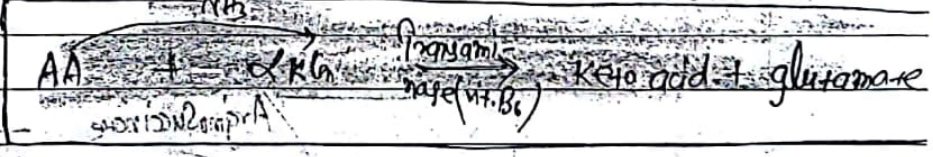
4. Based on Nutritional Requirement

Essential	Non-Essential	Semi essential
Tryptophan	Rest 10	Argenine
Valine		Histidine
Metheonine		(Non-essential in grown-up child)
Isoleucine		(essential in pregnant old age, sick etc.)
Leucine		
Argenine		
Phenylalanine		
Threonine		
Histidine		
Lysine		

TV [HMI] MILA PATH [M] Le [M]

{UREA CYCLE} | ornithine cycle | Kreb's Henseleit

- occuring in hepatocyte cycle
- Partly mitochondrial, Partly cytosolic
- Urea is formed in cytosol
- Mostly amino acids gives their Amino group to α-KG to form Keto acid & glutamate



* Two Mechanisms are available in human for the transport of NH_3 from Periphera tissue to Liver ⇒ ① Transport of Ammonia in form of Glutamine; by all tissues except ⇒ Muscle;

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

- Carbamoyl group of carbamoyl phosphate synthase is derived from "NH_4^+ & HCO_3^- ion."

* AA degradation ⇒ occurs in Reticuloendothelial cells

AA + αKG ⟶ Ketoacid + Glutamate

Glutamate ⟵ (Glutamine Synthetase, ATP, ADP, $+NH_3$) Glutamine

Major donor of NH_3 in Mitochondria of Liver.

Glutamine ⟵ (Glutaminase) NH_3 + Glutamate

Glutamate ⟵ (Glutamate dehydrogenase, NADH, CO_2) Glutamate ⟶ αKG + NH_3

Both Rxn ⟶ Oxidative deamination ⟶ delivery of NH_3

Liver ⟵ Mitochondria

Brain is a Rich Source of Glutamine Synthetase & predominantly detoxifies NH_3 by Synthesis of Glutamine.

Mitochondria of hepatocytes: $NH_3 + CO_2$ (2 ATP → 2 ADP) ⟶ CPS-I (Carbamoyl phosphate Synthase) ⟶ Carbamoyl phosphate

CPS-I: Rate limiting enzyme; allosterically activated by "N-Acetyl glutamate".

Carbamoyl phosphate + Ornithine ⟶ (Ornithine transcarbamylase) ⟶ Citrulline

Ornithine ⟵ (Ornithine carbamoyl transferase) ⟵ Ornithine transported (Antiport) ⟵ cytosol of hepatocytes

Neither prt. in tissue proteins nor in blood; but it is prt. in Milk.

Citrulline ⟶ Ornithine transported

Citrulline + Aspartate ⟶ (ATP ⟶ AMP + PPi; Argininosuccinate Synthetase) ⟶ Argininosuccinate

Argininosuccinate ⟶ (Argininosuccinate lyase) ⟶ Arginine + fumarate (⟶ goes to TCA cycle)

Arginine ⟶ (Arginase, H_2O) ⟶ Urea + Ornithine

Urea: $O=C(NH_2)_2$; one NH_2 from NH_4^+, other NH_2 from Aspartate

* CPS-I → cytosolic enzyme involved in urea cycle.

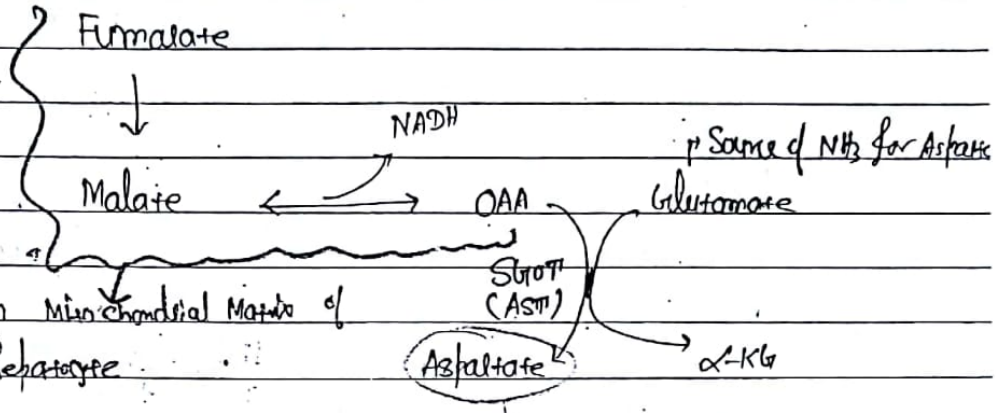
Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Aspartate —(Glutamine, ATP; AMP + PPi; Glutamate)→ Asparagine

Date
Page 89

→ Total 4 high energy phosphate is released here.



again enter urea cycle.

→ Few Reaction of TCA cycle is also required for Urea cycle.

$NH_2-CO-NH_2$

→ Urea → 2 ammonia required
1→ from glutamate → (free NH_3)
2→ combined c aspartate → (Bound NH_3)

∴ Source of Nitrogen in Urea → Aspartate
Ammonia.

Source of 1st Carbon in Urea → CO_2.

UREA CYCLE DISORDER

Hyperammonemia → Lethargy; Nausea; Vomiting.

① Carbamoyl phosphate Synthase I → Hyperammonemia type I

② Ornithine transporter → HHH Syndrome NEET
– Hyperammonemia, hyperornithinemia, Homocitrullinemia

HHH Syndrome

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Phenylalanine type I/II/III ⇒ d/t deficiency of Phenylalanine hydroxylase
Phenylalanine type IV ⇒ d/t deficiency of BH4 Reductase
Phenyl ketonuria type V ⇒ d/t deficiency of BH4 Synthase

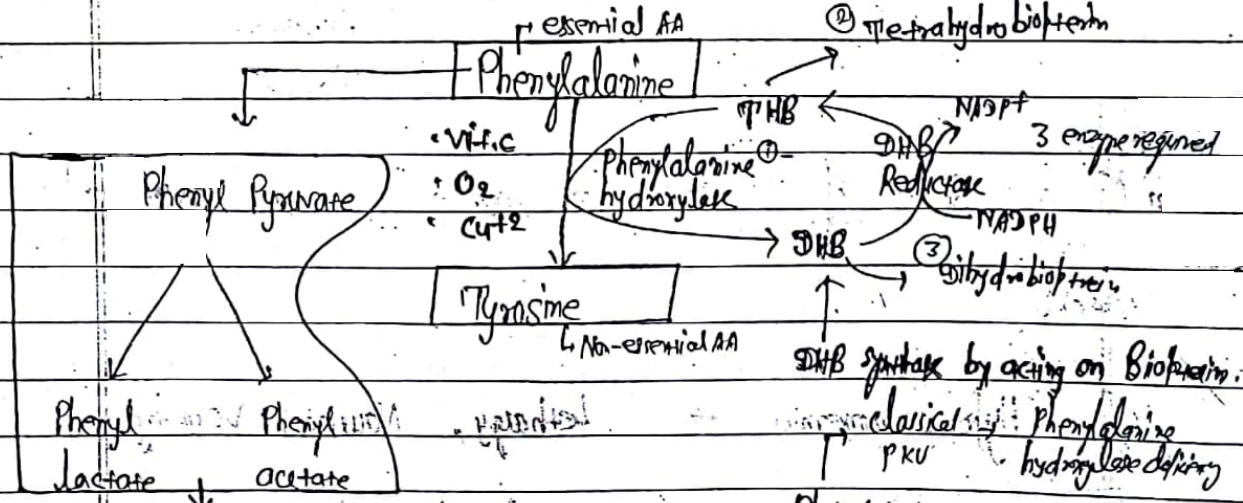
③ Ornithine transcarbamoylase → Hyperammonemia type II (less toxic than type I)
→ Orotic aciduria (X-linked)

④ Argino Succinate Synthase → Citrullinemia

⑤ Argino Succinase / Argino Succinate Lyase → Argino Succinic aciduria
associated with "friable & tufted hair"
Also "Trichorrhexis Nodosa"

⑥ Arginase → Hyperargininemia
Autosomal Recessive disease
b/c Arginine Reabsorbed ← ↑ Lysine, cystine in urine
Arginine high in Blood
ⓐ DCT by exchange of Lysine & cystine.
→ Which AA is regenerated in Urea cycle → Ornithine!

CONVERSION OF PHENYLALANINE TO TYROSINE



Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date: Page 91

1° Bile acid → cholic acid, chenodeoxycholic acid

2° Bile acid → deoxycholic; Lithocholic acid

THB ⇒ donor of H in → ① PKU → Tyrosine

② Serotonin synthesis ② Catecholamine synthesis

→ Atypical PKU → due to deficiency of "dihydrobiopterin Reductase"

→ Screening of PKU → Guthrie test (bacterial inhibition assay);

Fecl3 test (Urine) → green (+)

TYROSINE

Melanin · Catecholamine · T_3, T_4 · Tyramine

→ Cu^{2+} deficiency → will lead to melanin deficiency ⇒ Flag hair

Melanin Synthesis → Tyrosine

↓ Rate Limiting enzyme for Melanin Synthesis

Tyrosinase* → Cu^{2+} containing enzyme

NEET'16 QQ

Albinism

↓

Tyrosinase deficiency (Mutation of the gene of Tyrosinase)

DOPA (dihydroxyphenyl alanine)

↓ Tyrosinase

QQ Leucoderma (vitiligo)

⇓

Antibodies against Melanoblast

Patchy loss of Pigment

Dopaquinone

↓

Menaquinone

↓

Indole-quinone

↓

Melanin (pigment)

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

→ creatine & creatinine → Synthesis from Glycine, Arginine, Methionine

↑ VMA in Urine → Pheochromocytoma

Date
Page 92

Catecholamine Synthesis →

Tyrosine
↳ RLE (Rate Limiting enzyme)
↓ Tyrosine hydroxylase
DOPA
↓ Dopa carboxylase
Dopamine
↓ Dopamine β-hydroxylase
Norepinephrine
↓ N-methyl transferase
Epinephrine
↓
Metanephrine
↓
Catecholamine

excreted in urine ← 1-6 mg/24hr ← VMA (vanillyl mandelic acid) ← DHB

Methyl Donor
SAM → S-adenosyl methionine
SAH → S-Adenosyl homocysteine

Tyrosine catabolism

Tyrosine
↓ αKG / Glutamate — Tyrosine transaminase (X) Tyrosinemia II (Richer Hanhart Syndrome) NEET'16
Parahydroxy phenyl pyruvate
↓ O2 / CO2 — Hydroxylase, Decarboxylase (X) Tyrosinemia III / Neonatal tyrosinemia
2,5 - dihydroxy phenyl acetic acid (Homogentisic acid)
↓

Richer Hanbort syndrome

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

OCHRONOSIS → the end in which alkapton deposition occurs in connective tissue, bones & various organs (Nose, ear etc.)

Date
Page 93

(48)

↓ Homogentisic acid (X) Alkaptonuria
oxidase ↳ Black urine on standing

Maleyl acetoacetic acid

· associated ε "OCHRONOSIS"

↕ Isomerase

Fumaryl acetoacetic acid

↙ Hydrolase (X) NEETIL Tyrosinemia I → cabbage odour Urine
Fumarylacetoacetate hydrolase Q(NEET 18)
Fumylacetoacetate hydroylase

Fumaric acid → Glucose

Acetoacetic acid → Keeme body

By Producing "Alanine" By Producing "Acetyl Co-A"

Go mg tryptophan → 1mg Niacin [TRYPTOPHAN] both glucogenic & ketogenic

→ first identified essential AA.

→ Precursor for the Synthesis of important compounds like NAD+, NADP, Serotonin, Melatonin.

Tryptophan

THB ↘ Tryptophan hydroxylase
BHB ↙

5-Hydroxy tryptophan

↓ Decarboxylase

5-hydroxy indoleacetic acid (HIAA) ← 5-hydroxy tryptamine [Serotonin]

↓ Plasma / Urine

↑ in carcinoid syndrome

↳ Argentaffin cell Malignancy

↓ Acetyl transferase

Acetyl serotonin

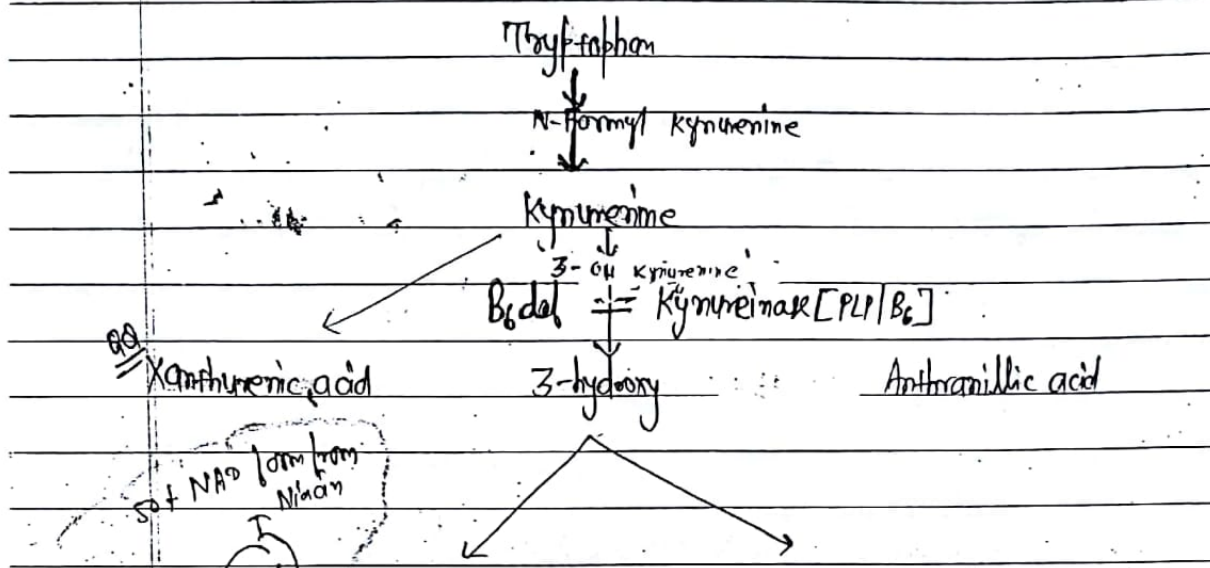
↓ Methyl transferase

Melatonin → Pineal gland hormone

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

→ NAD+ Pathway | Kynurenine Pathway or Major metabolic pathway of tryptophan ⟶
It is a catabolic pathway



50% NAD form from Niacin

50% → NAD+ (3%) | Ketone body (97%)

Rest 50% from Tryptophan (B6)

Niacin (Vit. B3) ⇒ B6 deficiency → ↑ Kynurenine → ↑ 3-OH Kynurenine

B6 Pellegra ⇒ deficiency of B6 → Xanthurenic acid excreted in urine
that have Pellegra like Manifestation (B6 def. Index)

Tryptophan Load test → done to find out latent B6 deficiency

Hartnup disease → Tryptophan metabolic defect

Hartnup disease

Tryptophane metabolic defect

* Pellegra ⇒ Vit. B3 deficiency

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Taurine is biosynthesized by "cysteine".

AA Secreted in cystinuria are → C → Cystine, O → ornithine, L → Lysine, A → Arginine

Date: Page: 95

METHIONINE

Sulphur containing essential AA.

Features of Homocystinuria:
- Downward subluxation of Lens
- Aortic Aneurysm
- Skeletal deformities
- Arachnodactyly

B12 supplement ↑ T/t

Homocysteinuria type II

Methionine → (ATP → PPi + Pi (Adenosine left)) → S-adenosylmethionine (SAM)

Homocysteine / Methionine methyltransferase / synthase (B12 dependent)

SAM + Acceptor → Methylated product + S-adenosylhomocysteine (SAH)

N^5-Methyl THF + B12 → THF + CH_3-B12

Homocysteine → Methionine

↑ Homocysteine also ∥ Atherosclerosis & cognitive distortion

Homocysteine + Serine → (cystathionine β-synthase [PLP/B6]) → Cystathionine

Typical / classical homocystinuria ⇑ Homocysteinuria type I

R_x → B6 supplement: cysteine becomes essential AA; bk Nw formed

Cystathionine → (cystathionase [PLP/B6]) → cystathionuria

"Methionine & cysteine" both required for proper wound Healing".

NEET'16 • Molecular Mimicry is established in presence of "cysteine : Arginine or Lysine".

Cystathionine → Cysteine + Homoserine

Cysteine → Serine → Methionine

Cysteine -> serine -> Methionine

Cysteine → dimer of cysteine (disulfide bond b/w two cysteine Molecules)

Folate trap → due to B12 deficiency

N_5 Methyl THF → THF

So, folate trapped in N_5 methyl THF (i.e methylated) form.

β-Alanine → End product of cysteine.

Beta Alanine -> End product of cysteine

Teacher's Signature .....

Conversion of Glycine to Serine →

Glycine + THF $\xrightarrow[\text{PLP}]{\text{Serine hydroxymethyl transferase,}}$ Serine + N^5, N^{10} Methylene THF + H_2O

Date
Page 96

dUMP $\xrightarrow{\text{Thymidylate Synthase}}$ TMP → DNA

N^5N^{10} Methylene THF → DHFA

This enzyme requires N^5N^{10} methyl THF

↓

Not formed in folate trap

↓

∴ DNA Synthesis hampered due to Inhibition of above reaction

↓

Cell enlarges but No nuclear division

↓

Megaloblastic Anaemia

NEET'16

BRANCHED CHAIN AA

Leucine	Valine	Isoleucine
	Transaminase (Bifunctional)	
↓	↓	↓
α-Keto acid	α-Keto acid	α-Keto acid
Branched chain α-keto acid dehydrogenase complex (3 enzyme; 5 co-enzymes)	(Oxidative decarboxylation)	
↓	↓	↓
Isovaleryl CoA	Isobutyryl CoA	α-methyl butyryl CoA
↓	↓	↓
Isovaleryl CoA Dehydrogenase	Isobutyryl CoA Dehydrogenase	α-methyl Butyryl CoA dehydrogenase
↓	↓	↓
X	Y	Z
↓	↓	↓
Acetyl CoA + Acetoacetyl CoA	Propionyl CoA	Acetyl CoA + Propionyl

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Maple Syrup urine disease (MSUD) → Branched chain Ketonuria ⇒

- deficiency of Branched chain α keto acid decarboxylase complex

↓

Result in Branched chain ketonuria

↓

excretion of α keto acids in Urine

- Urine odour → Burnt Sugar / Maple Syrup.

Isovaleric acidemia → deficiency of Isovaleryl CoA dehydrogenase

↓

Sweaty feet odour · Leucine catabolism defect

- Urine odour → Cheesy odour (Isovaleric aciduria)

↳ Isovaleric Acidiuria

→ order of Rxn → Transamination

↓

Oxidative decarboxylation

↓

Dehydrogenation

HISTIDINE

Histidine catabolism → Histidine

↳ Benign Histidinemia → Histidinase

↓

Urocanic acid

↓

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

CENTRIOLES

Histidine —(Histidine Decarboxylase; PLP; CO_2)→ Histamine

Date
Page 98

Urocanic aciduria ← (Urocanase) Urocanase

Imidazolone Propionic acid

4-imidazolone 5-Propionase (H_2O)

FIGLU (Formimino-glutamic acid)

THF

Folic Acid deficiency → N^5-Formimino-THF

Glutamic acid

∴ FIGLU in Urine → def. of folic acid

· Histidine load test → to find out latent folic acid deficiency

→ Urinary odours in Biochemical Disorder :-

	Inborn error of metabolism	Urine odour
1.	Multiple carboxylase deficiency	Tomcat Urine
2.	Phenylketonuria	Musty & Mouse like
3.	Tyrosinemia	Cabbage like; Musty
4.	Hypermethioninemia	Boiled cabbage; Rancid butter
5.	Trimethylaminuria	Rotting fish
6.	Hartnup disease (Methionine Malabsorption)	Sweat (Cooked malt)
7.	Maple Syrup Urine Disease	Maple syrup, Burnt Sugar
8.	Glutaricacidemia (type III)	Sweaty feet, acrid
9.	Isovaleric acidemia	Sweaty feet, acrid
10.	Hawkinsinuria	Swimming Pool

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Edman's Reagent → Phenyl isothiocyanate
Sanger's Reagent → 1-Fluoro-2,4-dinitrobenzene

Date 29/8
Page 99

STRUCTURE OF PROTEIN

1° → Covalent Peptide bond
2° → Hydrogen bond

α-Helix → M/c 2° structure
↳ R-handed helix → more stable (M/c)

Proline → Glycine → Never form α-Helix
↳ disrupt α-helix.

P-pleated → glycine → M/c Amino acid to kink

A tight curled or twist.

3° → Polypeptide chain → weak Non-covalent interaction

4° → Polymer of polypeptide chain
eg → Immunoglobulin
Protein structure

Simple Protein:
- Fibrous Protein → Collagen, Keratin, Myosin, Elastine
  Keratin contains Histidine, Lysine, Arginine in 1:4:12 Ratio.
- Globular Protein → Albumin, Globulin, Glutelin, Prolamine, Histone, Lectin, Protamine, Globin

Conjugated Protein → Nucleoprotein, Lipoprotein, Phosphoprotein, Chromoprotein, Metalloprotein, Glycoprotein

Derived Protein → egg white (coagulated albumin), Proteans, Metaproteins, Proteoses, Peptones, Polypeptides, Peptides

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Ultra centrifugation } → Base of size
Ultra-filtration

Date 28/2
Page 100

→ Loss of 2°, 3°, 4° structure of Protein.

Agent: Urea or Guanidine chloride → Denaturation → Loss of Biological function of Protein.

↓ Irreversible ; Peptide bond (covalent bond) remains Intact.

→ Chromatography → ① Gel filtration → Based on size.
↳ Mass movement by diffusion.

② Ion exchange → Based on charge

→ Electrophoresis → Based on charge & M_w
↳ M/c method of Protein separation.

PAGE (Polyacrylamide gel electrophoresis)
↳ Based on Mol. size & Mol. charge

SDS - PAGE ← Sodium dodecyl sulfate
↳ for M_w determination

Protein gradient created by → Ampholyte

Cystine → formed by disulfide bond b/w two cysteine

→ Cysteine & cystine formed from → Methionine
→ Serine

→ Glycine → Glycine —THFA, PLP→ Serine
↳ Synthesis of Heme, Purine Ring, bile acid conjugation.

→ Serine → Cysteine & Selenocysteine formation

Carnitine → from Lysine & Methionine

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

- Ninhydrin Test → all α-Amino acids.
- Xanthoproteic Rxn → Aromatic amino acids;
- Millan's Test → Tyrosine (Phenol gp. of Tyrosine);
- Aldehyde test → Tryptophan;
- Biuret's test → Peptide bond;
- Diazo Rxn → Histidine & Tyrosine

(conc. Nitric oxide used.)

Keratin → Histidine + Lysine + Arginine (HLA)
1 : 4 : 12

- Alanine → from Pyruvate
- Aspartate → from OAA.
- Glutamate → from αKG

NEET'16
Proline → from αKG

→ Smallest functional unit of genome → gene

Smallest unit of genetic expression → cistrone

Nucleotide & its metabolism

Nucleotide
- N_2 Base
- Pentose Sugar
  - Ribose
  - Deoxyribose
- Phosphate (one/two/three)

Nucleoside → Nucleotide − $P_{o_4}^{-2}$

N_2 Base

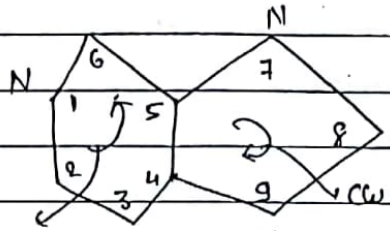
N2 Base

- Purine Base
  - Adenine
  - Guanine & more old.
  - ↓
  - double cyclic structure
- Pyrimidine Base
  - Cytosine
  - Thymine
  - Uracil
  - ↓
  - Single cyclic structure

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Purine Base

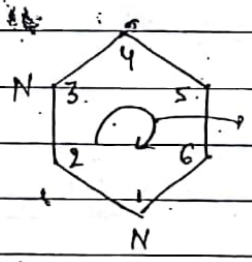


N → at 1,3,7,9 position.

cw in the 2nd Ring

Acw in the 1st Ring.

Pyramidine Base



N → at 1,3 position

clockwise

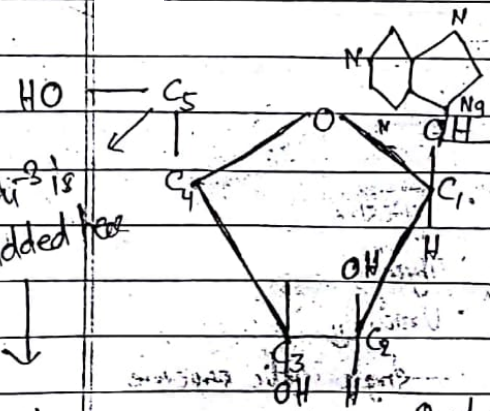
Adenine → 6 amino purine

Guanine → 2 amino, 6 oxy purine

Cytosine → 2 oxy, 4 amino Pyrimidine

Thymine → 2,4-dioxy 5 methyl pyrimidine

Uracil → 2,4- dioxy pyrimidine



NEET '16

β-N glycosidic bond

↓

b/w sugar & base

pair is added here

↓

Glycosidation

Ribose $\xrightarrow[\text{at } C_2]{O_2 \text{ absent}}$ deoxyribose

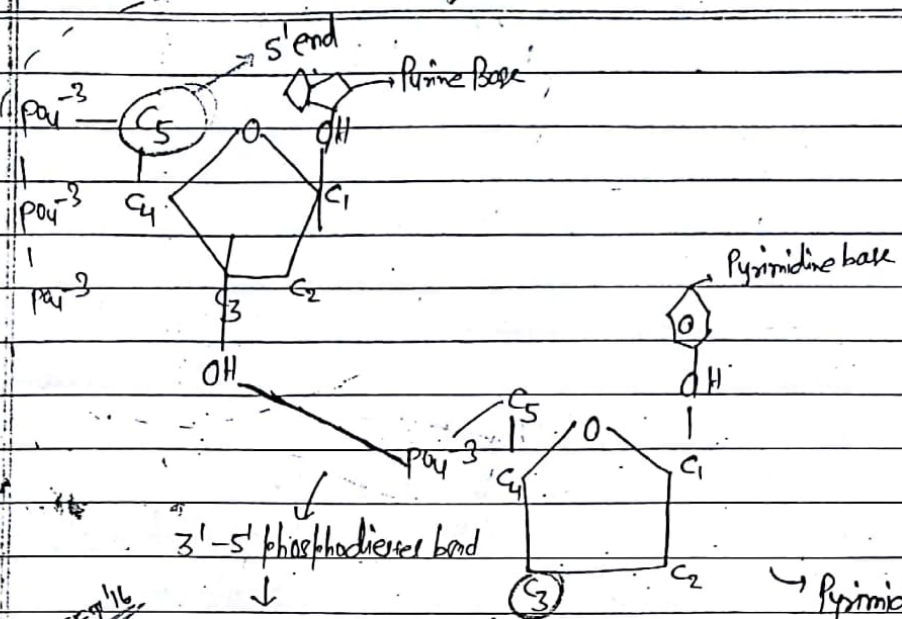
Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

M|C → B-DNA → Rt. handed

Date Page 103

→ Purine Nucleotide



→ Pyrimidine Nucleotide

NEET '16

b/w 2 Nucleotides (Purine & Pyrimidine)

free end is called → Prime end

∴ Direction of phosphodiester bond is 3'-5'

3' → Hydroxyl

5' → PO_4^{-3} end

NUCLEOTIDE METABOLISM

→ Purine Nucleotide

Synthesis

Glycine → C_4, C_5, N_7 (all)

Aspartate → N_1

Glutamine → N_3 & N_9 (1st give N_9 & then give N_3)

THF derivatives → C_2 & C_8

N^{10}-Formyl THF

N^5-N^{10} Methenyl THF

CO_2 → C_6

Major Pathway

→ Denovo

→ Salvage pathway

Breakdown

Recycling of bases to form purine

"PRPP glutamyl amidotransferase" is one of the rate limiting enzyme in denovo synthesis of purines.

Denovo synthesis is most active in Liver.

"Liver" → Major site of Purine Nucleotide biosynthesis (De Novo).

Brain, erythrocytes & PMNL can't synthesize Purine Nucleotides by denovo pathway. ; Salvage pathway synthesize Purine bases.

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

PRPP → Phosphoribosyl Pyrophosphate

Salvage → Property saved from loss.

Date
Page 104

Salvage Pathway (Rare)

The Purine can be directly converted to the corresponding nucleotides.

→ Source of Purine → Diet (1°)
DNA, RNA breakdown (2°)

Phosphoribosyl-5-Par
↓ PRPP Synthetase

Adenine + PRPP → (Adenine Phosphoribosyl transferase) → AMP

Diet

Guanine + PRPP → (HGPRT) → GMP

Purine catabolism → Hypoxanthine + PRPP → (HGPRT) → IMP

HGPRT → Hypoxanthine guanine phosphoribosyl transferase
↳ Bi-functional enzyme.

Salvage is significant in → RBC, Brain.

Deficiency of HGPRT → Lesch-Nyhan Syndrome

Catabolism of Purine

Lesch-Nyhan Syndrome → complete deficiency of HGPRT.
- Sex-linked metabolic disorder
- Structural gene for HGPRT is located on X chromosome
- affects only the male
- CF → overexcretion of uric acid production ← gout
- Neurological manifestation (Mental Retardation, Aggressive behaviour, Self Mutilation)

Teacher's Signature

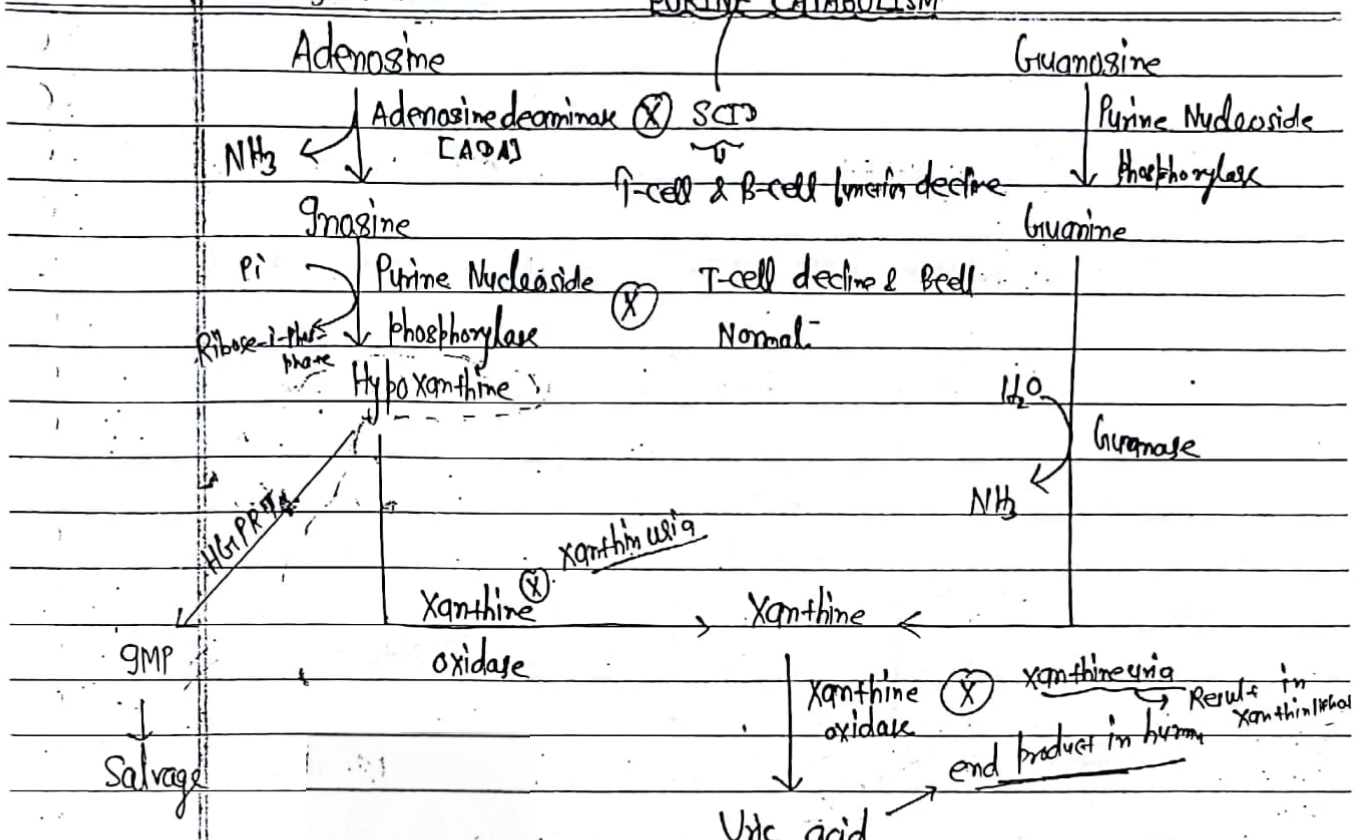
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date 105

- Allopurinol ⇔ Hypoxanthine Analogue.
- Purine is structural component of Coenzyme A, NAD+, NADP+ & FAD+.

Severe combined immunodeficiency

PURINE CATABOLISM



Kelley–Seegmiller Syndrome → Partial deficiency of HGPRT.

No self mutilation

Only feature → Hyperuricemia

- Most of the dietary purines are converted to uric acid in the "intestinal mucosal cell only". Intestinal bacterial flora is involved in degradation of the rest of the dietary purines that remain absorbed.

* De Novo Pathway of Purine synthesis → Ribose 5-P (+)

Occurs in Liver

ATP, AMP ← PRPP synthase | Rate limiting enzyme | committed step

PRPP

AMP ← 1st nucleotide to be formed ← Glutamine, Glutamate ← PRPP Glutamyl Amido transferase (+)

5-Phospho-D-Ribosylamine ..... IMP

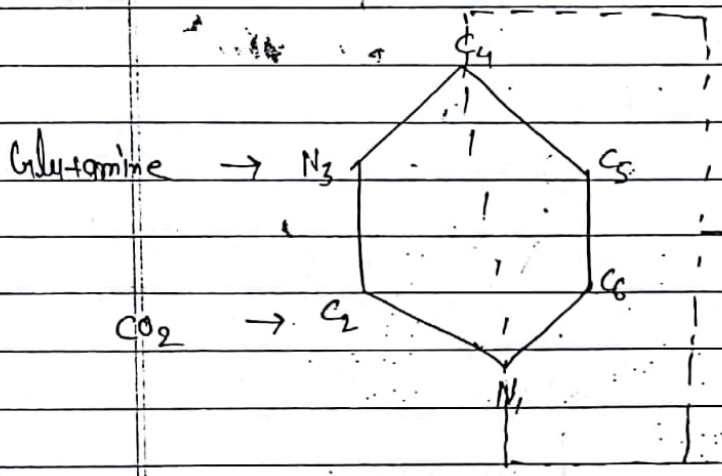
AMP

Pyrimidine Nucleotide

→ Main Synthesis is by denovo (also in Brain, RBC)

→ Salvage is very Rare (also absent in diet)

→ Precursor molecule → CO_2 & glutamine *



Denovo Synthesis → Resembles Urea cycle

CO_2 + Glutamine

UTP (−)

PRPP (+)

CPS-II

Carbamoyl phosphate

CTP (−) ATP (+)

Aspartate transcarbamoylase [ATC]

Carbamoyl aspartic acid

Dihydro-orotase

Dihydroorotic acid [DHOA]

Dehydrogenase

Orotic acid

Regulation of Pyrimidine Nucleotide Synthesis :

(A) Carbamoyl phosphate Synthase-II

(B) Aspartate transcarbamoylase
- In Prokaryote: Aspartate
- Eukaryote (in)

Hijick in examination

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Same in Biochemical Catalysis of Rxn

Substrate Same

Rest all different

Date
Page 107

Orotate phosphoribosyl transferase

PRPP

OMP (Orotidine monophosphate)

Part of UMP Synthase → Bifunctional enzyme

CO_2 ← Orotidylate decarboxylase

UMP → Common Precursor for Pyrimidine

Reductase

UTP

Amino-transferase

CTP

N^5, N^{10}-Methylene dUMP

H_4 folate

H_2 folate

Thymidylate Synthetase

TMP

Orotic Aciduria

Type I

deficiency of orotate phosphoribosyl transferase

+

deficiency of orotidylate decarboxylase

Type II

deficiency of only orotidylate decarboxylase

Deficiency of folate or vit B_{12} can cause hematological changes similar to Orotic aciduria

Catabolism of Pyrimidine

dUMP

CMP

TMP

Water soluble

β-alanine + CO_2 + NH_3

β-amino isobutyrate + CO_2 + NH_3 NEET'16

So, no associated disease as ever in their excess they are excreted

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Mitochondrial DNA

1% of total cellular DNA lies in Mitochondria

Consist of 2-10 copies of Small circular DNA.

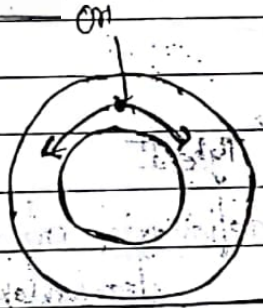
mt DNA codes for 13 protein that play a key role in Respiratory Chain (Rest all protein from Nuclear DNA).

Replication without Proof reading

∴ More chances of Mutation

Maternal Inheritence

Replication of DNA



Prokaryotic DNA

Eukaryotic DNA

Ori : Single

Multiple ori

origin of Replication

Replication from ori is Bidirectional in Both.

Replisome

Complex of protein & enzymes for the replication

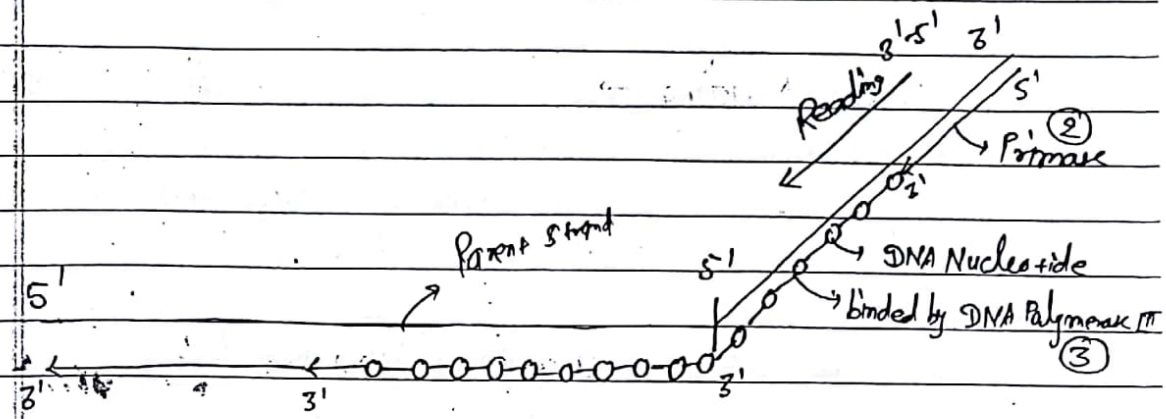
Teacher's Signature .....

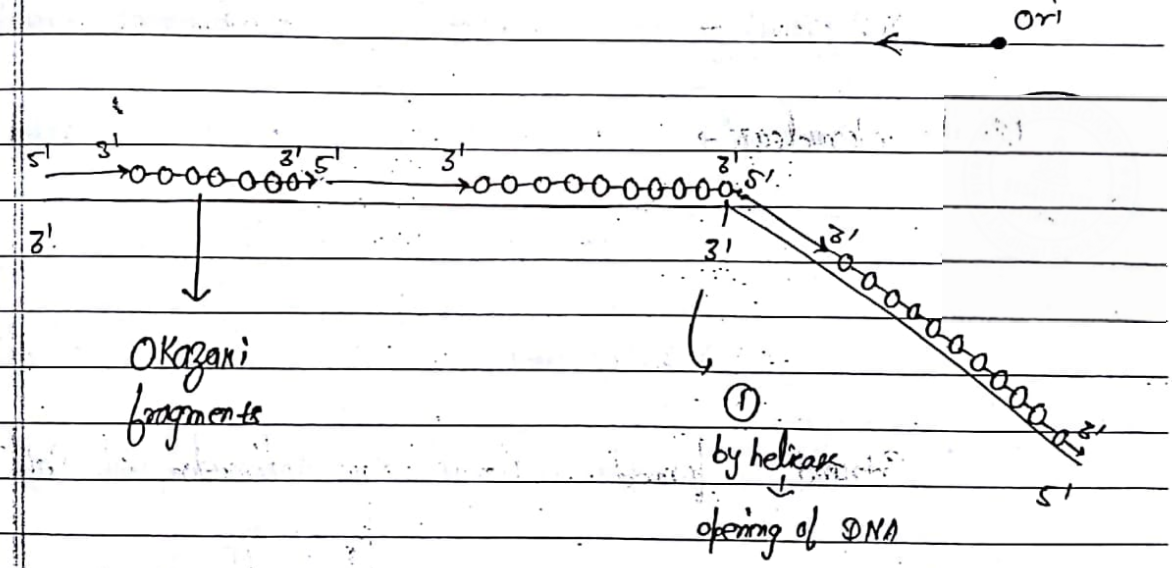
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

DNA Replication occurs in 3 phase → Initiation, elongation & Termination.

E. coli (Bacteria) has single, closed, circular, ds DNA, which is negatively supercoiled prt. in Nucleoid.

→ Segmental breaking (opening) & Segmental Synthesis of DNA occurs.





Primase will form RNA Primer
↳ DNA dependent RNA Polymerase

Reading of Nucleotide of ← Parent strand will be in a direction specific manner → 3'-5'

Synthesis of RNA/DNA → always 5'-3' direction.

DNA Polymerase III → ① 3'-5' Polymerase → ② Synthesis of daughter DNA
↓
addition of Nucleotide

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Proof Reading → Intra-Replication
DNA Repair → Post-Replication

Date
Page 110

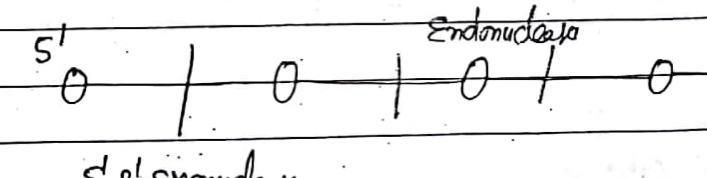
② 3'-5' Exonuclease
↳ Proof reading ✓

Proof Reading → During Synthesis of DNA if any wrong nucleotide is added, then it is removed immediately by DNA Polymerase III in 3'-5' dir.

– absent in RNA formation.

Exonuclease → Cutting of External phosphodiester bond

Endonuclease → Cutting of internal phosphodiester bond



Strand formed along the direction of Replisome
↳ Leading Strand

Strand formed opposite the direction of Replisome
↳ Lagging Strand

DNA Replication is → Semiconservative & Continuous
Kornberg enzyme

Removal of RNA Primer → by DNA Polymerase I

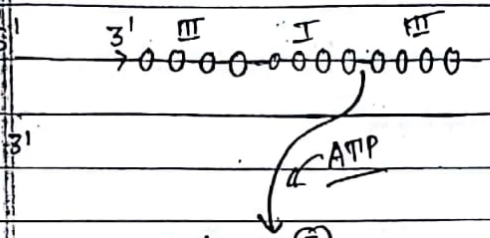
Gap filling ← ① 5'-3' Polymerase activity } in DNA Polymerase I/II/III
Proof Reading ← ② 3'-5' Exonuclease activity
③ 5'-3' Exonuclease activity
↳ Removal of RNA Primer ✓

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Klenow fragment → When 5'→3' exonuclease activity is Removed, Remaining Large fragment of DNA Polymerase I is Klow "KLENOW FRAGMENT"

Date
Page 111

57



- Gap filling after Primer Removal by DNA Polymerase I (4)

Joins the fragment formed by DP III & DP I By phosphodiester bond

& Proof reading is also done by DPI here.

Okazaki fragments = DNA + RNA Primer

formed by DNA Polymerase III + Primase

DNA Polymerase II = Repair activity

Not involved in DNA Replication

Replisome :→

1. Helicase → Unwinding of DNA (Parent strand)
2. SSBP → (Single Strand Binding Protein) Prevent premature annealing of ds DNA
3. Topoisomerase → Relieves torsional strain (supercoiling)
4. DNA Primase → RNA Primer Synthesis
   - DNA dependent RNA Polymerase
5. DNA Polymerase → DNA Polymerisation
   - III / I
6. DNA ligase → Nick Sealing ATP is required

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

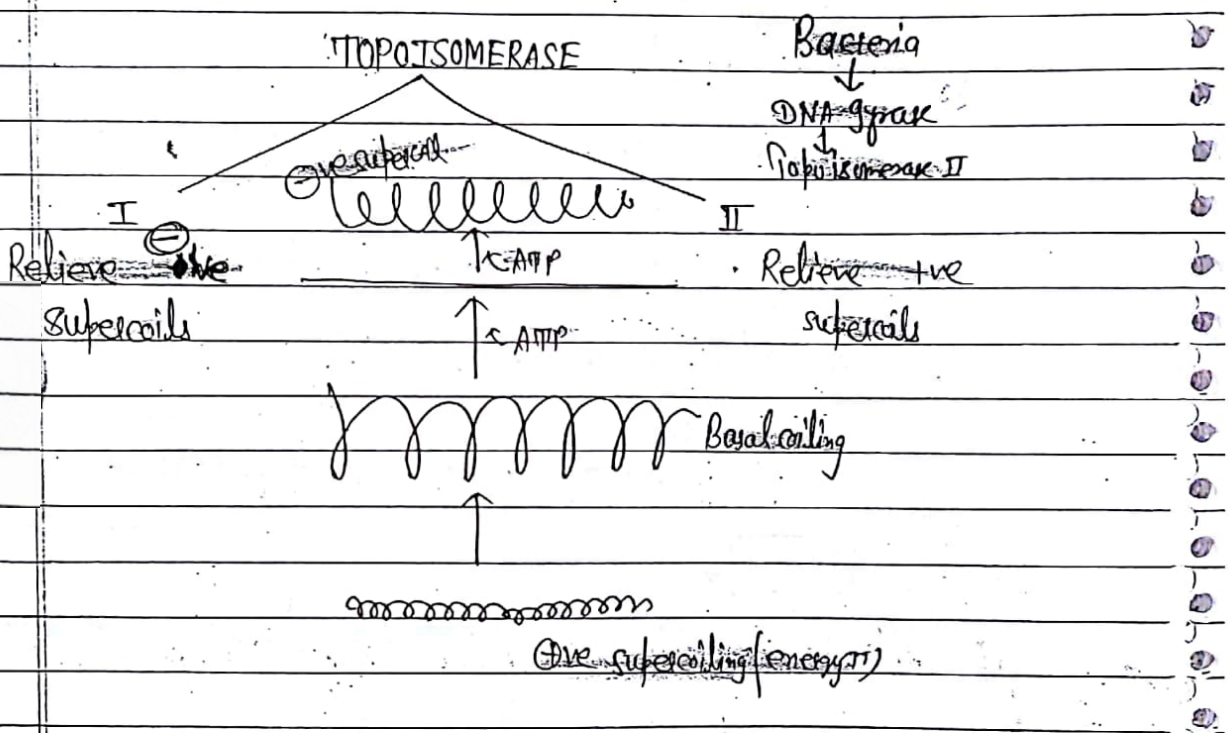
⊖ve Supercoil → direction of coil is opposite to Base coiling

⊕ve Supercoil → No. of coils ↑ in same dim of Basal coil.

Date
Page 112

- DNA ligase → forms phosphodiester bond to join deoxy-nucleotides.

- Topoisomerase → Prevents Supercoiling
  ↓
  So that DNA replication can occur
  (activity of Helicase is smoothly occuring)



- Relieve ⊖ve Supercoils
- Relieve +ve supercoils
- Bacteria → DNA gyrase → Topoisomerase II
- Introduce ⊖ve Supercoil (sometimes)
- ATP required for introducing of ⊖ve Supercoil
  E.g. Sometimes ATP req.

- Nicks Single DNA Strand
- Nicks both strands of DNA

- Topoisomerase III → introduce Single Strand break during Recombination

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

:- DNA Polymerase :-

E.coli [Prokaryotes]	Mammalian [Eukaryote]	Function
I	α	Gap filling, Synthesis of lagging strand
	ε	DNA Proof reading & Repair
II	β	DNA Repair
	γ	M+ DNA Synthesis $^{\alpha I \rightarrow B}$
III	δ	• Processive/Leading strand Synthesis • Okazaki fragment Synthesis

Eukaryotes →

α & ε → lagging strand Synthesis

δ → leading strand Synthesis

Proof reading & Repair activity present with all DNA Polymerase.

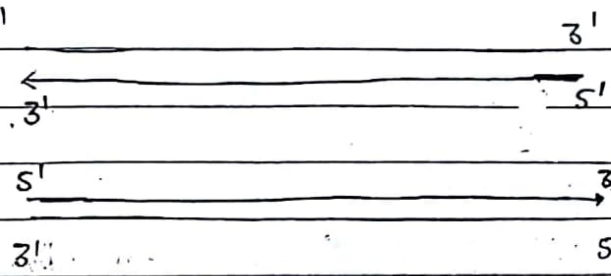
:- Telomere & Telomerase :-

- Arrangement that prevents the loss of daughter DNA.
- Only present in eukaryotic DNA
- In Eukaryotes Shortening of daughter strands occur ∴ each

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

replication.



due to lack of receeding (Peeche) Nucleotide at extreme end gap filling is absent.

↓

hence Shortening occurs.

→ 6 Nucleotide DNA Segment → Hexanucleotide

↓ ↓

5' TTAGGG 3' Telomere

→ Telomerase →

↓

Protein factors + RNA (inert)

↓

i.e No enzymatic activity

(RNA dependent DNA polymerase)

Reverse transcriptase activity of Telomerase

↓

Present in protein factors

- Telomerase is not a ribozyme
- Telomere → 5' TTAGGG 3'
  - ↳ Rich in guanine
- RNA of telomerase provides template for telomere formation.

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Telomerase is abt. from Most Somatic cells. It is prt. in gem(germinal cells), cancer cells & stem cells (hematopoietic stem cells)

Date 01/03
Page 115 (59)

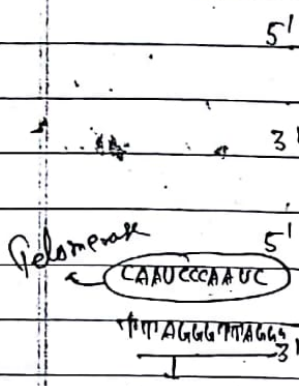
* As the advancing age; Loss of enzyme activity ∝ advancing age.

Telomere is added on 3' end of New Daughter DNA (20-200 telomeres)

↓

Seen as overhanging segment of Newly synthesized DNA

Telomere added on 3' end of parent DNA strand



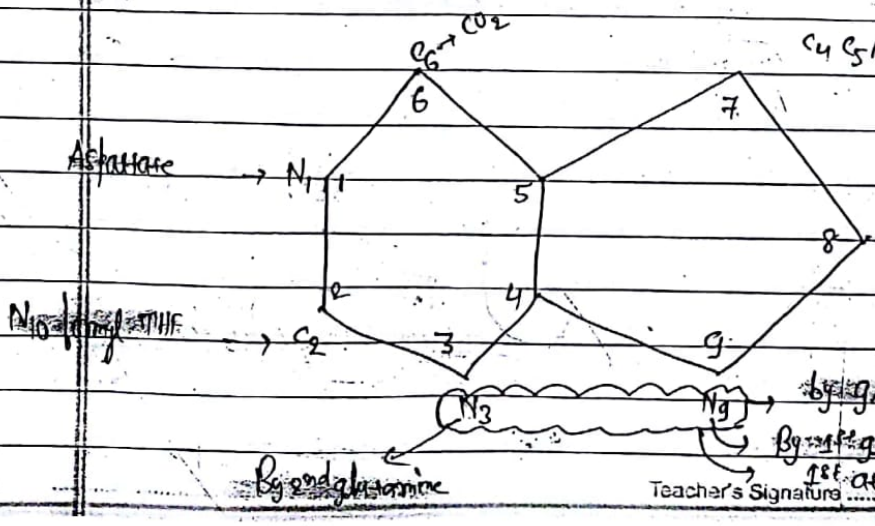
Telomer (work as Primer)

Shortening is prevented b/c the end which is not replicated from parent was also telomere

* In certain Malignancies ⇒ Telomerase gene Mutated ⇒ Persistent Telomerase activity ⇒ Multiple Replication

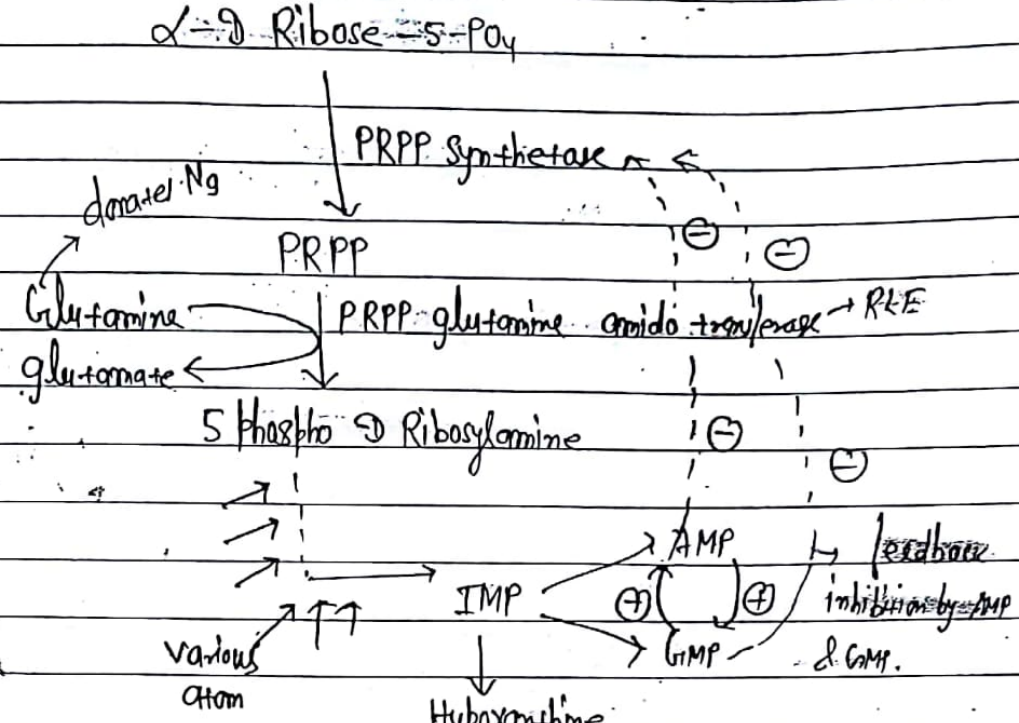
De Novo Synthesis

It refers to Synthesis of complex molecules from simple molecules. eg: Nucleotides are not needed in the diet as they can be constructed from small precursor molecules



Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397



Base	Nucleoside	Nucleotide
Adenine	Adenosine	AMP
Hypoxanthine	Guanine	GMP.

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

DNA Repair

→ Post Replication process;

→ Mechanism :- ① Base excision Repair;

② Nucleotide Repair;

③ Mismatch Repair;

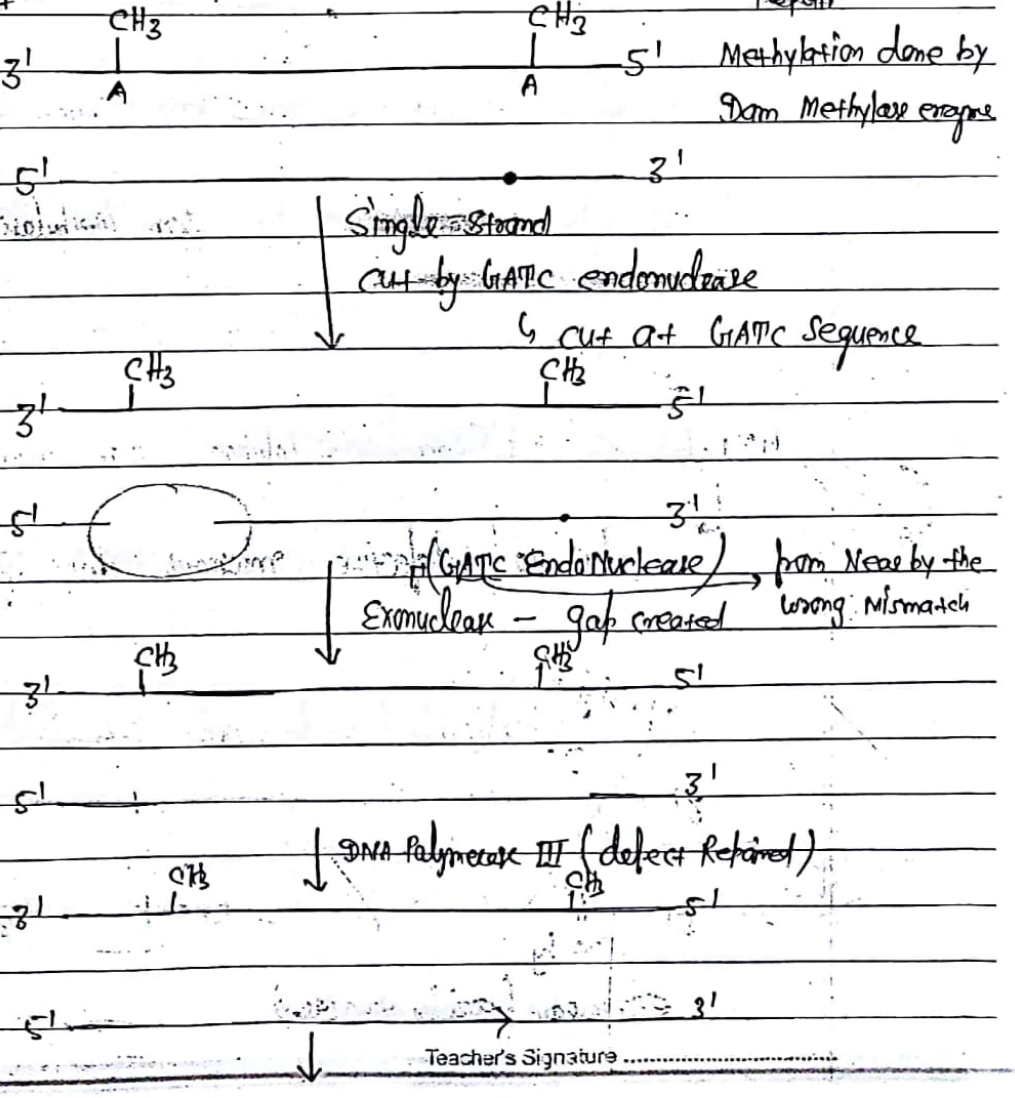
④ Double-Strand break Repair

MISMATCH REPAIR

→ Immediate Post-replication Repair

Methylation done by Dam Methylase enzyme

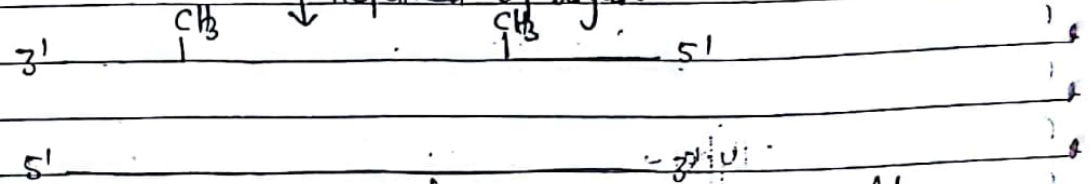
Only Repair in which demarcation of Parent & daughter strand



Teacher's Signature .....

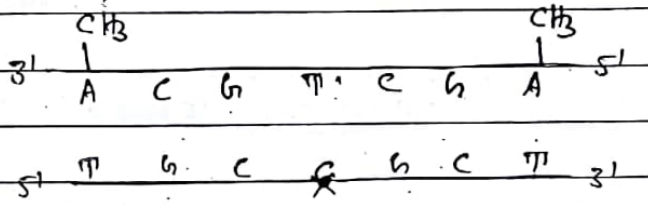
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

↓ Repaired by ligase



→ The template strand of the DNA exists in a methylated form, while the newly synthesized is not methylated

Eg →



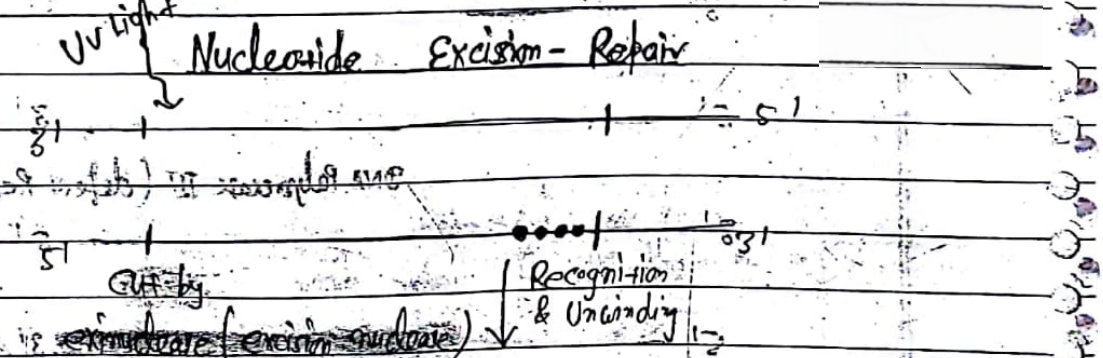
Methylation at adenine base → Parent strand

Methylation occurs by → Dam Methylase ∵ only in Parent strand during DNA adenine Methylation Replication

HNPCC (Hereditary Nonpolyposis colon cancer)

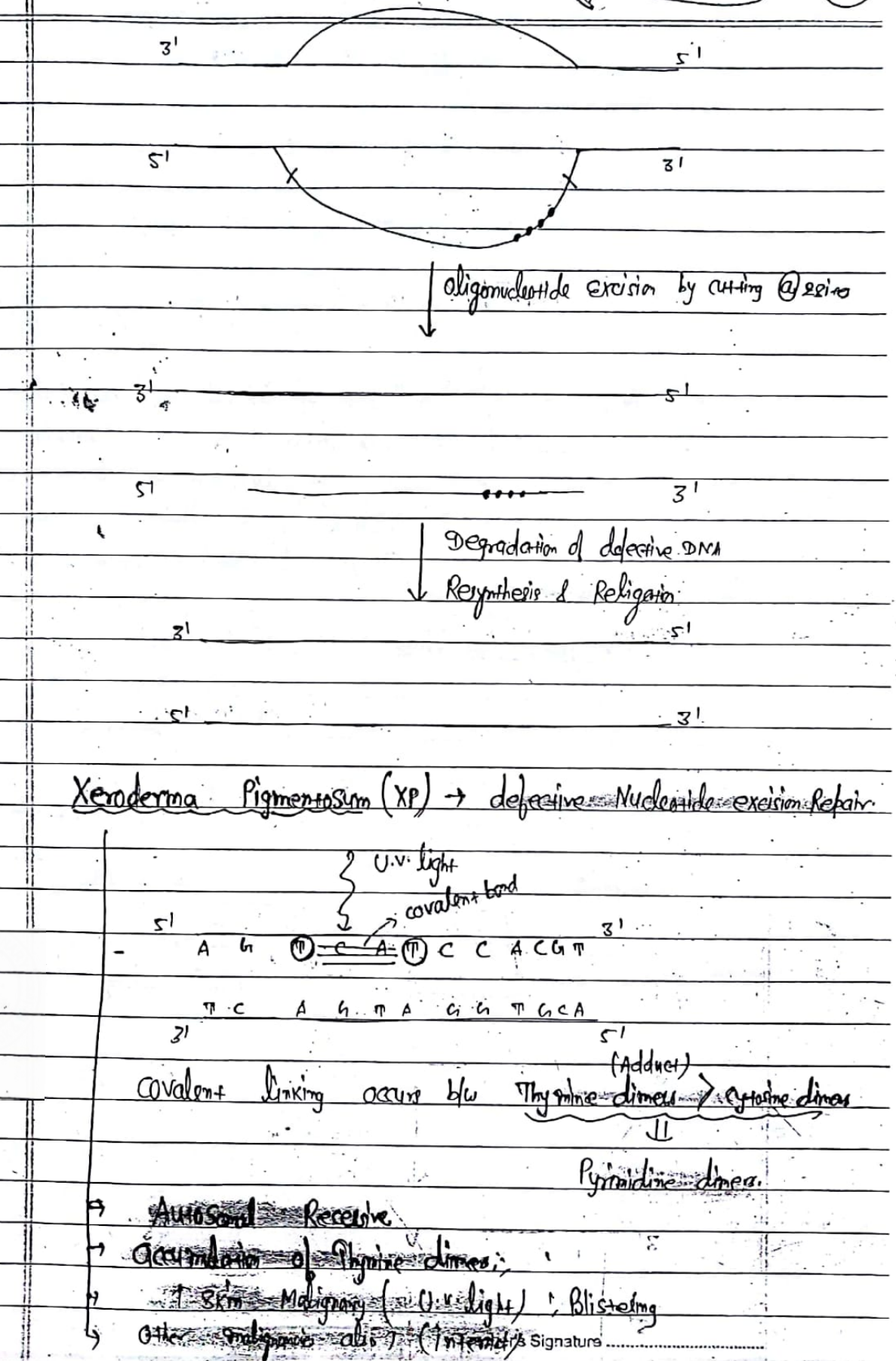
↳ due to defective mismatch Repair System.

UV Light → Nucleotide Excision - Repair



Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397



Xeroderma Pigmentosum (XP) → defective Nucleotide excision Repair.

Covalent linking occurs b/w Thymine dimers (Adduct) > Cytosine dimers

Pyrimidine dimers.

- AutoSomal Recessive
- Accumulation of Thymine dimers;
- ↑ Skin Malignancy (U.V. light) ; Blistering
- Other malignancies also ↑ (Internal)

Student's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

"Cockayne Syndrome" ⇒ also seen in Nucleotide excision Repair

During Nucleotide excision Repair

↓

Cut made at 5' & 3' end

↳ 20-25 bases are excised

↳ done by UvrA, B, C eximuclease enzyme (reactive)

↓

Maxim case of Xeroderma Pigmentosum is due to its effect

Cut at two sites induced by U.V. light.

Normally Not prt. in cell; but after UV Ray incident; it created & activated

cutting Phosphodiester bond

→ Enzymes involved → Eximuclease enzyme

DNA Polymerase I

DNA ligase (less cases of XP)

BASE EXCISION REPAIR

3' — © (very Much Labile base) — 5'

5' — G — 3'

Heat energy, IR ray, X-ray —

↓ UV ray, viral infection, chemical agents

3' — V — 5'

5' — 3'

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

U ← Uracil DNA glycosylase
↳ Removal of base

3' ——— * ——— 5'
G
5' ——— 3'
Nuclease [AP endonuclease] ← Abasic/apyrimidinic
↳ create a nick on either side of defect

3' ——— 5'
G
5' ——— 3'
DNA Polymerase I + DNA ligase

3' ——— C ——— 5'
G
5' ——— 3'

→ Most labile base to change → Cytosine
↓
2-oxy-4-amino pyrimidine

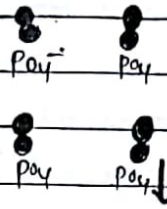
Changes to Uracil → 2,4-dioxy pyrimidine
addition of 1-oxy
+
Cytosine deamination → Uracil
↳ 4 amino

AP site [abasic site or apyrimidinic site] → No base but phosphodiester bond is present.
AP site is identified by → AP endonuclease
No known disease due to its defect

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Double-Strand break Repair process



~~Kinase protein~~ → Binds ē 4 broken ends of DNA

↳ Recruits DNA Protein kinase enzyme

↓

adds ~~Phosphate (poly)~~ group at broken ends

↓

approximation

Broken ends open in a fork like manner due to repulsion of -ve charge of Poly⁻.

ligation

degraded

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 123

Purpose → ~~Repair of broken ends~~
- ~~Rearrangement of Nucleotides~~

NEET PG This repair is seen in ~~Immunoglobulin gene rearrangement~~ eg ⇒ ~~Ataxia Telangiectasia~~ QQ, ~~Bloom's Syndrome~~, Fanconi's Anemia.

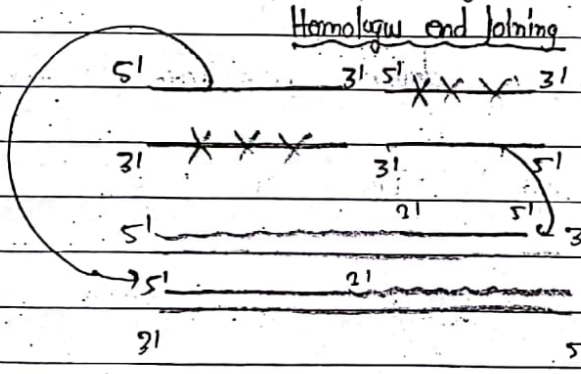
→ ~~Double strand break~~ → ~~Results in genetic Recombination~~;
↓ Lead to
chromosomal translocation;
Broken chromosome & finally cell death.

(QQR)
Homologus end joining
(Less common)
(Less common)

(QQR)
Non homologus end joining
(More common)
↳ error prone.

AIIMS Nov'17 SCID (Severe Combined Immunodeficiency Disease) ⇒ d/t defective Non Homologus End joining Repair (NHEJ)

Homologus end joining



Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date 2/3/18
Page 124

TRANSCRIPTION → Initiation → elongation → Termination.

5' ——— 3' coding strand

3' ——— 5' Template strand

↓ Gene X

5' ~~~ 3' RNA → Sequence same as coding strand & as RNA codes for protein

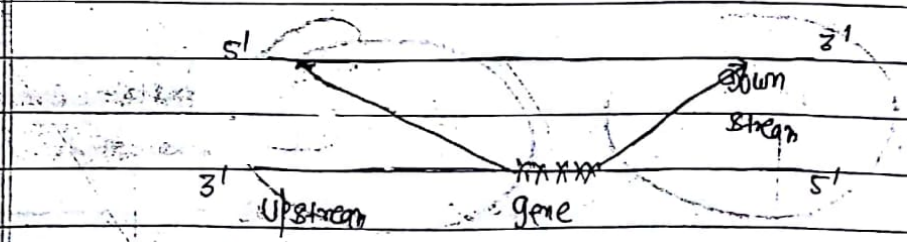
Template strand → produces working copies of RNA molecule
- also k/as "Non coding / Minus strand / Bottom strand / Antisense"

Coding strand → doesn't participate in transcription.
- also k/as "Sense / plus / up strand."

Transcriptional control elements

Portion of template strand towards 5'-end of coding strand from 1st Nucleotide of gene → Upstream portion

Portion of template strand after gene towards 3'-end of coding strand → Downstream portion



Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

- Binding of Transcription Regulatory proteins to DNA is Regulated by :-
  i) Helix-turn Helix Motifs;] → Symmetrical Palindromes
  ii) Leucine-zipper Motifs;
  iii) Zinc-finger-Motifs (For Steroid Receptor Family & Thyroid Receptor family)

Date: Page: 125

Periodic Repeat of Leucine Residue at every 7th position

Binding site is Repeated by 2-9 times

Gene → Transcriptional control element

Basal control elements
↓
always upstream
↓
Promoter proximal element or Promoter area
→ "CAAT" box or "GC" box (-75 position) Eukaryotes
→ -35 box
↓ 5' TGTTSA
Prokaryotes
- decides the frequency of basal transcription.

Regulatory elements
↓
May be upstream or downstream
↓
decides the location where RNA Polymerase binds the DNA

Req for regulation of expression (+ or -)

Element = Segment of DNA

* Central dogma of genetics do have amplification.
DNA (one) → RNA (Multiple) → Protein (1 RNA Make very protein)
No. of RNA

Promoter proximal area
Binding of RNA Polymerase
← Upstream
3' — Gene — 5'

Promoter Region
Rich in TATA
+1 Nucleotide (In downward direction "+")
-1 Nucleotide (In upward stream direction "-")

Prokaryote
↓
Pribnow box (5'TATAAT 3')
(-10 Position)

Eukaryote "Goldberg Hogness box"
↓
TATA Box / Hogness box
(-25 Nucleotide upstream)
(TATAAA Sequence)

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Promoter proximal element → decides the duration of binding of RNA Polymerase to template strand

↓

decides frequency of transcription

if RNA Polymerase binds to template strand for more duration → Many gene expressed

↓

More RNA Produced

↓

More protein

↓

K/as "Amplification of central dogma"

Regulatory elements

Located far from genes.

↓

K/as "Distal regulatory elements"

- Enhancers
- Repressors
- Hormones Binding element
- Toxin Binding element

} Bind & change or alter the expression

Replication } on nucleus
Transcription }

RNA Polymerase → 3 RNA Polymerase activity

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 127

Termination of RNA Synthesis :-

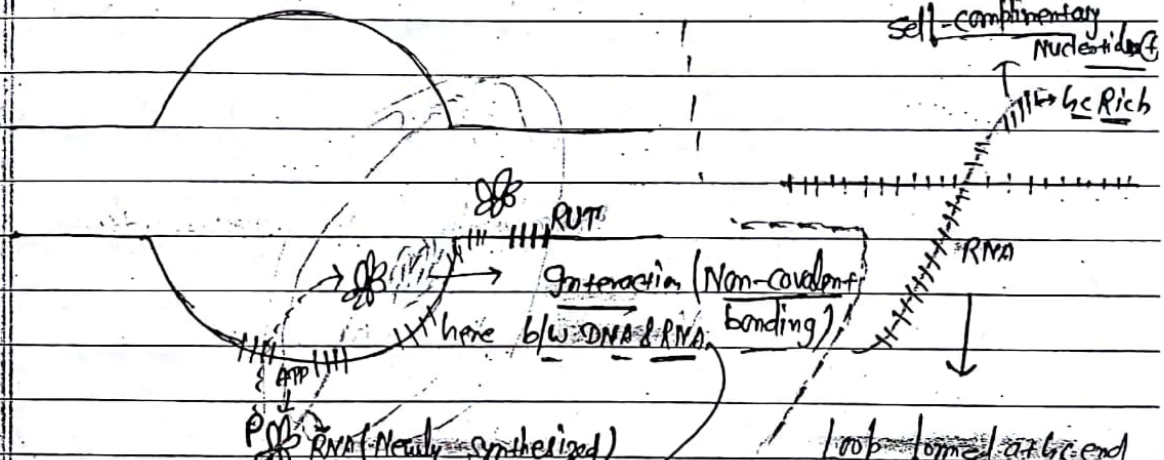
In Prokaryotes	In Eukaryotes
① ρ dependent termination	Ill-defined
② ρ Independent termination	

ρ(Rho) dependent

Requires →
- ρ factor (ρ)
- ATP
- RUT element at Gene end ↓ Rho utilizing termination signal

ρ(Rho) Independent

- None of 3 things is required.
- requires specific sequence of RNA (Gc Rich).



- Known as Hairpin loop or stem loop
- No ATP Required
- Loop formed due to H-bond b/w complimentary bases

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

P factor →
- → Hexameric protein
- → Captures RNA & ascend on this RNA
- → 6 Subunits
- → Uses ATP
- → Reaches extreme end of RNA
- → After identifying RUT element enzymatic activity is induced in P factor

↓

DNA-RNA helicase

↓

Interaction b/w DNA RNA is lost

↓

RNA free from bubble

↓

Termination of transcription.

→ Not identified in Eukaryotes

→ **Types of RNA & Post transcriptional modification :**

In Eukaryote

Gene	Enzyme	Product
I	RNA Polymerase I	In Nucleolus formation 5.8S, 28S rRNAs
II	RNA Polymerase II	In Nucleoplasm mRNA, miRNA, SnRNA
III	RNA Polymerase III	tRNA, 5S rRNA, U6 SnRNA

Mnemonic :- RMT

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page: 129

↳ 5'-3' Polymerase Activity (No 3'-5' exonuclease activity)

In Prokaryote → RNA Polymerase → Known as "core enzyme"

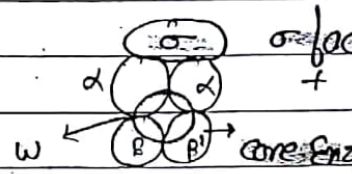
components: α_2 β & β', ω

↓

has complete transcribing ability: Major form correct RNA

- Rifampicin inhibits β-Subunit of RNA Polymerase

- For correct RNA Synthesis in Prokaryotes σ (Sigma factor) is required:



σ factor + core Enzyme → Holoenzyme

↓

Catalytically active

↳ Resides in β subunit.

σ factor binds to promoter area.

↳ ∴ correct binding is due to σ factor

rRNA → Post transcriptional Modification of 45S rRNA → cleavage in Nucleolus.

Prokaryotic:

- 5S rRNA
- 16S rRNA
- 23S rRNA

Small big unit

↳ Sedimentation Rate.

Eukaryotic: In nucleus, RNA Polymerase III, independently synthesized

- 5S rRNA

In Nucleolus, RNA Polymerase I, Synthesized as rRNA Precursor

- 5.8S rRNA
- 18S rRNA
- 28S rRNA

Most abundant RNA in cell → rRNA

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

85% ⇒ rRNA
10-15% ⇒ tRNA
~5% ⇒ mRNA

Date
Page 130

Function → Making ~~Structure~~ of Ribosome

↓

rRNA + Protein

Ribosome

Prokaryotic

30S — 16S rRNA

50S — 5S rRNA, 23S rRNA

70S ribosome

Eukaryotic

40S — 18S rRNA

60S — 5S rRNA, 5.8S rRNA, 28S rRNA

80S Ribosome

23S rRNA
28S rRNA
} → It is a Ribozyme → RNA showing catalytic activity

↓

Peptidyl ~~transferase~~ & activity

↓

Present in large Subunit of Ribosome

rRNA → formed in Nucleolus ***

↳ cleaved into Smaller units (Post transcriptional modification)

↓

5.8S, 18S, 28S

↓

occur in Nucleolus

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 131

Codon → Unambiguous → codes for Single AA.

Poly "A" tail translated into "POLYLYSINE". QQ

mRNA

Eukaryote → Prokaryote

Prokaryote → Start translational quickly

HnRNA → Heteronuclear / Heterogenous RNA / 1° transcript

↓ Precursor of mRNA

mRNA → Very large molecule as compared to mRNA.

→ Post transcriptional modification of HnRNA (in Nucleus only) :-

5' E | I | E | I | E | I | E 3'

HnRNA

Nucleus

Exons ⇒ coding (expressed sequence)

Introns ⇒ Non-coding (Non-Expressed Sequence)

- Inside Nucleus
- Capping at 5' end (7 methyl guanosine triphosphate)
- Splicing (Removal of introns)
- Tailing at 3' end (Poly A Tail) ⇓ Never translated; 80-250 AA.

* Capping & Tailing is for protection of m-RNA from exonuclease

5' E | E | E | E | E or little intron 3'

mRNA

↳ seen towards end, if parts { all introns are not removed }

↳ 1. Much Shorter

↳ Comes out of Nucleus → to cytosol

Splicing → by Spliceosome → Remove Intron → Joins exons

Components → (1) Intron

(2) SnRNA (Small Nuclear RNA)

(3) SnRNP

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

SnRNP → Small nuclear Ribosomal proteins

↳ Function → Positioning the spliceosome on introns

Types of SnRNA → U_1
U_2
U_4
U_5
U_6

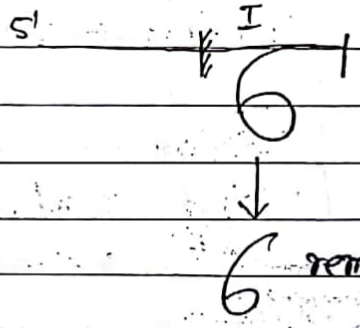
U_1	U_4	U_6
U_2	U_5	

SnRNA is a Ribozyme

↳ Phosphodiesterase activity

↓

Cut the Intron at 5' end & then intron loops around itself & removed from hnRNA.



↓

removed Intron

↓

automatic loop formation.

Faulty splicing → Removal of wrong intron by mistake

↓

this formed mRNA will not be translated.

Eg → β-thalassemia.

Spinal Muscular dystrophy.

Teacher's Signature .....

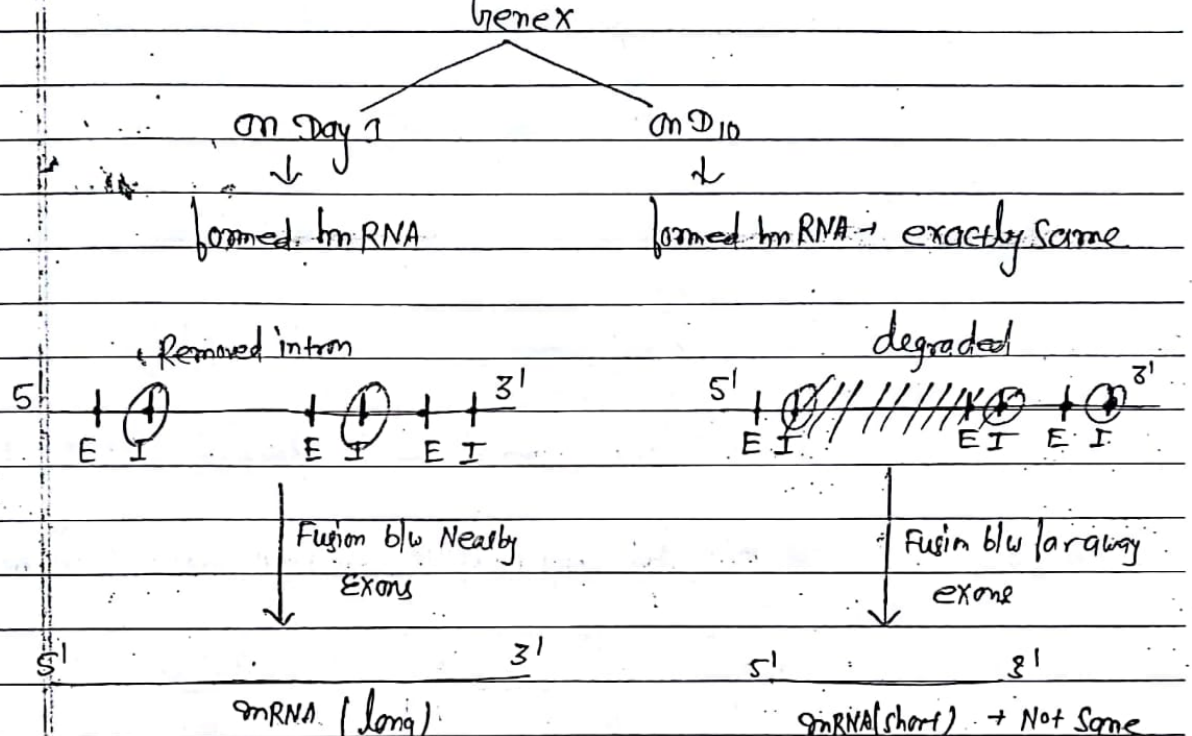
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

- only about 1.5% of human DNA is coding (exon DNA), carrying information for protein Products.
- Post-transcriptional Modification of RNA → i) 5'-capping, ii) Addition of Poly-A tail (Polyadenylation), iii) Removal of introns (Splicing).

Date: Page: 133

Alternate Splicing ⇒ Physiological process

1 gene → Results in → 1 types of Protein.
(generally 1 gene → 1 type of protein)



A process by which same gene results in formation of different mRNA at different time frame due to joining of adjacent exons at one moment of time & joining of far away exons at different time frame

↓↓

Different mRNA → hence diff. Proteins

eg → Formation of different types of Immunoglobulin from the same chain.

Self-splicing ⇒ Occurs for Rare introns that form a Ribozyme, perform the functions of splicesome by RNA alone.
↳ "Lariat intermediates" are formed.

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 134

→ occurs in "Ribosomes"

TRANSLATION

→ Biosynthesis of a protein or a polypeptide in a living cell.

→ Stages of translation :-

i) Requirement of the components;

ii) Activation of amino acids;

iii) Protein Synthesis Proper;

iv) Chaperones & protein folding;

v) Post-translational modifications

→ "Aminoacyl tRNA Synthetase" - enzyme involved

Protein Synthesis Proper

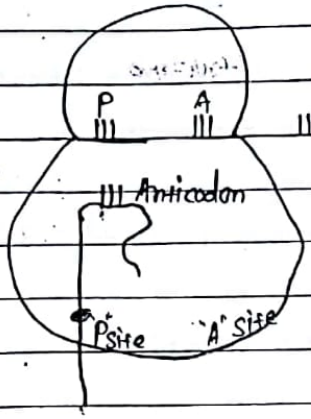
Prokaryotic mRNAs → Polycistronic
↳ a single mRNA has many coding regions that code for different polypeptide

Eukaryotic mRNAs → Monocistronic
↳ code for single polypeptide

→ mRNA binds to Smaller Subunit of Ribosomes;
↳ it read in the 5'-3' dirn & the polypeptide Synthesis proceeds from N-terminal end to C-terminal end

Teacher's Signeture

http://mbbshelp.com WhatsApp: +1 (402) 235-1397



- "Shine Dalgarno sequence" in Prokaryotes
& "Kozak consenses sequence" in eukaryotes
↓↓
both helps in Initiation of Protein Synthesis

- mRNA
- tRNA
  - Methionine → only AA which binds directly "P" site of large Subunit of Ribosome

premature
Prevent Reassociation of 60s & 40s

80s initiation complex

IF → Initiation factor

IF-3
IF-1A

80S

40S

60S

- Small Subunit of Ribosome undergoes modification
- Large Subunit of Ribosome doesn't undergoes any modification

IF-2
GTP
"methionine tRNA"

43S ← 43S PIC

pre initiation complex

IF 4F (4A Subunit, 4G, 4E)
mRNA
ATP

60S

48S initiation complex ← 48S IC

IF-5

→ 80S initiation complex

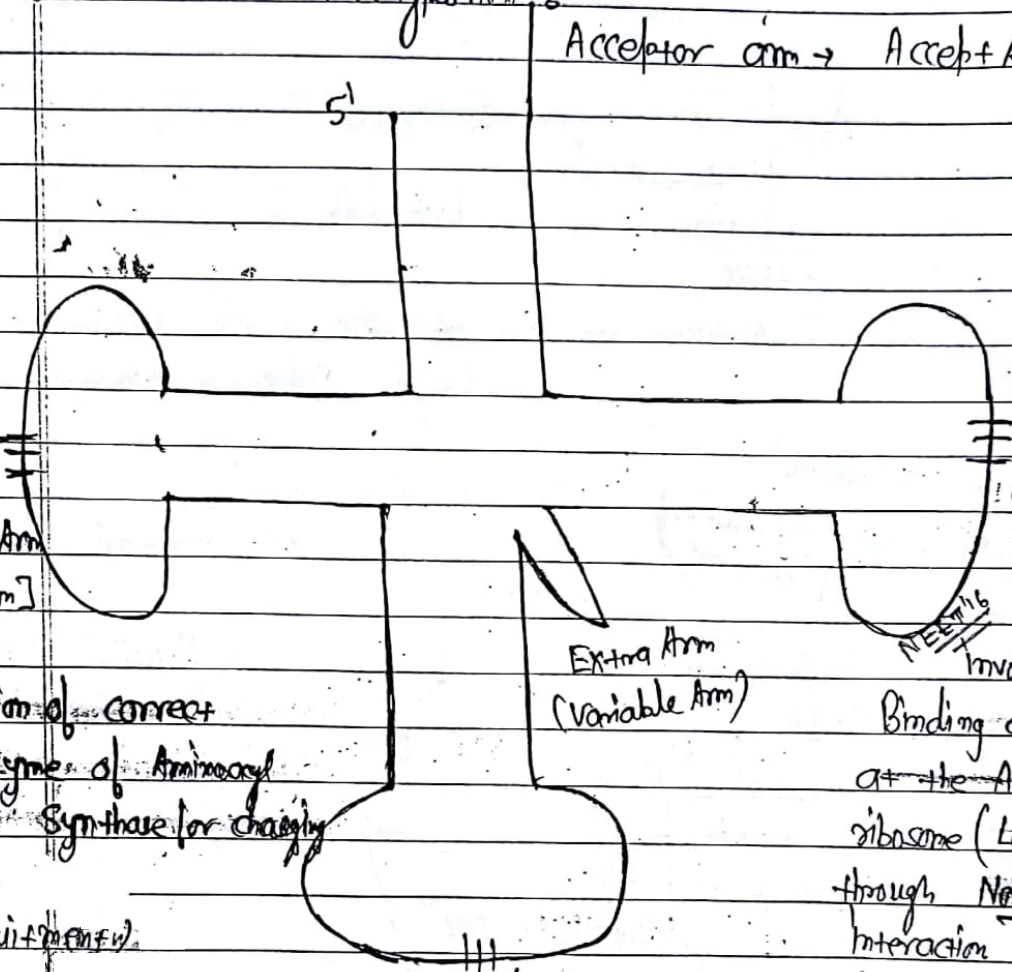
Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

tRNA → 31 types for Nuclear DNA ; for 20 AA

- Clover leaf Structure ;
- 5 arms

Mitochondria → DNA → 22 types tRNA



↓
Selection of correct Isoenzyme of Aminoacyl tRNA Synthase for charging

(Recognition)

↓
Involved in Binding of tRNA at the A site of ribosome (Large subunit) through Noncovalent Interaction

Carry one AA, we have more than one tRNA for one AA

eg → Serine → 6 tRNA

→ Charging of AA on tRNA → Should be correct

↓

done by Aminoacyl-tRNA Synthetase enzyme

↓

in order to form correct Protein.

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Q8 1 peptide bond formation Needs Four high energy phosphates.

Date 3/3
Page 127

(70)

* P & A site → canonical site

Aminoacyl tRNA Synthase → function → charging of correct AA on tRNA, matching with its anticodon.

→ Cytosolic enzyme
20 iso-enzyme;
Proof reading activity. ATMs-91

Charging of t-RNA

Activation of AA
↓
ATP used

Eg → Glycine + ATP → AMP
Glycyl
↓
active AA
↓
2 high energy phosphate is used

Transfer of activated AA to 3' end of tRNA

tRNA loading c AA → goes to A site
∴ New tRNA attaches to Acceptor site (A-site)
1st tRNA → P site
↳ Methionine
→ 1st peptide bond formed at A-site

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Meithionine Make "N" terminal of protein.
↳ Amino

Date
Page 138

Synthesis of Protein → "N terminal to C terminal" (N to C) terminal of protein

Peptidyl transferase →

Transfer AA from P site to A site

↓

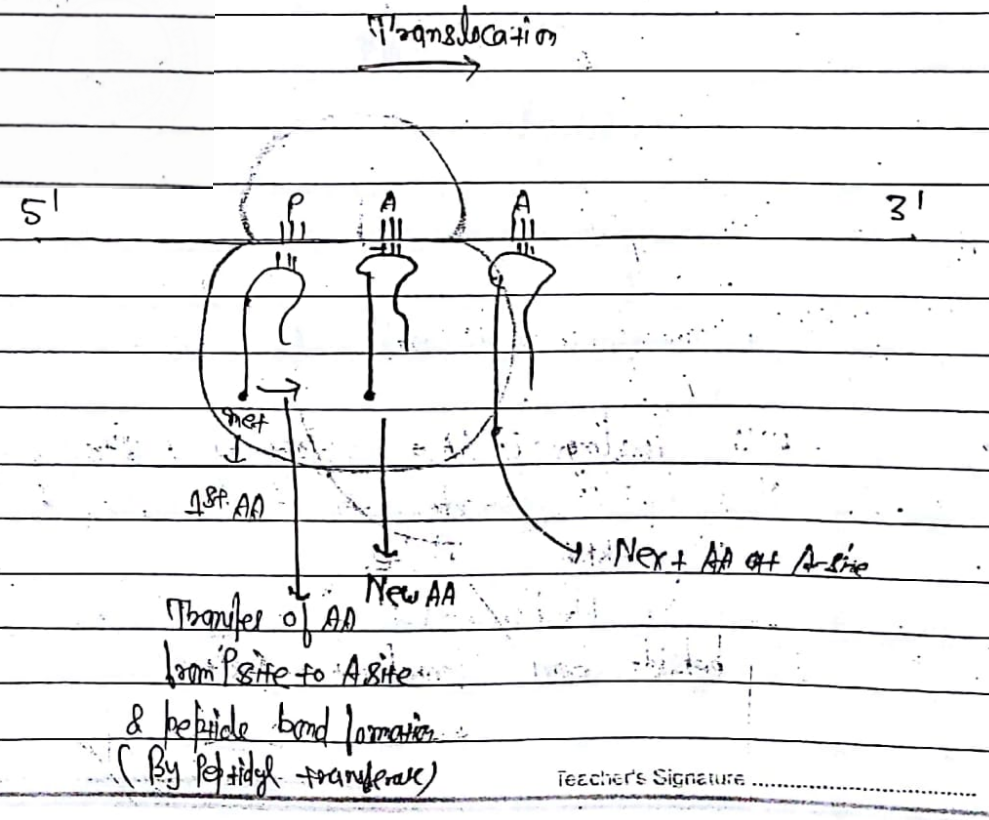
Peptide bond is formed.

Translocation → GTP used (GTP → GDP)

↳ Ribosome moves on mRNA.

↳ New site will beome A site & Previous A site becomes P site.

Protein Synthesis is a cyclical proces.



Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Formation of Peptide Bond → 4 Pi (high energy phosphate used)

1. ATP ⟹ AMP (charging) → 2 Pi
2. GTP → GDP (Translocation) → 1 Pi
3. GTP → GDP (either Peptidyl transferase activity or localization of tRNA at A site)

Termination → By stop codon at A site
- UAA → Ochre
- UAG → Amber
- UGA → opal

- Releasing factor bind at A site [RF] ; when stop codon is encountered
- RF ∴ the help of
  - H_2O **
  - Peptidyl transferase **
  - GTP **

  } Release Polypeptide from P-site

A site ↓ will have stop codons

∴ Protein is released from P site

RF → also dissociates Ribosome to Small & large Subunit

↳ Small + Subunit undergoes modification & Mature Ribosome is formed

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Fidelity (faithfullness) of protein Synthesis

↳ according to codon on mRNA the AA sequence should be same

Maintained by — ① tRNA

② Aminoacyl tRNA Synthase

Maximum modified bases ⟶ tRNA

Pseudouridine
dihydrouridine
IMP
Hypoxanthine etc

Small RNA → miRNA (Micro) ↱ 2006 Noble Prize given for its discovery

↳ Regulatory RNA

↓

Causes gene Suppression

* Drosha cut & form Pre miRNA & (Pre miRNA) goes outside Nucleus & Form "RISC"

→ 22-25 nucleotide, SSRNA

PremiRNA = double standard

RISC = SSRNA → Part of RISC in cytosol

miRNA = SSRNA

↓

RNA induced silencing complex

miRNA ≠ cut by Drosha

PremiRNA ↓ RIS

- Mi RNA once if bind to mRNA → causes degradation of that mRNA
- Transcribed by "RNA Polymerase II & Drosha" enzyme II involved in cutting process

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

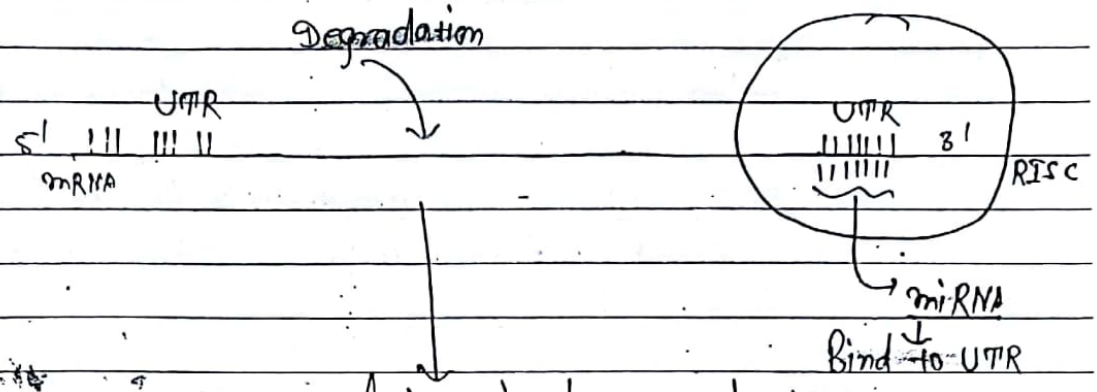
"P" Bodies ⇒ found in cytoplasm; Contains Nuclease.

* Lack of miRNA ⇒ d/w Malignancy;

* miRNA ⇒ (N) cells.

Date: Page: 141

UTR → Untranslated Region.



No translation in presence of miRNA

→ mRNA in presence of miRNA will not form protein,

→ Small Interfering RNA / Silencing RNA

SiRNA → Exogenous miRNA

→ Used for RNA Interference / RNA Silencing.

→ experimental use to suppress disease causing mRNA translation.

→ double Stranded (22-25 Nucleotide Long)

→ Size Same as miRNA

→ Binds anywhere along mRNA, not necessarily on UTR.

→ Gene Suppression by degrading mRNA (function Same as miRNA)

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

↳ Gene of one species is incorporated in vector so as to produce Recombinent vector ; so, as to utilize various purposes

Recombinent DNA technology or genetic Engineering or DNA cloning

Loading of vector ∴ Recombinent DNA

DNA library :- Various Nucleotide sequence is stored which represent the genomic constituent of one species

2 types → Genomic
→ Complimentry

Genomic DNA library → For Sequence analysis → eg:- Polymorphism study
↓
Nuclear DNA stored
↓
Gene may be expressed or Unexpressed
↓
It has to undergo transcription
↓
mRNA formed → Protein may or may not form

Complimentary DNA library → For Protein Synthesis
↓ cDNA
DNA complimentry to mRNA is stored
[i.e Reverse transcriptase copy of mRNA]
↓
Only expressed gene ⊕
↓
∴ Protein will form

Size of gene → Large | Small

In both library Recombinant tech is used to store DNA & vector

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 143

→ Plasmid artificial chromosome

Vectors ⇒ Size of DNA that can accomodated in the vector ⇒

	Vector	DNA insert Size (kb) (Amount of DNA accomodated in vector)
Natural	Plasmid PBR322	0.01–10 kb
Natural	Lambda charon 4A (Bacteriophage)	10–20 kb
Artificial	cosmids	35–50 kb
Artificial	BAC (Bacterial Artificial Chromosome)	50–300 kb
Artificial	PAC	100–300 kb
Artificial	YAC	800–3000 kb

↳ Yeast artificial chromosome

Restriction Endonuclease →

- Cut both strands of DNA together
- → Kn as "Molecular Scissor"
- → Extracted from bacteria

↓

effect of bacteriophage on bacteria is restricted from this enzyme

↓

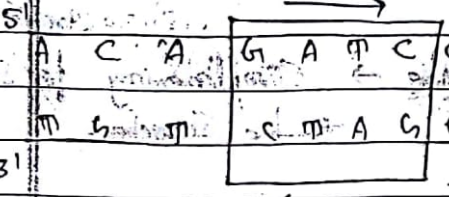
bacteria is saved & Phage degraded

↓

So K/as "Restriction Enzyme".

→ It acts on Palindromes

Palindromes [2–6 Nucleotides] ⇒ Regional areas of double standard DN



Sequence same in both strands in 5'→3' dir.

which all showing Symmetry of Nucleotide sequence of either strand of the DNA, when they are being read in Antiparallel dir.

Teacher's Sig.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

ends formed after action of RE

↳ Sticky or Staggery or overhanging ends
↓
due to complementary bases they can reattach.

↳ Blunt ends may also form.

BLOTTING TECHNOLOGY

↱ TO detect a specific segment of the DNA in whole genome.

① Southern blotting → invitro DNA hybridization
↳ for DNA
→ to Search particular sequence of nucleotide in DNA (eg → Mutation Sequence)
↳ Qualitative Analysis.

Steps to follow :-
- DNA extraction
- RE (Restriction Endonuclease)
- Electrophoresis
- Denaturation of DNA using alkali
- Blotting over nitrocellulose paper
- Fixing at 80°C temp for 1hr
- Layering of Radioactive probe
- Washing
- Auto Radiography to detect radioactive probe

Technology → Prepare probe → Complimentary to Sequence ↱ Single strand Sequence
to be Searched

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 105

RE is used to fragment DNA.

Electrophoresis on Agarose gel

↓

Separation of DNA fragment

↓

Neutral particle can't move

↓

criteria of mobility → Charge / Mass ratio.

Whole gel with DNA is transfered to weak alkali
1/2 N. NaOH

↓

Denaturation

↓

Blotting on Nitrocellulose paper (Not visible)

↓

DNA fragments all transfered on this

↓

(80°C for 1 hr) Heat fixation

↓

Probe labeling

allow hybridize by washing

↓

Washing is done to remove unbound Probe

↓

Examine the Probe

Probe is used to hybridize the desired segment

"cumblesome procedure"

[Probe is labelled with
fluorescent Material
enzyme (radio)
Radioactive labelling]
Hazardous

↳ Enzyme convert → colourless Substrate → to coloured Product

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

↳ Gene Expression in Real Time
↳ mRNA More → More gene expression

Gene X
↓
mRNA
↓
Complementary DNA
↓
Probe
↳ complimentary to cDNA

NORTHERN BLOTTING ⇒ Quantitative technique

→ Technique for the specific identification of RNA molecules.

Blotting done by using a chemically reactive paper prepared by → diazotization of Aminobenzyl-oxymethyl to create diazobenzyloxymethyl (DBM) Paper.

DOT- BLOTTING

- Technique by which the nucleic acid (RNA or DNA) are directly spotted onto the filter
↓
Not subjected to electrophoresis

WESTERN BLOTTING ⇒ detect Ag-Ab.

→ It involves identification of proteins.

→ Very useful to understand Nucleic acid function

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 147

Single phenotype; Single locus & Multiple Normal allele.

POLYMORPHISM

Change of Nucleotide Sequence at the level of DNA in human population.

Types → MicroSatellite (Short (2-6 bp) Tandem Repeats, Less than 1 Kb) & Minisatellite (15-70 base pair & 1-3 Kb.)

- SNP → Single nucleotide Polymorphism / we Need Probe
- VNTR → don't Need Probe. Variable No. of Tandem Repeat
  eg. ABCABCABC / 121212
  (Tandem ⇒ one after Another)

eg →

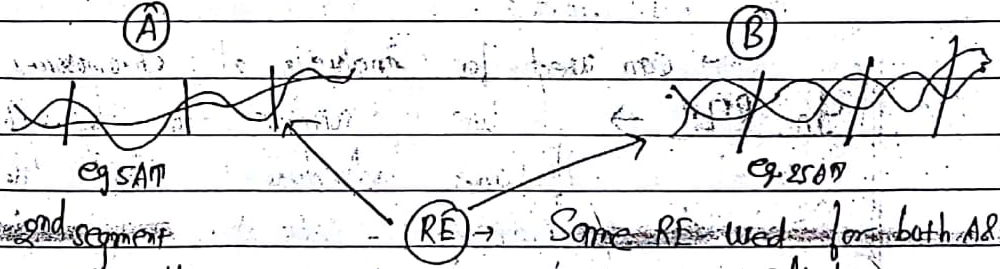
(A)	(B)	(A)	(B)
CACCHATIC	CACCHAAC	ACATTATCH	ACATATATAT
		(2) AT	(4) AT

May or may not change Palindrome

SNP will not change length of DNA

VNTR also changes length of DNA

Q. Compare sample A & sample B of DNA & find out if they belong to Same person :-



Suppose in 2nd segment we have VNTR Polymorphism → So length changes

RE → Same RE used for both A & B so same Palindromes are targeted

take the fragments in the well & go for electrophoresis

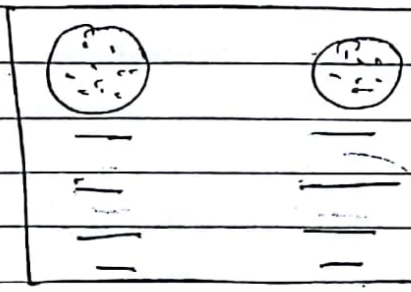
Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

RFLP: Restriction fragment length polymorphism

↳ Single base pair substitutions in germ line DNA of different individuals that either destroys or creates new recognition site for a given restriction enzyme

Date
Page 148



→ we get bands of DNA

↓

Band Pattern if not same for both DNA

Ethidium bromide is used to see these bands under UV light

↓

Bands appear orange colour

Bands if same → DNA of same person

Bands if different → DNA of different person.

↓

due to VNTR

→ Fragment, if different in length, will move differently on electrophoresis (Charge / Mass ratio)

↳ can used for Analysis of chromosomes structures. QQ

Qn RFLP → we examine the polymorphism

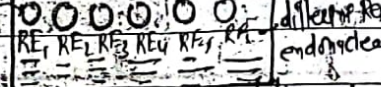
↳ if same individual → same polymorphism

↳ detects variation in DNA sequence by Southern blotting. QQ

Eg. → Crime investigation

Paternity disputes

Principles of DNA fingerprinting → Polymorphism



Chromosome walking → It will eventually define the disease locus.

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 149

Kary Mullis (1993) Nobel Prize

PCR → Amplification of DNA Segment.

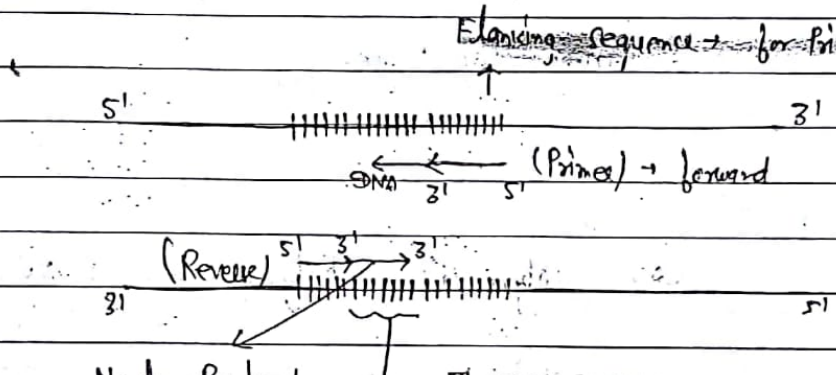
Steps :- ① Primer construction;

② DNA denaturation;

③ Primer annealing.

④ extension of Primer with DNA Polymerase.

- PCR is based on Principal of Natural DNA Replication

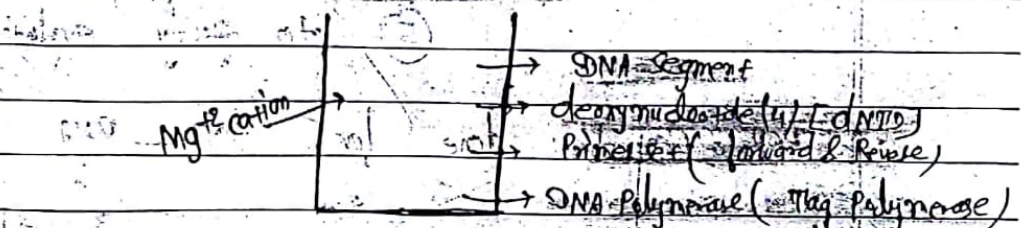


- which needs to be amplified

- For 1 DNA PCR → 2 Primer are required.

For PCR → Flanking Sequence is must to know
→ Target Sequence is not must

Tube used → PCR Cuvette



Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 150

Place this cuvette in PCR machine.

Each cycle

↓

① 92–96°C [94°C] → for 10 min

↓

Denaturation of DNA

② 45°C for 4 min

↓

Annealing of Primer

③ 72°C for variable time

↓

DNA Polymerisation (elongation)

72°C → Optimum temp for Taq Polymerase

↓

Same sample is repeated to get multiple sample of same taget DNA

PCR

↓

Cyclical Rxn

Clinical application → ① In IVF

② to detect infectious agent

③ Prenatal genetic diagnosis

④ Tissue typing for transplantation

⑤ to study evolution

PCR can be done for DNA, RNA

↓ ↓

PCR RT-PCR

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

RTPCR → Reverse transcriptase PCR

→ RNA
→ Tth Polymerase (Thermus thermophilus)
↳ having additional DNA Polymerase Reverse transcriptase activity.

Mg++
Primer
dNTPs (4)

Real time PCR (qPCR → quantitative)

PCR product can be quantified at any moment by looking at the amount of fluorescence.

Can be done for DNA as well as RNA.

→ DNA
→ DNA Polymerase
→ dNTPs (4)
→ Dye (Real time Dye) ← fluorescent dye
↳ SYBR green dye
↳ Molecular beacon dye
↳ Taq man dye

Mg++

M/c & most non-toxic dye → SYBR green dye.
↳ Intercalate the DNA (बीच में घुसना)

In PCR we use DNA Polymerase only once (Not in each cycle) as they are thermostable.

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Q. Which is not req. in PCR-

(1) dNTD
(2) Thermostable enzyme
(3) dideoxyribonucleotide → will stop DNA Synthesis abruptly
(4) DNA template

DNA was used for DNA Sequencing by Sanger

↓

Sanger's enzymatic DNA sequencing

↓

dideoxynucleotide trail sequencing

↓

Replication stopped by use of ddNTD. Can also be used to detect the mutation

MICROARRAY (DNA CHIP)

also known as "Comparative genomic hybridisation (CGH)"

Principle → Hybridization

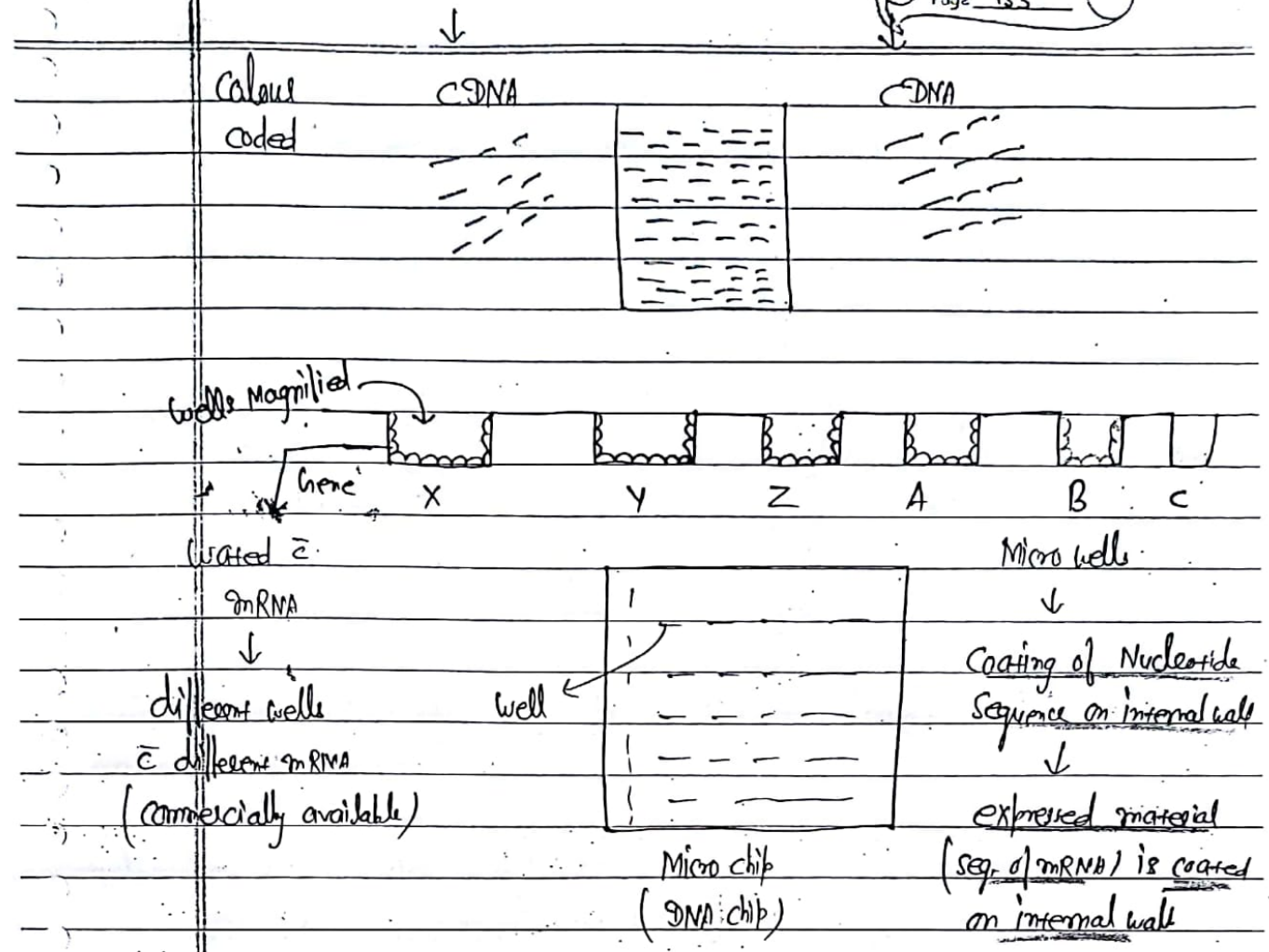
Compare the genome of two cells →

A → Isolate mRNA

B → mRNA

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 153



all wells are filled with cDNA

Let the chip hybridize

Wash (unbound cDNA washed away)

different wells are now showing different colour

Maxm wells → Yellow colour
Red colour → Annealing of cDNA (this gene only in B cell)
Yellow colour → Hybridization
↳ So, particular gene is present in both cell

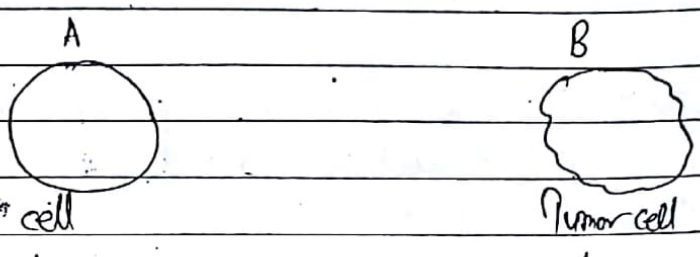
Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Green colour → gene only present in cell A

Black colour → gene not present in any cell

eg →



Microarray will tell us → gene (A) in Normal cell but suppressed in tumor cell

→ gene Not expressed in Normal cell but expressed in tumor cell etc

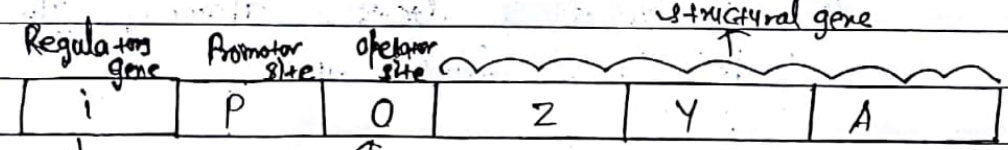
Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

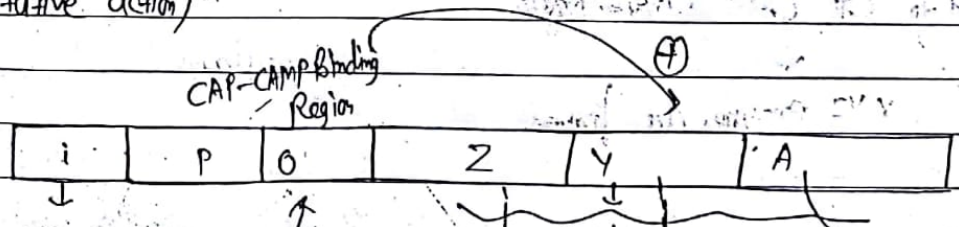
LAC OPERON MODEL

- 3 Structural genes, one Operator gene, one Promotor site & 1 Regulatory gene.
- Prokaryotic gene regulation model by Jacob & Monod.
- He explained why Lactobacillus is able to form enzyme of Lactose catabolism only in presense of Lactose & absense of glucose

Lactobacillus
↓ forms
enzyme of lactose catabolism
↓ only if
Lactose ⊕
glucose ⊖



i → LacI gene (Repressor gene) → ⊖ve Allosteric Modifier
↓
Produce Repressor protein (constitutive action) ⊖



Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

- lac I gene bind to operator gene
- RNA Polymerase bind to promotor area but not able to move further b/c operator is not free
- operator becomes free → in presence of Lactose
  Lactose —(+)→ Allolactose (induces)
  ↓
  Inhibit binding of Repressor protein to operator Area.

9| glucose is present — CAP-CAMP protein is not formed
So, Lack of glucose is also must. ↓
∴ Positive allosteric modifier of lac operon.

So, in presence of lactose & absence of glucose enzyme Synthesis by Lactobacillus occurs.

Lack of glucose → Protein CAP → CAMP formation
↓
Transcription
↓
Translation
Bind to CAP-CAMP Binding Regio
↓
X Y Z enzymes are formed

CAP ⇒ Catabolite Activator Protein
↳ Positive Regulator ∴

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Hb → ④ globin + ④ Heme (Prosthetic group)
Date 157
• one gram of Hb contains 3-34 mg of iron.

HEME SYNTHESIS → See Page 230 & 231

In Bone marrow (85%) & Liver (15%)

No Regulation → ALA-II enzyme

Regulated Pathway → ALA-I Synthase → Q Rate limiting enzyme

Partly mitochondrial partly cytosolic

Precursor → Glycine & Succinyl choline

	Deficiency	Condition
Hepatic Porphyria ①	PBG (Porphobilinogen) Deaminase / UPG-I Synthase	→ (AIP) Acute intermittent Porphyria
Erythropoietic Porphyria ②	UPG (Uroporphyrinogen) III Synthase	→ (CEP) Congenital erythropoietic porphyria
Hepatic Porphyria ③	UPG III Decarboxylase	→ Porphyria cutanea tarda (Mc Porphyria)
Hepatic Porphyria ④	CPG (Coproporphyrinogen) oxidase	→ Hereditary coproporphyria ↳ also cause "Harderoporphyria" (erythropoietic Porphyria)
Hepatic Porphyria ⑤	PPG (Protoporphyrinogen) oxidase	→ Variegate Porphyria
Erythropoietic Porphyria ⑥	Ferrochelatase	→ Protoporphyria

* Soret bands → Sharp Absorption band near 400 nm; shared by all Porphyrins.

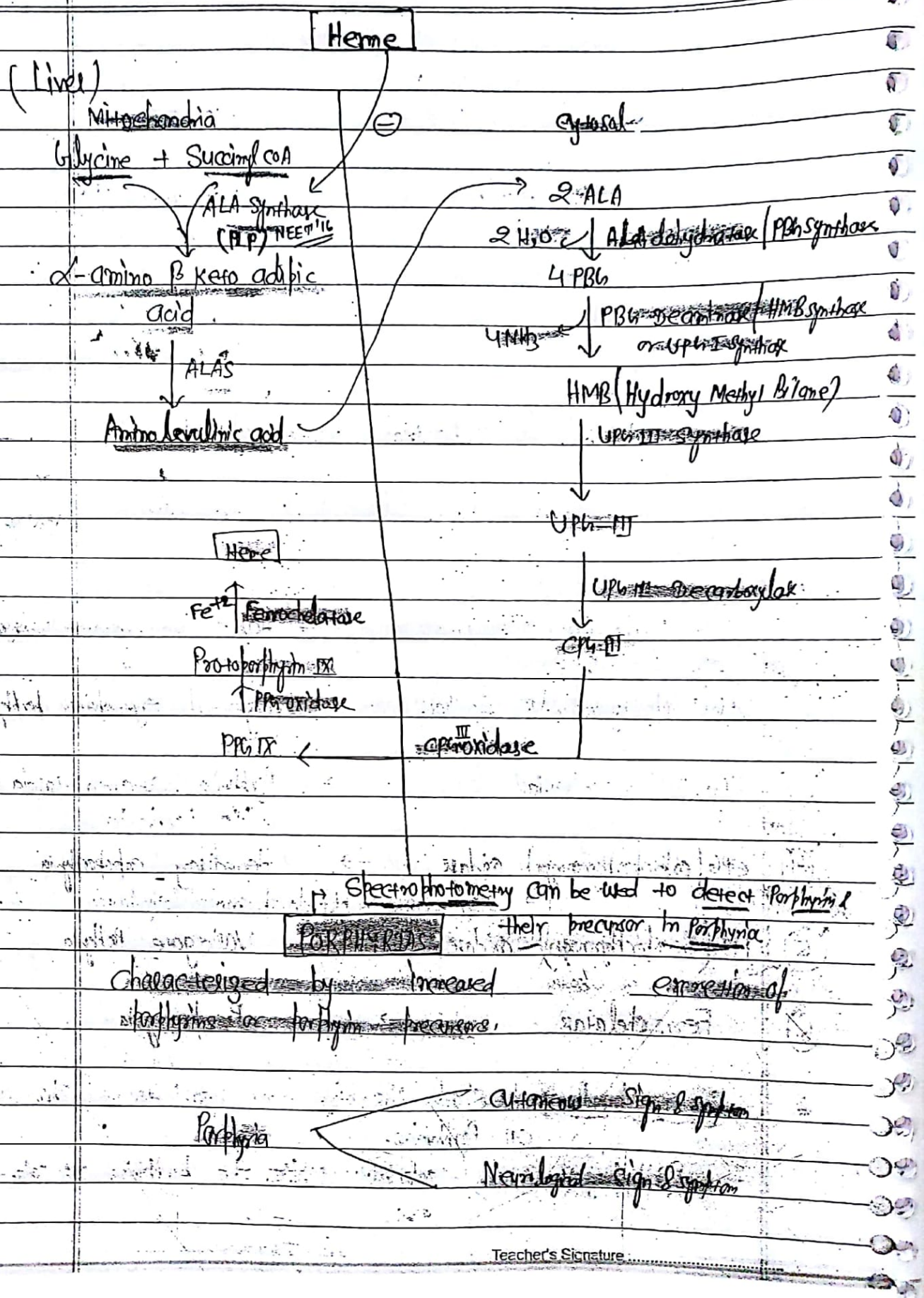
• Porphyrinogens are colorless; while the porphyrins are colored.

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Depression of ALA Synthase :⇒ biochemical basis of precipitation of Porphyria by barbiturates

Date
Page 158



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date 159

- ~~Ehrlich aldehyde test~~ + Porphobilinogen ~~& Uroporphyrin in Urine~~
- Uroporphyrin ⇒ Most water-soluble of the Porphyrins; excreted in urine
- Protoporphyrin ⇒ Least water-soluble; so; excreted only in bile

Purely Neurological	Purely cutaneous	Both
• Acute intermittent Porphyria	• Congenital erythropoietic Porphyria	• Hereditary coproporphyria
	• Porphyria cutanea tarda	• Variegate Porphyria
	• Protoporphyria	

- All Porphyria are ~~Autosomal dominant~~ except ~~Congenital erythropoietic Porphyria → Autosomal Recessive~~
- all of the above are "hereditary Porphyria"
- Acquired Porphyria → Plumbo porphyria
  - NEET'16
  - ↓
  - Lead affect ALA dehydratase > Ferrochelatase
  - ↓
  - Purely Neurological
- ~~ALA Synthase deficiency~~ → X-linked Sideroblastic Anemia

Porphyrinogen	Porphyrin
Reduced Porphyrin	-
Colourless	Coloured
X	Luminous
Methylene bridges	Methenyl bridges

Teacher's Signature .....

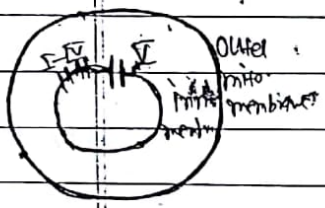
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Deficiency of complex I, Sometimes complex IV ⇒ MELAS (Mitochondrial Encephalopathy with lactic Acidosis)

Date
Page 160

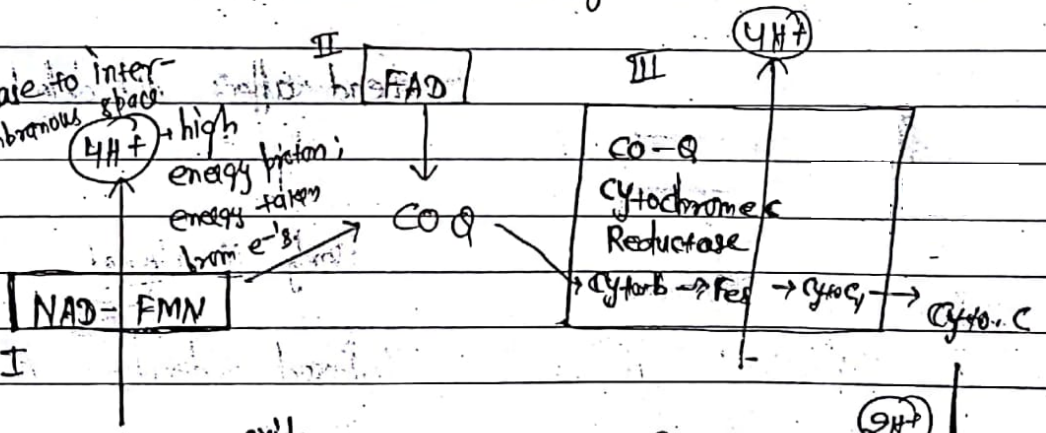
ETC

- Strength of Bond → Covalent > Electrostatic > Vanderwall (weakest) ***
- 5 complexes
- all complexes are present on Inner membrane of Mitochondria.



Complex I – IV → Particle form
Complex V → Channel form

- Class-I Enzymes { Oxidoreductase } I – IV → Oxidation
  V → Phosphorylation
  ↓ also known as "ATP Synthase".
  "Oxidative Phosphorylation occurs here".



Complex I ⇒ NADH – CoQ oxido Reductase (NADH dehydrogenase)
Complex II ⇒ Succinate – COQ reductase (FADH2 – CoQ OxidoReductase)
Complex III ⇒ CO Q – Cysto. C reductase (cyto-c Reductase)
Complex IV ⇒ Cytochrome C. Oxidase

- Free Mobile component → COQ, Cyto-C
- Last e⁻ acceptor → O2

→ Reduction potential of K^+ → -2.93

→ NADH (derivative of Nicotinic Acid) & $FADH_2$ (derivative of Riboflavin) Serves as the substrate for ETC by donating their electron.

Date
Page 161

• Criteria for this arrangement → Redox potential
Means e⁻ Release easily

• Redox potential ---> NAD+ → −0.32 V (Min)
O_2 → +0.82 V take e⁻ easily.

Fe^{+3}/Fe^{+2} → +0.772 ; Fe^{+3}/Fe^{+2} in cytochromes → b^* +0.077 ; c_1 +0.22 ; c +0.254 ; a −0.29 ; a_3 +0.29

• Redox potential difference across ETC → 1.14 V

• When NADH is starting point → Complex II not encountered.

• When $FADH_2$ is starting point → Complex I is not encountered.

↳ bc difference of Redox potential b/w Co Q & FAD is very low.

• Complex II → Not accumulating any proton in inter-membranous space.

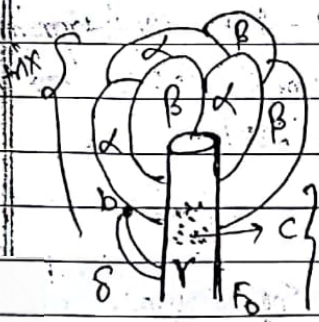
जैसे-जैसे Complex I → IV तक जाएंगे ; e⁻ accepted easily & Release energy.

• NADH → 10H+ → 2.5 ATP

$FADH_2$ → 6H+ → 1.5 ATP

4 proton → for formation of one ATP.

Complex V ⇒ • **ATP Synthase (Multisubunit complex)**



In Matrix

γ → Hollow Subunit

3α, 3β, c, δ, b Subunits

→ like a channel along inner membrane

• "Oxidative Phosphorylation" occurs at here.

Teacher's Signature .....

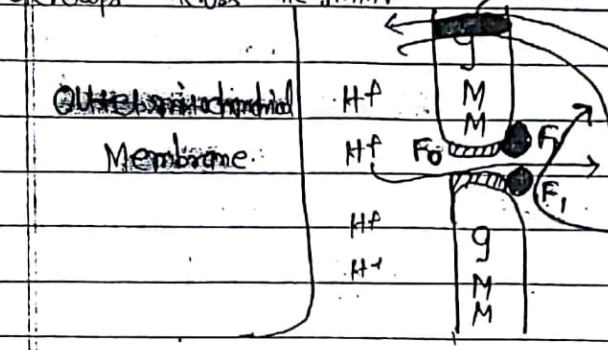
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 162

Atractyloside ①

electro-chemical gradient develops across the IMM.

ADP-ATP antiport



* CHEMIOSMOTIC MODEL OF PETER MITCHELL → Oxidative Phosphorylation

Movement of H^+ is due to proton gradient
↓
rotation of γ Subunit occurs.
↓
Produces Catalytic activity in β Subunit
↓
[ADP + iP → ATP] ATP Synthase activity
↓
In Matrix

[1β → 1ATP ∴ 3β = 3ATP]
↳ due to 360° of γ → 3ATP formed

Inhibitor of F_0F_1 ATPase in ETC
Oligomycin ②
↓
Block the holloconers of γ
↓
Channel block
↓
No ATP Production
↓
∴ oxidation ⊕ Phosphorylation ⊖
↓
In long term oxidation also stop due to ↑↑ H^+ in intermembrane space

Atractyloside → Inhibit ATP-ADP anti-transporter
↳ ATP not formed due to lack of Substrate (ADP).

UNCOUPLERS → [Both oxidation & Phosphorylation occur independently]

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

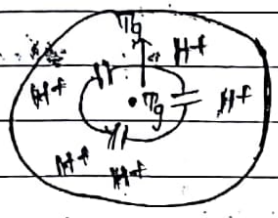
RNA Primer Synthesized by → DNA Primase

Date 4/5
Page 163

Uncouplers → compound that can uncouple the electron transport from oxidative Phosphorylation

Natural

- Thermogenin (Tg) → Permeable across IMM
  - Protein found in Mitochondria of Brown adipose cell
  - Tg releases high energy H+ of IM space to low energy H+ of matrix across membrane
  - Protonation of Thermogenin → Heat released
  - once protonated it goes to matrix
  - Release H+ in matrix
  - This proton can't form ATP.
  - ATP only formed via complex V
  - ∴ Less Phosphorylation is occuring



- Physiological Uncouplers → Inhibit ATP Synthase only Not ETC
  - FFA
  - T_3, T_4
  - Bilirubin

Chemical

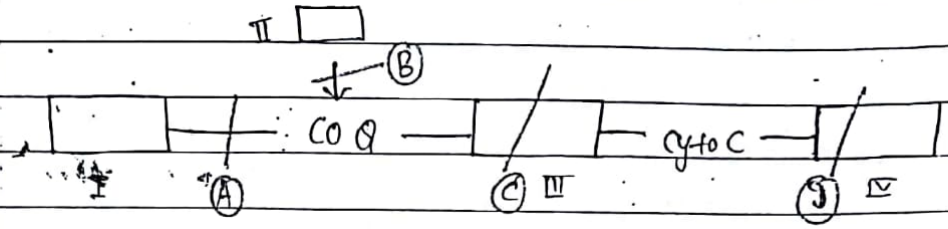
- 2,4-dinitrophenol
- 2,4-dinitrocresol
  - damage the inner membrane
  - Make Perforation (Non-catalytic) in inner membrane
  - H+ can cross these pores
  - No ATP formed
  - H+ Pasing through complex V
  - ATP formed
  - ⇒ Less Phosphorylation
- CCCP ⇒ chloro carbonyl cyano phenyl hydrazone

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

ETC Inhibitors :-

Chemicals which inhibit ETC at some point.



(A) Complex I blocker (b/w I & CoQ)

PAR
- Piericidin
- Aminobarbital (Barbiturate)
- Rotenone

(B) Complex II (b/w II & CoQ)
- Carboxin
- TTFA (Tetrathiofluoroacetate) / Trithionylfluoroacetate

(C) Complex III
- BAL (British Antilewisite)
- Antimycin A

(D) Cyanide → cyto-c
- Carbon monoxide
- H_2S
- Sodium azide
- CN

Complex IV

CO_2 more toxic

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

- Reactive oxygen species ⇒ Incomplete Reduction of O_2 & generation of Reactive oxygen Intermediates

Date
Page 165

↳ also known as ROR (oxygen free Radical), ROM (Reactive oxygen Metabolites), AO (Active oxygen)

FREE RADICALS Reactive oxygen intermediate

- Free Radical are molecule or molecular fragment which are having one or more than one unpaired e⁻ in the outer orbit.

eg → Superoxide [O_2^-]

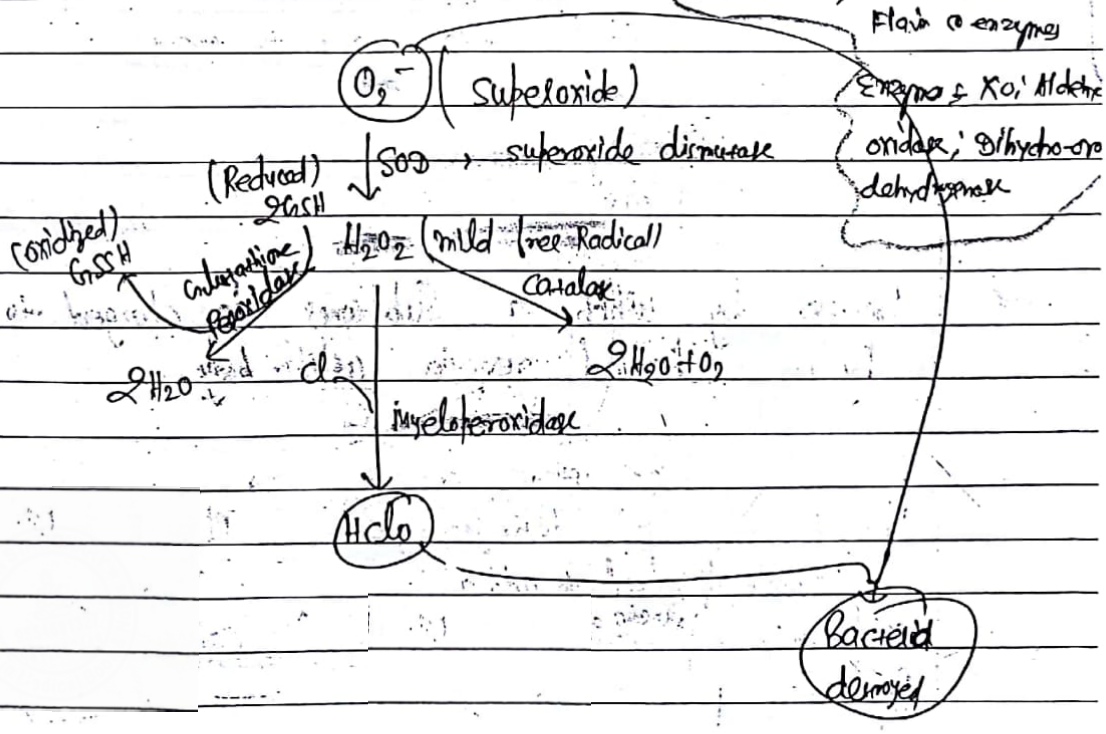
H_2O_2

OH⁻ (Hydroxyl) → Most potent Free Radical

[O] → Nascent oxygen.

- Source of free Radical →
  - Exogenous Agents (CCl_4, Ionizing Radiation, cigarette smoking);
  - Respiratory Burst
  - Electron leakage;
  - Enzymatic Rxn; ETC (Major source)
  - viral infection
  - UV rays
  - Normal oxidation - Reduction Rxn

→ Free Radical Scavenging System → Autoxidn of Adrenaline, thiols; Ascorbic acid; Flavo enzymes



Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

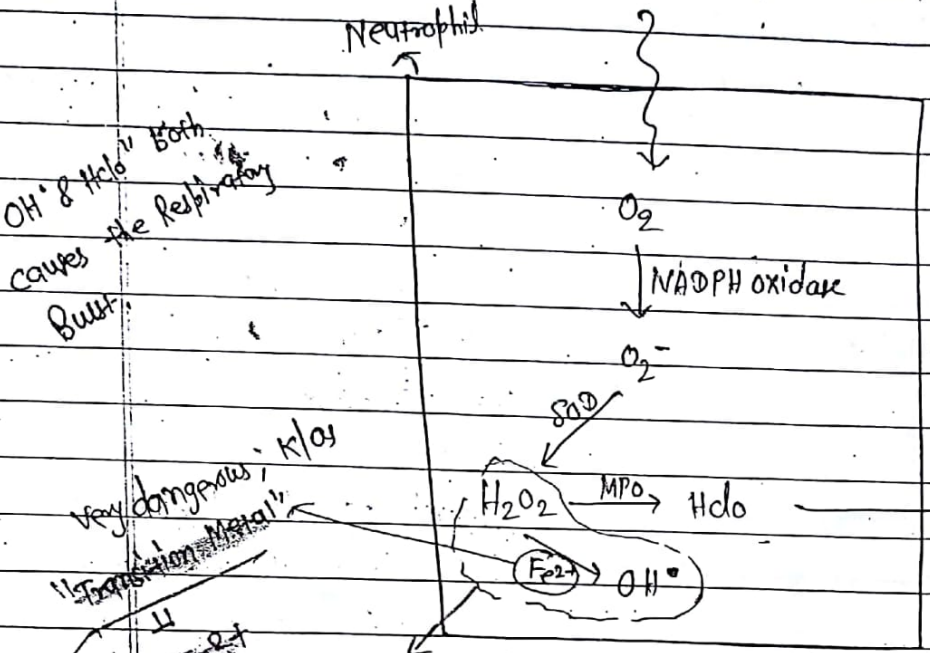
Date
Page 166

Respiratory Burst

A large amount of O_2 is consumed by macrophages during their bactericidal function

⇓

this phenomenon is K/as "Respiratory Burst".



Biotransformation & Detoxification of Xenobiotics

Process by which a substance is changed to other by a chemical reaction within body

- Phase I → Results in detoxification
  - ⇓ attraction of molecule to add a functional group
  - Oxidation;
  - Reduction;
  - Hydrolysis;
  - ↑ addition of some functional group
- Phase II
  - ⇓
  - Conjugation Rx

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 167

Phase I
- → Hydrolysis
- → Dealkylation
- → Epoxidation.

Phase II
↓
Conjugation Rx^n
- Easily excretable
- Conjugation with →
  - glucuronic acid
  - glycine
  - Acetylation
  - cysteine
  - Glutathione - if whole glutathione involved it lies in phase III
  - Methylation
  - Glutamine
  - Sulphate donated by PAPS (Phospho adenosine phospho sulphate)

Conjugate of bilirubin ←

γ-glutamyl-cysteinylGlycine ←

Dipeptide glutathione ← (Glu-cy-Gly)
↓
Conjugation active of cysteine of glutathione

Phase III → Very Rare
↳ When conjugation is with whole glutathione

- Cyto. 450 ⇒ Microsomal enzyme located on Smooth ER.
- Most of the drugs (xenobiotic) are metabolized by CYP-450 located on Smooth ER.

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

- Enzymes ↑ Rate of Rxn by ↓ activation Energy (Free energy difference b/w Substrate & transition state)
- Most coenzymes are derivatives of Vit. B (Biotin, Folic acid 168 organic)

Thiamine (B_1); Riboflavin (B_2); Niacin; Pyridoxine (B_6); Co-enzyme → organic
Cyanocobalamin, Pantothenic acid.

ENZYMES

Co-factor → Inorganic

- Ribozymes ⇊ Enzyme; which is not a protein, RNA Molecule
- Ceruloplasmin; Cyto C; Tyrosinase; ALA Synthetase; MAO; SOD; Phenoloxidase (convert Fe^{+2} into Fe^{+3}) — Selenium → Glutathione Peroxidase
- Cu^{+2} → cytochrome oxidase, Lysyl oxidase
- Zn^{+2} → Carbonic anhydrase, Carboxypeptidase, RNA Polymerase, Superoxide dismutase, Alcoholic dehydrogenase, Lactate dehydrogenase, Glutamate dehydrogenase, Alkaline phosphatase
- Fe^{+2}/Fe^{+3} → xanthine oxidase
- Mo → Xanthine oxidase, Sulphite oxidase
- Mg^{+2} → Phosphatase, kinase, Glutathione Synthetase (NEET)

→ Holoenzyme (complete enzyme)

Protein part (Apoenzyme) — Co-enzyme

Non-protein part — Co-factors

- Classification → OTHLIL

EC (Enzyme code)

EC number consists of four digits → EC (A.B.C.D)

EC → (I)	Oxidoreductase	Main class
EC → (II)	Transferase	Sub class
EC → (III)	Hydrolase	Sub-sub class
EC → (IV)	Lyase	Individual enzyme
EC → (V)	Isomerase	
EC → (VI)	Ligase	

Cleavage of Bond with help of H_2O (Irreversible)

Eg → Max^m (VI^th) enzymes (Urease, Pepsin, Trypsin)
- Urease ⇊ cut Other CN bond
- Pepsin, Trypsin; Peptidase ⇊ cut Peptide bond
- Ligase ⇊ cut ester

(I) Oxidoreductase → involved in transfer of Hydrogen (oxidation & Reduction)

Eg → Dehydrogenase → acceptor of hydrogen is coenzyme (NAD+, NADP+)
Oxidase → O_2 molecule - acceptor of hydrogen
Peroxidase → H_2O_2 molecule - acceptor of hydrogen
Oxygenase → Incorporating oxygen atom in the Substrate molecule with the help of H_2.

Dioxygenase ⇊ Tryptophan Pyrrolase

Eg → Hydroxylase ⇊ is Monooxygenase

Other Eg → Catalase, Reductase

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Prosthetic group ⇒ Co-enzyme covalently bound c enzyme
  ↳ Metal constitute M/c type of Prosthetic group

Date
Page 169

(II) Transferase ⇒ Transfer any group other than Hydrogen
eg → All Kinase (Hexokinase, Glucokinase)
Branching enzyme, DHL transacetylase (PDH complex)

(III) Lyase ⇒ cleaves bond without H_2O [Reversible/Irreversible]
eg → Aldolase ↳ Atom elimination & leaving double bone behind $(-\overset{|}{C}=\overset{|}{C}-)$
Fumarase
Decarboxylase
Arginosuccinate lyases
Synthase (if rxn is Reversible)
↳ $AB \rightleftharpoons A+B$
Hydratase & Dehydratase NEET'16

(IV) Ligase ⇒ Two molecules are united with the help of ATP
eg → Synthetase (PRPP Synthetase, Arginosuccinate synthase)
Carboxylase (Pyruvate carboxylase)

(V) Isomerase ⇒ Atom in a compound is Redistributed (Geometrical Reorganization)
eg → Mutase
epimerase
Aldo-keto isomerase

ENZYME INHIBITORS

1. Competitive ⇒ They are drugs during Prick formation

Vmax →	Same
Km →	Raised

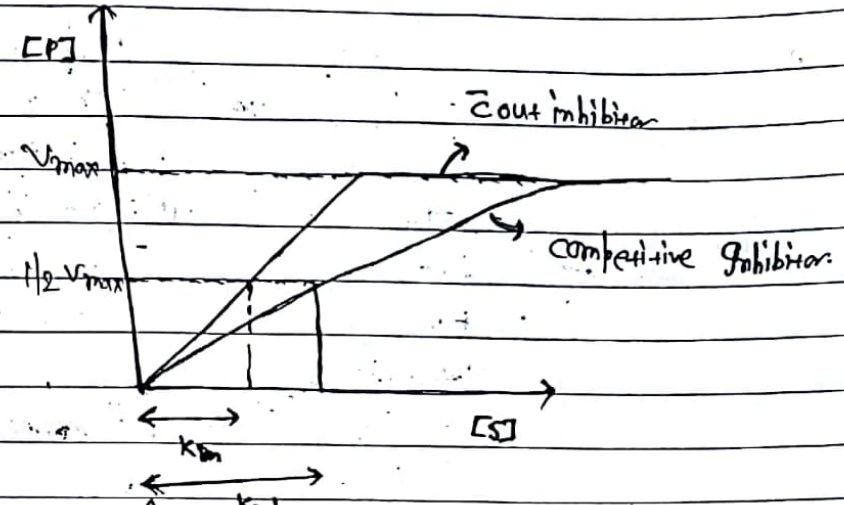
eg → Malonate inhibiting Succinate dehydrogenase
Sulpha drug as a PABA analogue
↓
Req. by bacteria for Folic acid synthesis
Statin → HMG CoA Reductase Inhibition
Methotrexate → DHF Reductase Inhibition.
Fluoroacetate → Inhibition of Aconitase
Thiosemicarbazide → Inhibition of Urease

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

The Substrate bind to Active sites by "Non covalent" interactions like H-bond, Ionic (electrostatic) bond & Hydrophobic bond.

Page 170



- Dicumarol (Vit. K inhibitor) ⇒ Anticoagulant

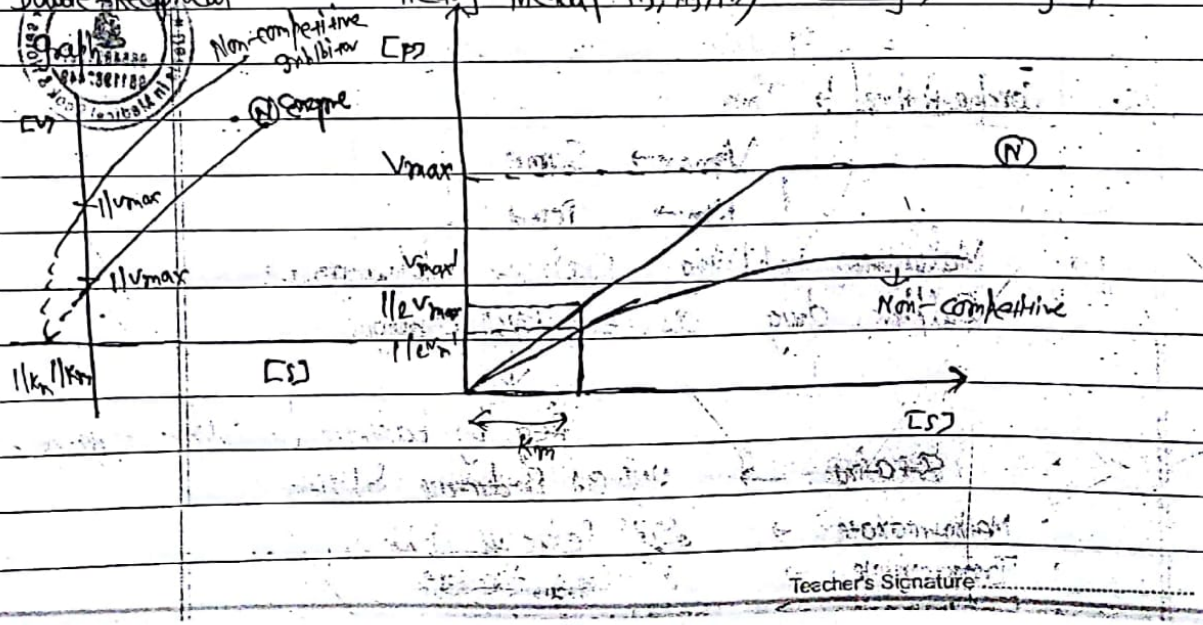
2. Non competitive (Mixed type of inhibitors)

They are Poisons Mainly as trick to Memorize

V_{max} → ↓se
K_m → Same

eg →
- Organophosphate poisoning as AchEase inhibitor
- cyanide as cytochrome oxidase (cyto c) inhibitor
- Fluoride as Enolase inhibitor
- Iodoacetate as Glyceraldehyde-3 Poy inhibitor
- Heavy Metal (Hg, Ag, Pb) blocking → SH-group

Double Reciprocal Graph



Teacher's Signature:

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Abzyme → Antibody with catalytic activity.

Uncompetitive Inhibition
Enzyme
1/Vmax
1/Vmax
On Double Reciprocal graph
-1/Km
1/Km

3. Uncompetitive

Vmax → ↓es
Km → ↓es

[V]
Vmax
Vmax
Vmax/2
Km
eg → Inhibition of Placental ALP by Phenylalanine [3]

4. Suicidal inhibition ⇒ Enzyme own catalytic activity to convert a less potent inhibitor → More potent Xanthine Inhibitor.

Xanthine oxidase ← Xanthine ⊖ Allopurinol
Allopurinol → Xanthine oxidase
Uric acid
Alloxanthine

K/a "Mechanism based inactivation": Drug become more poisonous by using the mechanism of some enzyme.

5. Irreversible inhibitor :-

Km → No effect
Vmax → ↓es

eg → Cyanide inhibits cytochrome oxidase (Respiratory chain) Irreversibly & Non-competitively.

AIIMS * "cyclooxygenase" ⇒ K/a "Suicide enzyme" b/c it catalyzes its own destruction.

Lineweaver - Burke plot ⇒ K/a "Double Reciprocal plot" (b/w 1/v & 1/s)

Competitive inhibitor
1/v
Normal Enzyme
Competitive Inhibitor ⇒ Km more, so 1/Km less
1/Vmax
(1/Km) value
(1/Km')

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 172

NUTRITION

MICRO-NUTRIENTS

- Macrominerals
  - → 9t- constitutes 60-80% of body's inorganic material.
  - → Ca^{+2}, PO_4^{-3}, Mg^{+2}, Na^+, K^+, Cl^- & SO_4^{-2}
  - → 9t- requires in amount greater than 100 mg/day
- Microminerals
  - → 9t requires in amount less than 100 mg/day

Essential trace elements	Possibly essential trace elements	Non-Essential trace elements
eg → Fe, Cu, I, Mn, Zn, Mo, Co, F, Se, Cr	eg - Ni, V, Cd, Ba	eg- Al, Pb, Hg; B, Si, Bi

→ Zn, Mn, Cu, Se ⇒ Antioxident Property!!

MACRO-NUTRIENTS

- → Carbohydrate → 65-80% of total Energy
- Fats → 10-30% of energy intake
- Protein → 7-15% of energy intake

→ Respiratory Quotient (RQ) :- Ratio of volume of CO_2 produced by a volume of O_2 consumed.

$$RQ = \frac{CO_2 \text{ Produced}}{O_2 \text{ Consumed}}$$

(High/Low) Carbohydrate = 1

Mixed diet = 0.85

Protein = 0.8

(Fat/Lipid = 0.7

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

→ SPECIFIC DYNAMIC ACTION (SDA) :→

It is the extra heat production by the body, over and above the calculated caloric value, when a given food is metabolized by the body.

Calculated Energy from food	=	Actual Energy	+ SDA

Calorific value →

Carbohydrate → 4Kcal/gm
Protein → 4Kcal/gm
Lipid → 9kcal/gm

After consumption of these product we get some less energy than calorific value, b'coz some energy is invested in digestion assimilation (SDA)

SDA → Protein → Max^m
→ 30% of its calorific value

→ Carbohydrate → 5% of its calorific value

→ Fat → 15% of its calorific value

→ Mixed diet → 10% of its calorific value

→ SDA is extra energy consumed in digestion, absorption & assimilation of food

→ Thermogenic effect of food → Rise in Metabolic Rate after ingestion of particular food. Result in an rise in the amount of heat generated by the body.

AIIMS - May 17 Protein > Carbohydrate > Lipid → order of thermogenic effect.

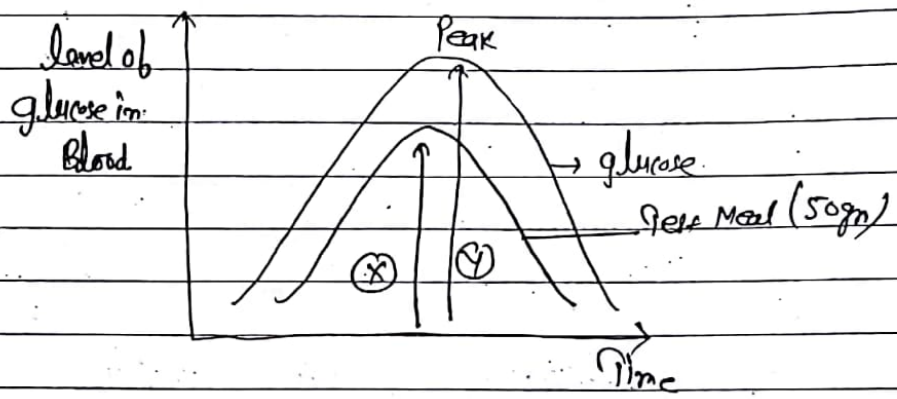
Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Glycemic Index :-

Give 50gm glucose to person & assess blood glucose level over time.

Glucose tolerance curve :-



$$\text{Glycemic index} = \frac{X}{Y}$$

Ratio of incremental area under the glucose tolerance curve after 50gm of ingestion of test meal that of 50gm of glucose is "Glycemic index"

Potato chips → 80-90
Bread → 70-79 = White Rice
Brown Rice → 60-69
Banana → 60-69
Legumes, Peanuts → 05-40
Milk, Icecream → 35-40

↓
Less absorption hence less rise of blood glucose

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Dietary fibre → The complex carbohydrates that are not digested by human enzymes

Insoluble fibre → prt. in vegetable & grain

- ↳ it absorbs H_2O & swell up
- ↳ it increases bulk of stool & reduces transient time

Eg → Cellulose;
Hemicelluloses
Pectin;
Lignin;
Grains;
Gums.

Limiting AA :→ deficient AA

Pulses → Methionine [Met]
Cereals → Lysine [Lys]

Biological value :→ to assess the protein quality.

$$BV = \frac{N_2 \text{ Retained}}{N_2 \text{ absorbed}}$$

Net protein utilization: Better index to asses the protein quality

$$NPU = \frac{N_2 \text{ Retained}}{N_2 \text{ Intake}} \times 100$$ ***

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

VITAMINS

Fat Soluble → A, D, E, K

Vitamin A [Retinoids]

Compounds having Vit A like activity

- β-carotene
- Retinal
- Retinal
- Retinoic acid

Retinal (oxidized) → Retinoic acid

Retinal Reduced → Retinol

**** 1 β-carotene = 2 Retinal

Sources → Liver oil, Butter milk, cheese, egg yolk, Pumpkin, Tomato, Carrot, Papaya, Mango, Sweet corn

RDA → 5000 IU/Day

- 1 Retinal equivalent = 1 Mg of Retinol = 6 Mg β-carotene
- Antioxidant & anticancer
- Retinol absorbed in GIT & stored in liver in the form of Retinyl Palmitate
- In man liver is the only organ where β-carotene is converted to Vit A

(Stored in liver as Retinal ester) Ans

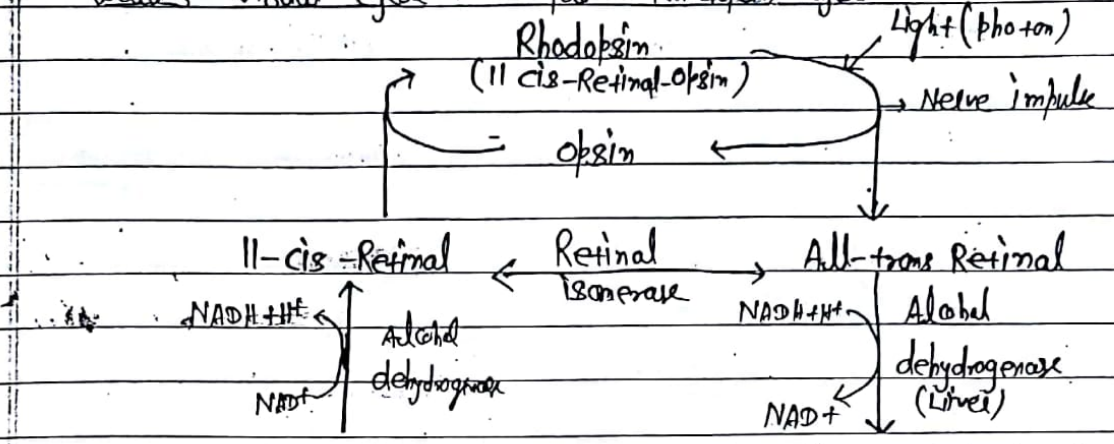
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

A, E → Antioxidant

Date
Page 171

Role → ~~Growth, vision, differentiation, reproduction~~

- Wald's visual cycle → Also "Rhodopsin cycle":



- Active form → 11 cis retinal
  ↓
  When combined with opsin form Rhodopsin
- Inactive form → All trans Retinal

Deficiency of Vit. A →

- Night blindness (Nyctalopia)
- Xerophthalmia ← dryness in conjunctiva & cornea
- Bitot's spot ← White triangular plaques in certain area of conjunctiva
- Urinary calculi
- Keratinisation of skin
- Keratomalacia ← destruction of cornea, causing total blindness

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

- Blindness
- Sterility in males → due to degeneration of germinal epithelium
- Hypervitaminosis A → Rupture of lysosomal*** membrane;
  - Pseudomotor cerebi
  - Bony Swelling

NEET'16 Headache & Papilledema" are found to be caused by increase in gcm.

Retinoic acid (action) →
- Gene expression;
- Tissue differentiation
- Glycoprotein Synthesis
- Mucopolysaccharide Synthesis
- Prevents keratinization
- Prevents collagen breakdown

Vit. A acts via → RAR (Retinoic acid Receptor) } Nuclear Receptor
RXR (Retinoid X Receptor)
↓
form dimer

Q8 Action of Nuclear Receptor → Vit. A & Vit. D

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Vit. D

- Prohormone
- Synthesized in body
- Major storage form → 25, OH cholecalciferol (calcidiol)
  ↓
  In liver
- Most potent form – (1), (25) Dihydroxy cholecalciferol (calcitriol)
  (1) ← Kidney
  (25) ← Liver
  ↓
  Active form

Biosynthesis of active form of vit. D →

7-Dehydrocholesterol (in Animals)

Sunlight → Skin

↓

Cholecalciferol (D_3, calcial)

↓ calcial 25-hydroxylase (liver)

25-OH cholecalciferol (calcidiol)

↓ calcidiol 1α-hydroxylase (kidney)

1,25-Dihydroxy cholecalciferol (calcitriol)

↳ active form.

~~g of Ca+2 ↑ → 24,25 di-OH cholecalciferol formed~~ (inactive)

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Source → Fish liver oil (Best Source (NEET'16)), egg yolk, Margarine

Provitamin → 7 dehydrocholesterol, ergosterol

↓

⊕ in skin → absorb UV → calcidiol

RDA → Adult → 200 gm/day

Pregnant, Lactation, children = 400 gm/day

old age = 600 gm/day

Role of vit. D → · GIT absorption of Ca^{++} & PO_4^{-3} & send them for bone mineralisation

· Renal absorption of Ca^{++} & PO_4^{-3}

· Excess dose of vit. D → toxic

Deficiency of vit. D → Rickets in children & osteomalacia in adults

Rickets → Bow-legs;
Plasma level of calcitriol
Alkaline phosphatase activity elevated;

* Excess dose for vit. A & vit. D both are toxic

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Vitamin E (Tocopherol)

- Anti-infertility & anti-oxident
- α-tocopherol → Most active form
  - ↳ Most potent antioxident.
- Sources → Cotton Seed oil;
  Corn oil;
  Sunflower oil;
  Wheat germ oil;
  Margarine;
  Soyabean;
  Cabbage
- RDA → Children → 10-15 IU/day (7mg/day)
  Adult → 20-25 IU/day (10mg/day)
- Role → Free Radical Scavenger
  Reproduction in Rats
- Therapeutically used in → Nocturnal Muscle cramp (NMC);
  Intrahepatic cholestasis (IC);
  Fibrocystic breast disease (FBD);
  Atherosclerosis
- Selenium → Vit E sparing effect (vit E like action)
- Prevent Rancidity of fat.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

compliments by liver → C_3, C_6, C_9

Vitamin K → Function depend on calcium

three different form :-

K_1 → Phylloquinone (alfaalfa, Spinach, Cauliflower, cabbage, Soyabean, tomato)

K_2 → Menaquinone (least potent) - by GIT bacteria

K_3 → Menadione (Most potent) - Synthetic Vit. K (injection)

Vit. K crosses placenta & is available to fetus.

Role of vit. K → γ-carboxylation of glutamic acid residue to clotting factor 2, 7, 9, 10 & calcium binding Protein (osteocalcin, Matrix Gla Protein) & Protein C, S, Z

- oxidative Phosphorylation

RDA → 50-100 mg/day

Immediate inj. of vit K to New born

Deficiency → Hemorrhagic disease of Newborn

Antagonist → Dicumarol, Salicylate, heparin, Warfarin-Coumarin, Cumarin

- Vit. K functions as a co-factor for an enzyme carboxylase that catalyzes post-translational modification of glutamate residues

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Vit A → 9so-tretinoic acid → Teratogenic → cleft lip
↓
Contraindicated in Pregnancy

Date
Page 183

Vitamin C (Ascorbic acid)

- Heat & alkali labile — Max^m in adrenal cortex
- Versatile vitamin
- It is hexose derivative & closely Resembles monosaccharide in structure

Source → Amla, Guava, Lime

RDA → ~~1 mg/day~~

- Involved in hydroxylation of lysine & Proline (Post translational Modification)

Req for → Synthesis of epinephrine
Tyrosine Metabolism

Richest Source → Indian gooseberry (Amla)

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

AI+B → 5 of "B" vitamins participate in the release of energy from carbohydrate, fat & proteins ⇒ B_1, B_2, B_3, B_5, B_7.

~~"Antiberiberi vitamin"~~

Date 5/3/
Page 184

Vitamin B_1 (Thiamine)

→ also known as "Aneurine, Anti-beri-beri factor"

→ Found in "~~outer layer of cereals~~"

↓

~~outer layer~~ → ~~Removed by Polishing~~;

So, Unpolished Rice is good source

→ Made of Pyrimidine Ring & Thiazole Ring

→ Source → Cereals, Pulses, Liver, Pork, Meat, Egg, Milk etc.

→ TPP → Thiamine Pyrophosphate

– Coenzyme of

1. PDH complex;
2. α-Ketoglutarate dehydrogenase complex;
3. Branched chain α-Ketoglutarate dehydrogenase;
4. Transketolase; (Q)
5. Tryptophan Pyrrolase
6. Pyruvate carboxylase

→ "RBC transketolase" activity is used to assess Vit. B_1 in the body

↓ RBC transketolase activity

↓

Earliest Manifestation of Vit. B_1 deficiency

→ RDA = 1.5 mg/day

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 85

Deficiency → Beri-Beri :
Wernicke's Korsakoff's Psychosis :
Lactic Acidosis (Pyruvate ⇸ Acetyl CoA
Pyruvate → LA)

· Vitamin B_2 (Riboflavin)
· Yellow vitamin of Warburg.
· D-Ribitol attached to 6,7-dimethyl isoalloxazine by Nitrogen
↓
heterocyclic 3 Ring structure
· FMN, FAD are its two Coenzyme form.
· FMN → Cyto-c Reductase, L-amino acid oxidase
· FAD → Xanthine oxidase
D-amino acid oxidase
Aldehyde oxidase
Succinate dehydrogenase
Glycine oxidase
Acyl CoA dehydrogenase
Riboflavin Status
↓
Glutathione Reductase
→ RDA → 1.5 mg/day
→ Deficiency → Glossitis, cheilosis, Angular stomatitis, Circumcorneal vascularization, Proliferation of bulbar conjunctiva,
· Seborrheic dermatitis
→ Source → Liver, Yeast, egg, milk, fish, cereals

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Riboflavin → FAD | FMN
Niacin → NAD | NADP
→ oxidⁿ - Redⁿ Rxⁿ

Date
Page 196 Synthesized in body from Tryptophan.

Vitamin B_3 (Niacin) → Known as "Endogenous Vitamin"

- Pellagra Preventing factor of Goldberger.
- NAD, NMN & $NADP^+$ → Coenzyme form
- → NAD^+ →
  - Isocitrate dehydrogenase
  - alcohol dehydrogenase
  - Lactate dehydrogenase
  - Malate dehydrogenase
  - Glyceraldehyde-3-P dehydrogenase
  - PDH complex
  - α-KG Dehydrogenase complex
  - β-hydroxy acyl CoA DH
  - → function as ADP-ribose donor for ADP ribosylation
    - ↓
    - DNA Repair Mechanism
- → $NADP^+$ →
  - G6PD
  - Glutathione Reductase
- → Either NAD^+ or $NADP^+$ →
  - Glutamate dehydrogenase
  - Isocitrate dehydrogenase — cytosolic Need NADP
  - Mitochondrial NAD
- → Deficiency → Pellagra → Dementia, Diarrhoea, Dermatitis, Death.
- → RDA → 20 mg/day.

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

NEET 16 ★ High Leucine cause Niacin deficiency.

* Pellagra is characterized by Hypersensitivity to Sunlight (Sun exposed area present ē erythema, ~~desquamation & hyperkeratosis = hence presents as "Casal Necklace"~~).

Source → ~~Yeast~~, Rice, Liver, Peanut, Whole cereal, Legumes.

Pellagra Seen in → Hartnup's disease, carcinoid, Maize eaters } Tryptophan deficiency

★★ Tryptophan (60mg) —B_6→ Niacin (B_3) (1mg)

Vitamin B_5 (Pantothenic acid)

→ Act as co-factor after modification to Pantotheine

Pantothenate + cysteine ⟶ Pantothiene

→ Also " Filtrate factor / chick anti dermatitis factor "

→ Consist of β-alanine & Pantoic acid

~~CoA~~ → Active form [CoA-SH] Active moiety of CoA ↓ Thiol of Pantotheine

→ Richest Source → Royal jelly

→ Deficiency → ~~Burning feet Syndrome~~

→ RDA → 10 mg / 2500 cal [CoA → Acetylation]

→ deficiency ~~is very Rare~~ bc it is present in almost all food items

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 188

Vitamin B_6 (Pyridoxine)

→ Rat anti-dermatitis factor

→ Pyridoxine, Pyridoxal, Pyridoxamine (Vitamers of B_6)

→ Source → Yeast, Rice Polishing, Seed, grains, egg yolk

→ Richest Source → Royal jelly

→ Tryptophan Load test QQ

– High dose of Pyridoxine → Neurotoxicity

– B_6 Requirement ↑s with ↑ in intake of Protein

→ **Role of B_6** :
- Transaldolase activity
- Transamination
- Decarboxylation of AA
  - Glutamate → GABA
  - Histidine → Histamine
  - 5-OH Tryptophan → Serotonin
  - Cysteine → Taurine
  - Serine → Ethanolamin

→ deficiency of Pyridoxine causes Niacin deficiency

→ Sulphur containing AA formation requires B_6 (PLP)
- Cystathionine β Synthase
- Cystathionase

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 189

→ ALA Synthase
Kynureninase
AIIMS Nov'13 → Glycogen phosphorylase
} PLP co-enzyme

→ RDA → 1.5 mg/day

→ Deficiency → Epileptic convulsion in infant
Hypochromic Microcytic Anemia

→ Assessment of B_6 status → RBC transaminase activity
- Xanthurenic acid index

Vitamin B_7 (Vit. H / Biotin / Coenzyme R / Bios)

→ Anti egg white injury factor

→ Heterocyclic, Monocarboxylic Sulphur containing

→ Needed for *Carboxylation* Reaction :
- Acetyl CoA Carboxylase
- Propionyl CoA Carboxylase
- Pyruvate Carboxylase
- β-Methyl Crotonyl CoA carboxylase

→ Deficiency → Leiner's disease

→ RDA → 200-300 mg/day

→ Source → Bacteria, Yeast, Leaves, Soybean, Yolk

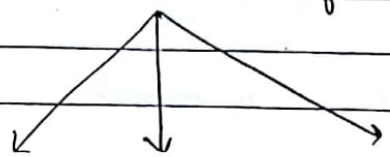
Uncooked egg white (Avidin) → Biotin absorption

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Vitamin B9 | Folic acid | Vit M | Fermentation Residue factor

→ Folic acid consists of three components



Pteridine Ring — PABA — glutamic acid

↓

p-amino benzoic acid

→ Imp. for "one-carbon Metabolism"

↓

use as carrier

Major form of Folic acid to transfer 1-c unit → Methylene THF

→ Active form → THF (FH4)

→ Blood form of Folic Acid → Methyl THF.

→ RDA → 200 Mg/day

400 Mg/day (in Pregnancy)

300 Mg/day (in Lactation)

→ FIGLU excretion test / Histidine load test

→ Trimethoprim (Antagonist of drug Septran or Bactrim)
Pyrimethamine (Antimalarial drug)

↳ Structurally related to folic acid

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 191

Vitamin B_{12} (COBALAMIN)

- Red Vitamine
- Antipernicious anemia factor / Extrinsic factor of castle / Animal protein factor
- Corrin Ring with central cobalt atom.
- Forms → Cyanocobalamine
  Methyl cobalamine
  Hydroxy cobalamine
  Adenosyl cobalamine
- → Source → Food of animal origin are the only source
- → Strict vegeterians → Vit B_{12} deficiency.
- → NEET'16 Only water Soluble Vitamin Stored in liver (2.5mg)
  ↓
  Used for years; as requirement is very less
- → RDA → 2-3 mg/day
- → Absorption → Intrinsic factor (Parietal cell of stomach)
  +
  B_{12} (extrinsic factor)
  ↓↓
  Ileum

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Action →

NEET'16 (1) Synthesis of methionine from homocysteine :→

Homocysteine —(B12 + FA)→ Methionine

Enzyme ↓

Homocysteine Methyltransferase

N^5-Methyl THF → THF

NEET'16 (2) Isomerization of Methylmalonyl CoA to Succinyl CoA :→

MMCoA —Isomerization (B12)→ Succinyl CoA

Deficiency :→ (1) Pernicious Anemia;

NEET'16 (2) Methyl malonyl aciduria;

(3) SCAD (Short-chain Acyl CoA dehydrogenase deficiency)

NEET'16 (4) Folate trap (Most of FA is trapped as N_5-methyl THF)

Methyl-THF —B12→ THF

Q. Major circulating form of folic acid → Methyl THF

Q. Major form of FA to transfer 1C → Methylene THF

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 193

Chromium, Zinc → Insulin
Cobalt → B_{12}
Copper → Lysyl oxidase

Vitamin involved in Energy production →
B_1, B_2, B_3, B_5, B_7

Post-translational Modification →

NEET'16
Vit. B_7 & K → Carboxylation
Vit. C → Hydroxylation
B_5 → Acetylation

CORT's CYCLE → Seen b/w Exercising Muscle & Liver.
Lactic Acid cycle

Anaerobic glycolysis in Muscle = Lactic Acid (Muscle)

Glucose ← (Gluconeogenesis) Pyruvate ← Lactic acid (Liver)

Gluconeogenesis doesn't occur in Muscle.

Cycle involves → Synthesis of glucose in liver from the skeletal muscle lactate
&
the Reuse of glucose by the muscle for energy purpose

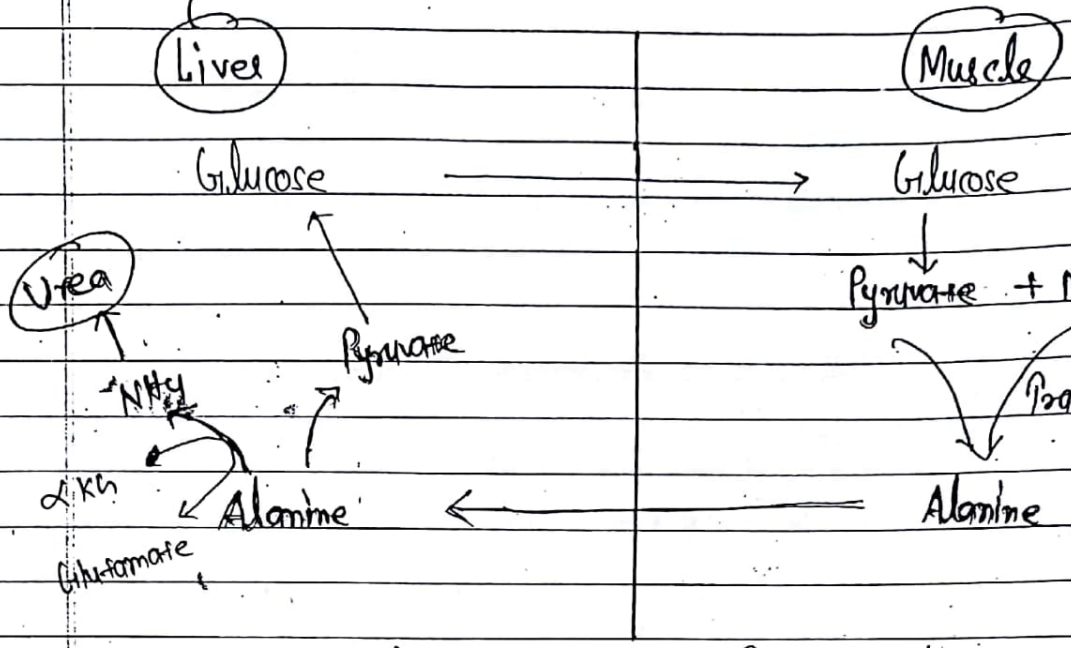
Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 194

Main Site of urea Synthesis ↱ Seen b/w starving Muscle & Liver

GLUCOSE– ALANINE CYCLE | CAHILL CYCLE



Other site of Urea Syn. → Brain, Kidney

Alanine → Transport ammonia (excretion of NH_4^+)

Alanine → Gluconeogenesis (during fasting)

↳ Major AA released from muscle to liver during Starvation

∴ Starvation → Serum alanine ↑

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date: Page: 195

ONE LINEAR QUESTIONS

Suicidal Inhibitor → Allopurinol
Suicidal enzyme → cyclo-oxygenase

Protein Kinase phosphorylates → STTT → Mnemonics
Serine
Threonine
Tyrosine

Iso enzymes → Multimeric complex
↳ everything different → but Catalyse the Same rxn → Same Substrate
↳ Specific tissue distribution

Iso-enzyme of Lactate dehydrogenase (LDH) ⇒
LDH_1 > LDH_2 → MI
LDH_4, LDH_5 → Liver, Muscle
LDH_2 → (N) healthy individual

LCAT (Lecithin- cholesterol acyltransferase) → Induced by Apo-AI

Vitamin Which act as Reducing agent → Vit C

1st Response to Hypoglycemia → ↓ Insulin

Allosteric Inhibition → Binding of Inhibitor to other site & Inhibition of Enzyme

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Rate limiting Enzyme :→

1. Bile Acid Synthesis → 7α hydroxylase
2. Catecholamine Synthesis → Tyrosine hydroxylase
3. Urea Synthesis → CPS-I
4. Fatty acid Synthesis → Acetyl CoA Carboxylase
5. Cholesterol Synthesis → HMG CoA Reductase (AI-IS)
6. Ketone body Synthesis → HMG CoA Synthetase (AI-IS)
7. Glycolysis → Phosphofructokinase

- SGPT / ALT → cytosomal enzyme
  - more specific for liver disease
- SGOT / AST → cytosol & Mitochondrial enzyme
  - more specific for heart disease
- Serine Proteases → Endopeptidase
  - eg → Trypsin, Chymotrypsin, Elastase } Serine at active site
- Serine Residue → Catalytic activity
  - Hydrolysis peptide bond by involving Carbonyl grp.

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 197

Carboxyl protease → eg Pepsin

Chymotrypsin cleaves carboxyl group of → Tryptophan, Tyrosine, Phenylalanine

AI→IS

High energy compounds :→ ≥ 7 kcal/mol

↓

eg → PEP → 14.8 kcal/mol
carbamoyl phosphate → 12.3 kcal/mol
cyclic AMP → 12.0 kcal/mol
ATP → 7.3 kcal/mol

ETC INHIBITOR

Complex I → C → Chlorpromazine, P → Piericidin
A → Amytal (Barbiturate drug) or A → Amytal
R → Rotenone, R → Rotenone

Complex II → Malonate, Carboxin

Complex III → B → BAL (British Anti Lewisite)
A → Antimycin
P → Perfomin

Complex IV → CO, CN, H_2S, Azide → CO → Reacts ē reduced form of cytochrome; CN & Azide → ē oxidized form of cytochrome

Atractyloside – Inhibitor of Nucleotide translocase
↳ ⊖ oxidative phosphorylation

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

- Cytosolic Pathways → Glycolysis (EMP);
  → HMP Shunt
  → Fatty acid Synthesis;
  → Glycogenesis;
  → Glycogenolysis;
  → Bile acid / Salt Synthesis
  → Cholesterol Synthesis

- Mitochondria → TCA cycle
  ETC
  FA oxidation
  Ketogenesis

- Both cytosol & Mitochondria → Gluconeogenesis
  Urea cycle

- Peroxisomes → Oxidation of Very long chain Fatty acid (VLCFA)

- Smooth Endoplasmic Reticulum → Triglyceride Synthesis
  Steroid Synthesis
  Cholesterol Synthesis

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Human cells Lacks enzyme beyond Δ_9 desaturate; so beyond Δ_9 EFA.
* Linoleic acid makes Arachidonic Acid; so it is semi-essential FA. Linoleic acid gives after making γ-Linolenic acid.

Date Page 199

101

Lipids — 3 types

Simple	Compound (complex)	Derived lipid
- ~~Glyceride~~ lipid	- Phospholipid	- Fat-Soluble vitamin
- ~~Sphingo~~lipid	- Glycolipid	- Steroid hormones
	- Lipoprotein	- Ketone bodies

→ Monoenoic acid → oleic acid (18C)
↳ Unsaturated FA having only one double bond
↳ Δ_9 position

→ Fatty acid with max^m C → Cervonic acid > Arachidonic acid
18:3 ($\Delta_9, \Delta_{12}, \Delta_{15}$) → They have Anti-Infla- (22C) (20C)
Docosa Hexanoic acid matory effect

→ ω_3 FA	ω_6 FA	(ω_8) ω_9 FA
· Cervonic Acid (DHA)	Linoleic acid (18:2 (Δ_9, Δ_{12}))	oleic acid (18:1 (Δ_9))
· α-Linolenic acid	γ-Linolenic acid	NEET Elaidic acid (trans-fatty Acid,
· Timnodonic acid (Eicosa Pentanoic Acid)	Arachidonic acid	(18:1 (Δ_9))
	↳ Semi-essential FA	

→ Human can't Synthesize → Linoleic acid
so, essential in diet. Linolenic acid

→ Most essential FA → Linoleic acid

→ FA present exclusively in Breast milk →
Docosahexanoic acid ⇒ also in Fish oil.
↓
Req for development of CNS & visual abilities

→ Trans fatty acids → ↑ risk of cardiovascular disease
↓ → formed by hydrolysis of vegetable oils.
In fried food → TFA ↑ → ↑ increase LDL & decrease HDL
Oil Refining → TFA ↑

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Rancidity → Deterioration of food

Date
Page 260

→ Cardioprotective FA → Unsaturated FA
ω3 FA ← (PUFA) → MUFA (oleic acid)
↓
Max^m

→ Saponification → Hydrolysis of fat by alkali

→ Auto-oxidation (Peroxidation) → Seen with PUFA
↓
Responsible for "Rancidity" of food. (eg. Arachidonic acid)

→ Medium chain FA / Short chain FA →
- don't required Pancreatic lipase, Bile salt for digestion;
- Directly absorbed into portal circulation;
- oxidized by Peripheral cells;
- Not used for storage.
- Stops chyluria

→ Large chain FA →
- Required enzyme & Bile salt for digestion.
- taken by Lymphatics
- Storage form of lipid (Triacylglycerol)

PHOSPHOLIPID

Glycerophospholipid
alcohol → Glycerol
eg → Phosphatidylcholine (Lecithin)
Plasmalogen
Cardiolipin

Sphingophospholipid
Sphingol
eg → Sphingomyelin

→ Sphingomyelin → FA + Sphingosine + Phosphoric acid + choline
↓
Ceramide

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

→ Glycosphingolipid = Ceramide (FA + Sphingol)
↓ +
Cerebroside Glucose

→ Cardiolipin → Major phospholipid of inner Mitochondrial membrane
↳ It is Antigenic

→ Gangliosides → Most complex form of Glycosphingolipid
↳ Ceramide + Carbohydrate + NANA
↓ ↓ ↓
Sphingol + Long chain FA oligosaccharide chain (glu + gal) Sialic acid

→ Sphingolipids are chiefly accumulated in
↳ CNS (Brain + Nerve)

→ Phosphatidic acid
↳ With glycerol as alcohol group
↳ Lecithin
Cardiolipin etc

↳ With Sphingosine as alcohol group
↳ Sphingomyelin
Cerebroside
ganglioside
globoside
Ceramide

→ Lecithin = Phosphatidyl choline
↓ Hydrolysis
Glycerol 3P + choline

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

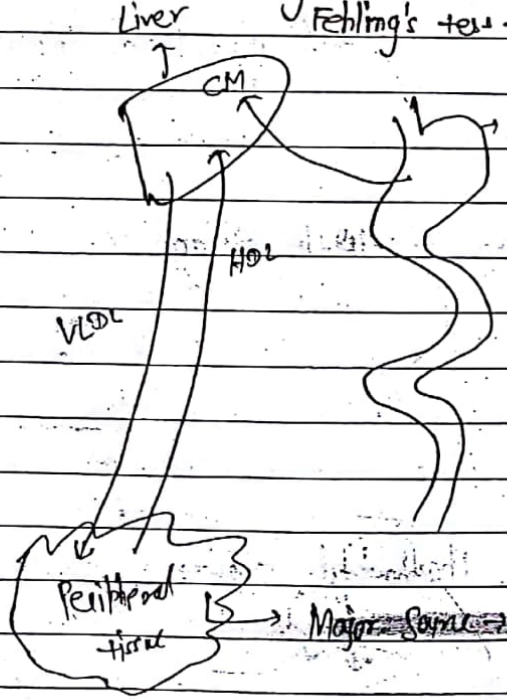
→ Insulin inhibits Ketogenesis by →

Inhibiting β-oxidation
Inhibiting Lipolysis
↑ esterification of Fatty acids
Directing Acetyl co-A to TCA cycle

→ Ketone body → ± glycosuria → DM
↳ without glycosuria → Starvation

→ Ketoacidosis → Presenting Sign & Symptom → Dehydration
Altered Sensorium

→ Tests → Benedict's test → Reducing Sugar in Urine
Rothera → Ketone bodies
Fouche's → Bile Pigments
Hay Sulphur → Bile salt
Fehling's test → Reducing Sugar in Urine



Source → CM → Intestine
VLDL → Liver
CM Remnant → CM
IDL, LDL → VLDL

Major Source → LDL

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

→ Protein absorb UV due to → Aromatic AA
↳ K/a " Photochromosity ".

→ AA with double chiral carbon → Isoleucine (Ile)
Threonine

→ AA with No chiral carbon, No Anomeric carbon
→ Glycine

→ AA ≈ pKa ≈ pH ⇒ Histidine
↳ Most stable AA at Physiological pH.

→ Keratin → Fibrous Protein

→ Transport protein → Albumin, globulin
↓
GLOBULAR PROTEINS

→ SDS PAGE → For M_w determination
PAGE → dependent on Molecular charge & Molecular size

→ DEAE cellulose chromatography → ⊕ve
↳ ⊕ve charge AA move faster on this
CM cellulose chromatography → ⊖ve
↳ ⊖ve charge AA move faster on this

→ Methods to determine Protein Structure →
- X-ray crystallography/ diffraction (Study of chola)
- UV light / IR spectroscopy
- NMR spectroscopy
- Mass spectroscopy (Peptide are studied by Projection of "hydrogen ion H^+")

→ Affinity electrophoresis → for protein-protein interaction

→ α-Amino acid ↓ DONOR —Transamination (PLP)→ α-Keto acid ↓ ACCEPTOR
↳ Transfer of Amine group

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

→ "PLP" (Pyridoxal Phosphate) → Co-enzyme for Transamination
→ Removal of Amino group → Deamination
→ Glutamine → In blood work as NH_3 transporter
→ Carrier of Ammonia (Nitrogen) from muscle to liver
↳ Alanine

→ Ammonia is detoxified in brain ⇒ by α-KG to glutamine
Detoxification →
α-KG ⟵ Glutamate ⟶ Glutamine
(NH_4^+)

In hyperammonaemia ⇒ More glutamate is required
↓
More α-KG consumed
↓
TCA cycle is inhibited

→ Glutamine → Major Source of NH_3 in Kidney.

→ Glutamine —Glutaminase→ Glutamate + NH_4^+
Source of NH_3 in urine → Glutaminase (Glutamine)

→ Oxidative deamination → Occurs in Mitochondria of Hepatocytes & Kidney,
↓
Catalysed by → Glutamate dehydrogenase
↓
Cofactor → NAD
Deamination of glutamine occur in liver

Teacher's Signature :

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Urea cycle – occurs in liver

- Starts in mitochondria, ends in cytosol
- Urea formed in cytosol.
- Source of Nitrogen — Aspartate & Ammonia

N-acetyl Glutamate (+)

CO_2, NH_3 –2ATP → carbamoyl phosphate Synthase – I (CPS-I) (−)

→ Carbamoyl phosphate

→ Hyperammonemia type I

Carbamoyl phosphate + Ornithine —(Ornithine Transcarbamoylase)→ Citrulline (Mito)

Citrulline → (Cyto)

Citrulline + Aspartate + ATP → (AMP + PPi) Arginosuccinate Synthase

Arginosuccinate —(Arginosuccinase)→ Arginine + Fumerate (used in TCA)

Arginine —(Arginase, Hydrolytic cleavage)→ Urea + Ornithine

Ornithine → (Cyto)

Arginosuccinate Synthase (−) → Citrullinemia

- Total 4 ATP are used
- Urea formed by hydrolysis of Arginine

→ Ornithine transcarbamoylase deficiency → ↑ Carbamoyl phosphate

→ CPS II (+) → Pyrimidine ↑ → Orotic Aciduria

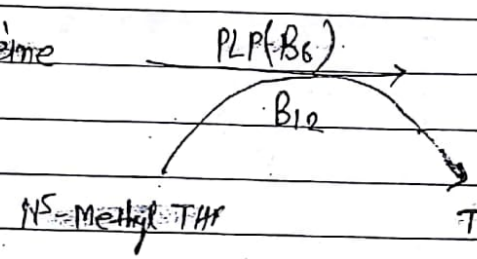
Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Viva AI-2K6

AA which can be converted to Succinyl CoA
V → Valine
I → Isoleucine
M → Methionine

→ Sulphur containing AA → Cysteine, Methionine, homocysteine



∴ Homocysteinuria → Abnormal Metabolism of Methionine

Starvation

→ At the time of Starvation, Body uses → Ketone bodies

Ketone body not used by →
RBCs → No Mitochondria
Liver → Lack CoA transferase required for activation of ketone bodies

In Starvation → Glucose ↓
but Still brain utilise glucose → due to ↓ Km of Hexokinase
Liver doesn't utilise glucose → due to ↑ Km of glucokinase

→ In Seriously ill patient → addition of AA in diet results in the N_2 Balance due to Tes secretion of gonadal +

↓

Glucose, Mannose, AA, β Keto acid. ⇒ ↑ insulin secretion
(Insulin has anabolic effect) ↓ Protein synthesis

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

AIIMS 2014

In traumatic brain injury

⇓

Pyruvate DH activity ↓

& Pyruvate carboxylase activity ↑ for gluconeogen.

Lactic acid ↑ in Brain & CSF

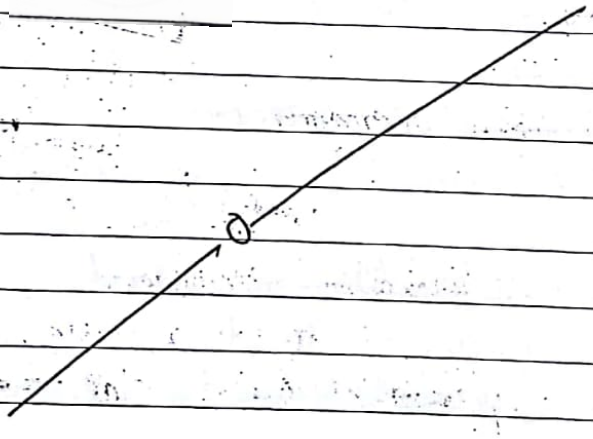
⇓

Uptake from circulation.

Earlier the fall in CSF lactate

⇓

Better Prognosis



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

ONE-LINER QUESTIONS

* NEET Aldehyde dehydrogenase requires "NAD" as "co-enzyme"

** SNB Enzyme Transketolase Requires "Thiamine Pyrophosphate (TPP)" as co-enzyme.

** AIIMS Vit. B_2 (Riboflavin) & Niacin ; both vitamins are involved in "oxidation & Reduction process".

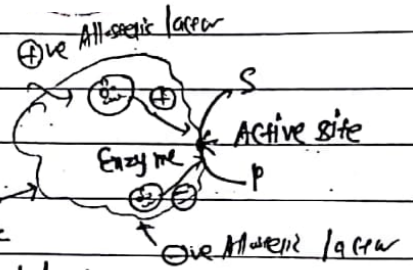
*

Co-enzyme

Works as

Co-Substrates (Second Substrate)	Prosthetic group
acts as either a donor or acceptor in a group transfer Reactions	it bounds permanently to the active site of its enzyme
Co-enzyme are associated ē active site of enzyme only "transiently"	

M/c Mechanism by which co-enzymes act.



** Allosteric Modulation

Allosteric enzymes → It posses a site, in addition to Substrate binding (catalytic) site, R/as "Allosteric site".

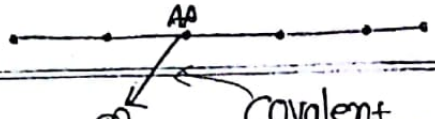
→ if allosteric Regulator

prevent the conformational change required for binding of Substrate.	facilitate the conformational change of catalytic site required for Substrate binding
Allosteric inhibitor	Allosteric activators
eg→ Citrate is an allosteric inhibitor of Phosphofructokinase-I	eg→ Fructose-2,6 bisphosphate is an allosteric activator of Phosphofructokinase-I

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Fine control of enzymatic activity is possible ē Allosteric Modification Not in Covalent Modification.



Covalent Modification (All or None phenomenon)

→ M/c covalent Modification → Addition or Removal of a phosphate group.

→ Phosphorylation (Addition of a phosphate group) —Catalyzed by→ Protein kinase

Dephosphorylation (Removal of a phosphate group) —Catalyzed by→ Protein phosphatase

Enzyme	Active	Inactive
→ Glycogen synthase	Dephosphorylated	Phosphorylated
→ Pyruvate dehydrogenase	Dephosphorylated	Phosphorylated
→ HMG CoA Reductase	Dephosphorylated	Phosphorylated
→ Pyruvate kinase	Dephosphorylated	Phosphorylated
→ Citrate lyase	Phosphorylated	Dephosphorylate
→ HMG CoA Reductase kinase	Phosphorylated	Dephosphorylated
→ Glycogen phosphorylase	Phosphorylated	Dephosphorylated

N.B. Protein kinase mostly add phosphoryl group to Serine, threonine & or Tyrosine Residues.

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

enzyme efficiency & specificity ⇒ Measured by

Ratio of K_{cat}/K_m

Date: 2/10

Measurement of enzyme activity

(1) Unit of enzyme activity :-

One Unit of enzyme activity ⇒ defined as amount causing transformation of 1 Mmole of Substrate/min at 25°C:

(2) Specific activity → No. of enzyme Units per miligram of protein.

(3) Turn over Number → No. of Substrate molecules transformed per unit time by a single enzyme molecule (or by a single catalytic site). denoted by "K_{cat}" (Measure enzyme activity)

Turnover No. → Catalase > carbonic Anhydrase > Acetylcholinesterase > Amylase > LDH > Trypsin > Chymotrypsin > DNA Polymerase > Lysozyme

Catalase → Highest turn over (So; fastest active enzyme).
Lysozyme → Lowest turn over (So; Slowest acting enzyme)

- ISOENZYMES (ISOZYMES)

→ They are physically distinct forms of the same enzyme.

→ They catalyze the same chemical reaction but differ from each other structurally & electrophoretically & immunologically

→ It possess quaternary structure and are made up of two or three different subunit (Multimeric)

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Physical differences ⇒ • Substrate affinity
• electrophoretic Mobility
• Immunological Properties
• Km value also differs
• Distribution

Date: Page: 211

organ (ALP) → Bile canicules, Placenta, Liver, GIT, WBC

Subunit association differs (Hybrid isoenzyme) eg: LDH, CPK ← Structure

Compartmentalization

- It acts on Same Substrate, but with different Km & Vmax values i.e isozymes have different kinetics.
- Tissue distribution of isoenzymes is quite specific.

1) Lactate Dehydrogenase (LDH) → LDH is tetramer with two types of polypeptide units: H (for heart) & M (for Muscle)

It has five isoenzyme → LDH1 (HHHH)

- LDH-1 & LDH-2 ⇓ Predominant isoenzymes in Myocardium; therefore they raised in MI (LDH1 > LDH2); ⇓ LDH1 is more specific for Myocardium than LDH2.
- LDH2 > LDH1 (Normal plasma) ⇓ Flipped pattern of LDH
- LDH2 (HHHM) → Tes in Megaloblastic Anemia.
- LDH3 (HHMM)
- LDH4 (HMMM)
- LDH5 (MMMM) → Predominant band in skeletal Muscle ⇓ Predominent isoenzyme in Liver
- Normal LDH Pattern on electrophoresis ⇒ LDH2 > LDH1 > LDH3 > LDH4 > LDH5

2) Creatine Kinase (CK) → Dimer Made up of two type of Subunits (B and M).

It has three isoenzyme →
- CK1 (BB) → Major isoenzyme in brain
- CK2 (MB) → Major isoenzyme in Myocardium
- CK3 (MM) → Major isoenzyme in skeletal Muscle

Total CK is None of diagnostic value do; M, B Separately

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

True isoenzyme : 1. True isoenzymes : ⇒ MDH → Cytoplasmic
(different genes) → Mitochondrial
Amylase → salivary
→ Pancreatic
2. Isoform isoenzymes : ⇒ Post translational Modification
↳ ALP → sialic Acid

3) Acid phosphatase → It hydrolyzes phosphoric acid esters at pH 5-6 Q

- Found in different isoforms in prostate, spleen, liver, erythrocytes, platelets & bones.
- Prostatic isoform → Inhibited by Tartarate Q
- erythrocytic isoform → Inhibited by formaldehyde & cupric ions Q

PLASMA ENZYMES

→ Blood plasma contains enzymes, which are classified into functional & Non-functional plasma enzymes :

	Functional (plasma-derived)	Non-functional (cell-derived)
Conc^n in plasma →	Higher in comparision to tissue	very low in comparison to tissue
Func^n →	Known functions	No known functions
Site of Synthesis →	Liver	Liver, heart, brain, skeletal muscle
clinical importance →	Nil	Diagnosis & Prognosis of disease
Examples →	Lipoprotein lipase Q, clotting factors Q, Pseudocholinesterase	ALT (SGPT), AST (SGOT), LDH, alkaline phosphatase, Acid Phosphatase, gamma glutamyl transpeptidase, lipase

Lipase is Non-functional enzyme but f

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 213

TRANSAMINASES

It catalyze reversible transfer of an Amino group from an α-amino acids to an α-Keto acids.

(A) Aspartate transaminase (AST or aspartate Aminotransferase) :-

Also " Serum glutamic oxaloacetic transaminase (SGOT)

Conc^{n} of this enzyme is very high in Myocardium & in liver cells.

It is found both in → Cytoplasm (AST or SGOT1) and Mitochondria (AST or SGOT2)

derives from heart & RBCs — present predominantly in Liver.

(B) Alanine transaminase (ALT or Alanine aminotransferase) :-

Also " Serum glutamic Pyruvic transaminase (SGPT) "

Mainly found in Liver. It is entirely cytoplasmic.

Both ALT & AST raised in liver disease, but ALT (SGPT) is always rise more than AST (SGOT).

In Normal healthy person " AST is slightly more than ALT

Teacher's Signatu

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 214

ALKALINE PHOSPHATASE

- It is an ecto-enzyme i.e localized to plasma membrane.
- It is found in liver, bone, kidney, intestinal Mucosa & placenta.
- Raised ALP ⇒ useful in diagnosis of "Bone & Liver" Pathology.

Isoenzymes of ALP ⇒ ① α-1 ALP → Produced in the "epithelial cells of biliary canaliculi".
② α-2 ALP → Produced by "hepatic cells" (Heat labile)
③ α-2 ALP → derived from "placenta". (Heat stable)

④ Pre-β ALP → It is of "Bone origin".

⑤ Gamma ALP → Originated from "Intestinal cells".

⑥ Leukocyte alkaline phosphatase (LAP) → originates from "Leucocytes".

N.B. "Regan enzyme" → Isoenzyme of "Alkaline phosphatase".

Teacher's Sign.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date:
Page: 215

PROTEASES

→ It catalyze the clevage of peptide bonds in proteins & peptide molecules with the participation of water as co-Reactant.

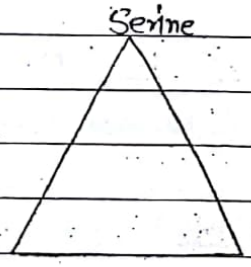
Classified on the basis of functionally essential critical groups or Residues at their active sites :-

i) Serine proteases → posses "Serine Residue" at the active site.
↳ eg → Trypsin$^{\alpha}$, Chymo-trypsin$^{\alpha}$, elastase$^{\alpha}$, Thrombin$^{\alpha}$

- They are inhibited by diisopropyl phosphofluridate which binds covalently to Serine Residue

- Catalytic Triad →

Active Site of Serine protease contains these three Amino acids.



- Serine protease → Highly Reactive ; can damage itself
↓
So, secreted in zymogen (inactive) form
↓
activated in the intestine by proteolytic activation
↓
only activated by autolytic (autocatalytic) activation, otherwise they damage the cells

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Serine Protease hydrolyze peptide bonds in 2 steps → (A) the highly Reactive serine 195 hydroxyl group attack the carbonyl group of the substrate to form Acyl-enzyme intermediate

Date
Page 216

(B) Acyl-enzyme intermediate is hydrolyzed & Released the carboxylic acid component of substrate.

PRIMARY

Chymotrypsin hydrolyses peptide bonds which are connected with carbonyl group of tryptophan, Tyrosine & phenylalanine.

Trypsine catalyses hydrolysis of Lysine & Arginine esters.

ii) Thiol or cysteine Protease :-

Active site cysteine Residue whose side chain -SH must Remain free for their activity

eg → papain, caspases.

Inhibited by "iodoacetamide"

iii) Aspartate or carboxyl or Acid proteases :-

active site a critical carboxyl group from Aspartic acid & have acidic optimum pH's.

eg → Pepsin, Lysosomal cathepsin & Protease produced by HIV.

iv) Metallo proteases → Requires at the active site a highly bound metal for their activity

eg → Carboxypeptidase A & B requires Zn^{2+}

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date:
Page: 217

- NAD^+- Linked dehydrogenases → Pyruvate dehydrogenase;
  Isocitrate dehydrogenase; Q
  Malate dehydrogenase; Q
  α-Ketoglutarate dehydrogenase;
  Glutamate dehydrogenase;
  Glyceraldehyde-3 P dehydrogenase; Q
  Lactate dehydrogenase; Q
  β-hydroxyl acyl CoA dehydrogenase; Q
  glycerol-3P-dehydrogenase (Cytoplasmic) Q

- $NADP^+$- Linked dehydrogenases → Glucose-6-P dehydrogenase;
  Gluconate dehydrogenase;
  3-ketoacyl Reductase;

- FAD- Linked dehydrogenases → Succinate dehydrogenase,
  glycerol-3P- dehydrogenase (Mitochondrial) Q

→ High Energy compounds

(A) Phosphate Compounds → Nucleotides (ATP, GTP, UTP, UDP-glucose);
  Creatinine phosphates;
  Carbamoyl phosphates;
  Arginine phosphates;
  Phosphoenol Pyruvate;
  Inorganic Pyrophosphate;
  1,3- bisphosphoglycerate

(B) Sulfur compounds → CoA derivatives (Acetyl CoA, Succinyl CoA, HMG CoA,
  S-adenosyl Methionine (SAM);
  Adenosine triphosphosulfate.....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

GLUT → glucose transporter
SGLT → Sodium glucose transporter.

Date: Page 311

GLUCOSE TRANSPORT

There are two kinds of transport mechanisms :-

Facilitated transport (Bidirectional)	Secondry active transport (Unidirectional)
$GLUT_1$ → Brain, kidney, Placenta, erythrocytes NEET'11	$SGLT_1$ → Small intestine & kidney
$GLUT_2$ → Liver, Small Intestine, kidney, Pancreatic Bcell	$SGLT_2$ → Renal Tubulis
$GLUT_3$ → Brain, kidney, Placenta, Neuron NEET'16	
$GLUT_4$ → Heart, Skeletal muscle, Adipose tissue	
$GLUT_5$ → Small Intestine	
$GLUT_8$ → Blastocyst, Testis; Brain (Transports glucose to Mature spermatozoa)	
$GLUT_9$ → Liver; Kidney (Urate transporter)	
$GLUT_4$ → Insulin - Stimulated glucose uptake	
$GLUT_5$ → Absorption of fructose AI-14	
$SGLT_1$ → Active uptake of glucose against a conc^n gradient	

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

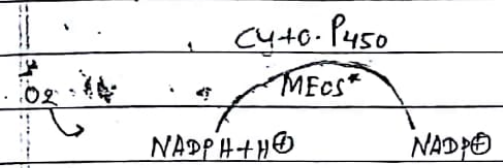
Date:
Page: 219

ALCOHOL METABOLISM

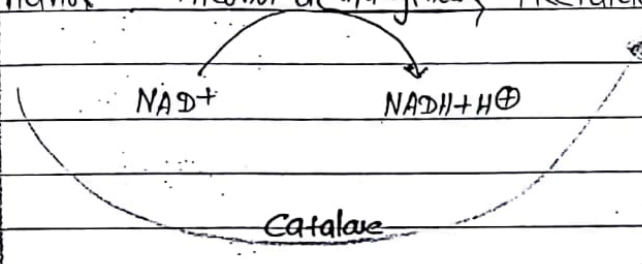
→ Ethyl alcohol ⇒ absorbed from GIT & degraded by oxidation (oxidative process)

→ "liver" → Major site for ethanol oxidation.

MEOS ⇒ Microsomal ethanol oxidizing system.



Ethanol → Alcohol dehydrogenase → Acetaldehyde → Aldehyde Dehydrogenase → Acetate



⇒ ≈ 80% of acetate "leaves the Liver" & undergoes further metabolism in extrahepatic tissues like heart & skeletal Muscle.

⇒ ≈ 20% acetate is utilized in liver in lipogenesis.

⇒ Excess alcohol intake causes → ① Hypoglycemia**

⇓

Excess alcohol intake leads to excessive production of "NADH"

⇓

↑ NADH favours Reduction of Pyruvate to Lactate & oxaloacetate to Malate

⇓

Result in ↓ Less gluconeogenesis

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(2) Inhibition of β-oxidation of FA & TCA.

(3) Tes lipogenesis, TG's synthesis & cholesterol synthesis from Acetyl Co-A

(4). Accumulations of lipids causing fatty liver, fatty myocardium & fatty kidney.

(5) Lactic Acidosis & Hyperuricemia.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 221

Synthesis of creatine & creatinine

- Creatine and creatinine are not Amino Acids; but they are specialized products of AA
- Synthesized from → Glycine; Arginine; Methionine
- Synthesis takes place in kidney; Start with formation of "guanidoacetate from glycine & arginine in kidney"; Further it takes place in Liver and Muscle.

Arginine + glycine → (in Kidney) Guanidoacetate (Glycocyamine) → (in Liver, SAM → SAH) Creatine → Muscle creatine phosphate → Creatinine

- Immediate precursor of creatine ⇒ Guanidinoacetate QQ
- Creatinine → Breakdown Product of creatine phosphate in Muscle QQ
  - Quick source of energy in Muscle;
  - as a reservoir of high energy phosphate groups.
- creatine phosphate —(ADP → ATP)→ creatine
  - Helps in generation of ATP in exercising Muscles by Substrate level phosphorylation

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 222

GLUTATHIONE

- Tripeptide made up of "glutamate, cysteine & glycine" (γ-glutamyl – cysteinyl – glycine).

- Present in all mammalian cells except → Neurons;

- "Sulphydryl (–SH) group of cysteine residue"

↓↓

Reactive portion of glutathione, which can undergo oxidation & Reduction.

Functions →
- helps in keeping some enzyme in active state; by preventing the oxidation of Sulphydryl group of enzyme
- Scavanges free Radicals & Superoxide Anion
- Detoxification of Xenobiotics by their conjugation (conjugation Rxn)
- Prevent formation of Methemoglobin
- Involved in the transport of AA across the cell membrane of kidney & Intestine

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

CM cellusse chromatography → CM (carboxy Methylcellulose) is Ovely charged ; so; Negatively charged particles will move bcuse of Repulsion from Ove charge CM.

Date
Page 223

(113)

SEPARATION AND PURIFICATION OF PROTEINS

Methods → chromatography ; centrifugation (Ultracentrifugation) , electrophoresis , Ultrafiltration & Salt extraction.

Property of Protein used	Method
→ Protein Solubility	→ Salting out or salt extraction (precipitation of protein by ammonium Sulfate) QQ
→ Molecular Size QQQ	→ Gel filtration chromatography Q (Agrose (sepharose) ; dextran (sephadex) are used.)
	→ Ultracentrifugation
	→ SDS-PAGE (Sodium dodecyl sulphate – Polyacrylamide gel electrophoresis) ;
	→ Dialysis
→ Molecular charge (Ionic charge)	→ Ion exchange chromatography QQ
	→ High performance liquid chromatography (HPLC)
	→ Electrophoresis.
	→ Isoelectric focusing
→ Molecular charge & Molecular weight	→ PAGE (Polyacrylamide gel electrophoresis)
→ Affinity Binding	→ Affinity chromatography
→ Hydrophobicity	→ Hydrophobic interaction chromatography.

DEAE cellulose chromatography → DEAE ("diethylaminoethyl") groups have Ove charges.
↳ Ove charge proteins associate with Ove charge DEAE groups & Replaced Cl ions.

CM cellulose chromatography → CM groups have Ove charges ; therefore they select Ove charged proteins i.e cation exchanger.

Teacher's Signature _____

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 224

METHOD OF PROTEIN PRECIPITATION

- Polarity (precipitation with ethanol or Acetone or Trichloroacetic Acid)
- pH (iso-electric) precipitation;
- Salt conc^n (Salting out ē ammonium Sulfate);
- By Heavy metals (Pb, Hg, Cd).
- Heat induced precipitation (for large scale plasmid purification)

TRANSAMINATION

occur via "Ping-Pong Mechanism".

Involves the Reversible transfer of α-amino group of α-amino acid to an α-Keto acid to form a New Amino acid and a new Keto acid.

Transaminase (Aminotransferase) catalyze the Reaction;
↳ Requires "Pyridoxal phosphate (vit. B_6) as coenzyme".

Alanine Transaminase (ALT) / glutamate Pyruvate transaminase (GPT)

L-Alanine + α-Ketoglutarate $\underset{PLP}{\overset{ALT}{\rightleftharpoons}}$ Pyruvate + L-glutamate

Aspartate Transaminase (AST) / glutamate oxaloacetate transaminase (GOT)

L-Aspartate + α-Ketoglutarate $\underset{PLP}{\overset{AST}{\rightleftharpoons}}$ Oxaloacetate + L-glutamate

Most AA undergoes transamination Rx except ↳ Lysine, Threonine, Proline, Hydroxyproline

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 225

DEAMINATION

→ Removal of $-NH_2$ group

⇒ It may be oxidative or Non-oxidative;

Oxidative deamination :→

NAD^+ (or $NADP^+$) → $NADH$ (or $NADPH$) + H^+

L-glutamate ⇌ α-Ketoglutarate + NH_3

⊖ → L-GDH ← ⊕

ATP, GTP, NADH — ADP, GDP

- Occurs Primarily in Liver & Kidney.
- GDH (Glutamate dehydrogenase) → Mitochondrial matrix enzyme;
  - Unusual enzyme in being able to utilize both NAD^+ & $NADP^+$ as co-substrates.

NEET-16
Requires Riboflavin in the form of FMN.

Nonoxidative deamination :→ (A) By Amino acid oxidases.

(B) By Amino acid dehydratase;

→ Transport of Ammonia :→ (A) In the form of glutamine :→

- In Many tissues like Liver, kidney & Brain, NH_3 Combines c glutamate to yield glutamine, by the action of glutamine synthase.

ATP → ADP + P_i (Mg^{2+})

Glutamate + NH_4 → Glutamine

Glutamine synthetase

The Brain is Rich Source of glutamine Synthase & it predominantly detoxifies NH_3 by this Route.

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Glutamine is a Non-toxic Major transport form of NH_3.
The glutamine is transported by blood to liver; where deamination (Removal of amino group) of glutamine takes place.

Glutamine $\xrightarrow[\text{Glutaminase}]{H_2O}$ Glutamate + NH_4

- Renal tubular cells → Maintain Acid base balance by formation & secretion of NH_3.
  - Metabolic acidosis → Excretion of NH_3 ↑es
  - Metabolic Alkalosis → Excretion of NH_3 ↓es

(B) In the form of Alanine →

Alanine transports NH_3 from Muscles to liver through "Glucose – Alanine cycle".

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 227

GENETIC CODE

It is the System of Nucleotide Sequences of mRNA that determines the Sequence of Amino Acids in protein.

Codon : is a Sequence of three adjacent bases that corresponds to one amino acid.

There are 64 Codon Sequences ; b/c of four Nucleotide bases A, G, C & U - (Thymine is not involved in codon)

Characteristics of genetic codes → (A) Universal →
Each codon specifically codes for Same AA in all species.
eg → UCA → Serine; CCA → Proline ∴ In all organisms

Exception → In Human Mitochondria →
- "UGA" codes for tryptophan instead of Stop codon;
- "AUA" codes for Methionine instead of Isoleucine;
- "AGA" & "AGG" serve as Stop codon instead of Arginine.
- "UGA" codes for Selenocysteine by a Mechanism called "Translational recoding".

(B) Unambiguous / specific → A Particular codon always code for the Same AA

(C) Degeneracy / Redundancy → A given AA may have more than one codon;

(D) Stop or termination or Nonsense codon →
UAA → Amber; UAG → Ochre; UGA → Opal

(E) Non overlapping & Non punctate (Comma less) →
Written as AUGCUAUUGAC

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Wobble Hypothesis → Degeneracy of codes can be explained by "wobble hypothesis for Codon-Anticodon interaction".

each codon base pairs with "Anticodon of tRNA" in Antiparallel fashion.

1st two bases of codon are the same; whereas the third is different, "wobble".

↓

1st two bases of codon pairs ∵ last two bases of Anticodon with normal watson-crick base pairing.

↓

Base Pairing of 3rd base of codon (at 3' end) with 1st base of Anticodon (at 5' end of tRNA) doesn't strictly follow watson-crick base pairing Rule.

↓

This allows a single tRNA to recognize more than one codon

↓

So; No need of 61 tRNA species to Read 61 codons that code for AA

Min^m of 31 tRNAs are Required to translate all 61 different codons for the amino acids.

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 229

***	TECHNIQUE	SAMPLE ANALYZED	GEL USED	PROBE
1.	Southern blot →	DNA Q	Yes	Radioactive DN.
2.	Allele specific oligoNucleotide (ASO) →	DNA	No	Allele specific oligonucleotide.
3.	Microarray →	m-RNA or C-DNA	No	DNA Probe
4.	Northern blot →	RNA Q	Yes	DNA Probe
5.	western (immuno) blot →	Protein Q	Yes	Labeled Antibody Q
6.	South western blot →	Protein DNA	No	DNA Probe
7.	ELISA →	Proteins or Antibodies	No	Antibody Q (Specific for protein to be Measure)
8.	Proteomics →	Protein QQ	Yes	—

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Phy:- Heme lies in the hydrophobic Interior (pocket) of hemoglobin & Myoglobin Both.

Date
Page 230

STRUCTURE OF HEMOGLOBIN

Hemoglobin = Globin (contain 4 polypeptide chains) + 4 Heme

HEME (Most important Type III Porphyrin)
Series IX. Porphyrin in Fischer series. (NEET 16)

- derivative of Porphyrin (Protoporphyrin) IX

composed by fusion of four Pyrrole Ring linked by Methenyl (=CH) bridges i.e tetra-pyrrole Ring.

- Iron is held in the center of Porphyrin Ring in ferrous form (Fe^{2+}).

- Iron has Six Co-ordinated bonds :-
  - (A) Four bonds b/w the iron & Nitrogen atoms of the Porphyrin Ring System;
  - (B) Fifth bond is b/w N_2 atoms of histidine residue of globin chain, K/as "Proximal histidine (His F_8)";
  - (C) Sixth bond is formed ε Oxygen.

N.B. → oxygenated form of Hb is stabilized by the H-bond b/w oxygen & side chain of Another histidine residue of globin chain, K/as "distal histidine (His E_7)".

→ Distal histidine (His E_7) of globin protein creates a hindered environment which drastically reduces affinity of heme for carbon Monoxide (CO).

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 231

GLOBIN → Made up of 4 Subunits i-e two pairs of identical Subunits.

HbA → $\alpha_2 \beta_2$

HbF → $\alpha_2 \gamma_2$

HbA_2 (Minor Hemoglobin) → $\alpha_2 \delta_2$

→ Four Polypeptides Subunits of Hb are held together by Salt bonds, H-bonds, & vander wall forces.

N.B → The Heme part of Hb is same in all types of Hb.
The protein part (globin) varies in different Hb.

Oxygenation of Hb & Co-operativity :-

Each Molecule of Hb can combine with upto four molecules of oxygen. eg

V.V.I.

1st O_2 Molecule → binds ē greatest difficulty

⇓

Tes affinity to Next O_2 molecules

⇓

4th O_2 Molecule to bind ē greatest ease.

⇓

Co-operative binding or co-operativity
↳ Responsible for Sigmid shape of the O_2-Hb dissociation curve

T-form (Tense or Taut or stressed form) is low affinity form; whereas R-form is more oxygen affinity form of Hb.

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Q8. Conjugation process converts water insoluble (hydrophobic) unconjugated bilirubin into water soluble (hydrophilic) conjugated bilirubin.

Date
Page 232

HEME DEGRADATION

HEME

CO^{++} ← Heme oxygenase
Fe^{+2} ←

Biliverdin

Bilirubin (Unconjugated)

* Bilirubin is conjugated ē glucuronic acid by enzyme UDP-glucuronyl transferase; to form "bilirubin diglucuronide"

bound to S. albumin

Bilirubin – albumin complex

uptake by liver & did conjugation

after transfer of bilirubin to hepatocytes; it is bound to "Ligandin".

Conjugated bilirubin (Bilirubin-diglucuronide)

Secretion into bile

Bilirubin-diglucuronide in intestine

Enterohepatic circulation

Urobilinogen

20% Absorption

80%

Stercobilinogen

Urobilinogen (in kidney)

Stercobilin (gives brown colour to stool)

Urobilin

excretion in feces

excretion in urine

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 233

INTEGRATION OF METABOLISM:

- FED STATE (ABSORPTIVE STATE) → Period (2-4 hr) following a meal & characterized by high levels of Nutrients in blood.

→ High Insulin : Glucagon Ratio QQ

- Glucose-6-phosphate has 3 fates in fed state

Utilized in glycolysis | Synthesis of glycogen | Utilized in HMP Shunt.

- In this stage, glucose is the Major Source of energy Sparing other (eg → fatty acids) to be stored as energy Reserve.

effect of insulin on Major Metabolic Pathway :-

Carbohydrate Metabolism	effect	Regulated enzyme
• Glycolysis	→ ↑ →	↑ PFK-I, ↑ Pyruvate kinase, ↑ Pyruvate dehydrogenase
• Gluconeogenesis	→ ↓ →	↓ Pyruvate carboxylase, ↓ glucose-6-phosphatase, ↓ PEP carboxykinase
• Glycogenesis	→ ↑ →	↑ glucokinase QQ, ↑ glycogen synthase
• Glycogenolysis	→ ↓ →	↓ glycogen Phosphorylase

Lipid Metabolism	effect	Regulated enzyme
• Lipogenesis	→ ↑ →	↑ Acetyl CoA carboxylase; ↑ FA synthase
• Lipolysis	→ ↓ →	↓ Hormone Sensitive lipase
• Cholesterol synthesis	→ ↑ →	↑ HMG-CoA Reductase
• TAG Synthesis	→ ↑ →	↑ glycerol kinase, ↑ Acyl-CoA-glycerol-3P-transferase
• Lipoprotein degradation	→ ↑ →	↑ Lipoprotein lipase

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Protein Metabolism	effect	Regulated Enzyme
Protein Synthesis	→ ↑ →	↑ RNA Polymerase & Ribosome assembly.

- FASTING & STARVATION → Fasting → No food is ingested after the absorptive period(24hr); Starvation → Prolonged severe deprivation of food.
  - High Glucagon : Insulin Ratio

BODY STORES OF ENERGY

- Largest Reserve of energy in the body → Fat in Adipose tissue.
- 1st Main Provider of energy → Liver glycogen.
  - It Maintains the blood glucose levels b/w Meals.
- ① Brain → No stored fuel in Brain ; but it utilized 60% of total energy under Resting conditions.
  - Glucose → Sole fuel of Brain
  - Ketone bodies → ← Ins. Prolonged Starvation.
  - Fatty acids don't Serve as fuel for the brain ← ↓ ↑ ← because they are bound to albumin in plasma so can't cross blood-brain barrier.

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 235

② Skeletal Muscles → Major fuels for Muscle are glucose, glycogen, fatty acids & ketone bodies.

- after Meal → glucose
- Resting Muscle during Starvation → FFA
- During Prolonged Starvation → ketone bodies.

- During Muscular activity

Immediate energy System	Anaerobic glycolytic System	Aerobic (oxidative) System
• Energy production is immediate (0-30 sec);	• Energy production is fast (30-180 sec).	Energy Production is slow (>3 min)
• Substrate → ATP, creatine phosphate	• Glucose or glycogen	• Glucose or glycogen, FFA
eg → Weight lifting; Short Sprints (100m) & jumping.	Longer Sprints (200m) & 100m Swim	Jogging & Marathon Run

③ Heart → FFA serves as major fuel (60-90%). ketone bodies, Lactate & Some glucose can also serve as the fuel for heart.

④ Adipose tissue → After Meal → Glucose
During fasting → Fatty acids
During Prolonged Starvation → Ketone bodies

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

⑤ RBCs :- only glucose is the sole fuel for RBCs. (AIIMS)

⑥ Liver :- α-keto acids derived from degradation of Amino acids are the fuel of liver.

Metabolic alteration during Fasting - Starvation

- divided into three categories →

(A) Initial Stage (Lasts upto 2-3 days) :-

Liver glycogen provides energy upto 16-18hrs of Starvation.

- Gluconeogenesis ↑
- Lipolysis ↑
- Ketogenesis ↑
- Protein degradation ↑
- Glycogenolysis

(B) Intermediate stage (3-24 days) :-

Enhanced these Pathways
- Gluconeogenesis ↑↑
- Lipolysis ↑↑
- Ketogenesis ↑↑
- Ketone body oxidation ↑↑

Slowed these Pathways
- Protein degradation
- Protein synthesis

(C) Last Stage (>24 day) :-

Enhanced these pathways
- Ketone body oxidation by brain ↑↑↑
- Fatty acid utilization ↑↑↑
- Glyconeogenesis ↑↑↑

Teachers Stop

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 237

During Starvation, Muscle proteins are degraded to serve Amino acids (especially Alanine) as substrate for gluconeogenesis.

MUTATIONS

→ Permanent alteration in genetic material i.e in DNA sequence

- Point Mutations (Base Substitution Mutation)
- Frameshift Mutations
- Trinucleotide repeat Mutation.

↓

- Substitution of a Single base by another is k/a "Point Mutation".

if Purine replaced by Purine ⇒ TRANSITION
Pyrimidine replaced by Pyrimidine ⇒

if Purine replaced by Pyrimidine ⇒ TRANSVERSION
Pyrimidine replaced by Purine ⇒

→ Silent Mutation → (GGC → GGG) → Both code for glycine.
↳ No change in expression of Protein.

→ Mis-Sense Mutation → codon containing the changed base codes for different Amino Acids.

- Acceptable mis-sense: eg → "Hb Milwaukee" has glutamic acid in place of valine; "Hb Bristol" has aspartic acid
- Partially acceptable Mis-sense: eg: substitution of glutamine by valine at 6th position of β-chain
- Unacceptable mis-sense: eg: Methemoglobin histidine replaced by tyrosine at 58th position of α-chain

→ Non-sense Mutation → Sense codon into Non-sense codon.
↳ Protein Synthesis stops

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Frame-Shift Mutation → due to insertion or deletion of one or two bases or three base pairs

↓ Change whole reading frame distal to Mutation

↓ Single AA is incorporated or deleted; Rest AA has same sequence

TriNucleotide Repeat Mutation → A codon (i.e trinucleotide sequence) undergoes amplifications & the same codon is repeated so many times.

eg → Huntington's disease (CAG repeat);
Spinocerebellar ataxia (");
Fragile-X Syndrome (CGG or CCG repeat);

Some other types of Mutation →

(A) Splice site mutation → eg: Myotonic dystrophy gene;

(B) Conserved Mutation → Substituted AA has same properties of original AA. Thus; the function of protein is not altered.
eg → glutamic acid replaced by aspartic acid;
Alanine replaced by leucine

(C) Null Mutation (Loss of function Mutation);

(D) Neomorphic Mutation (Gain of function Mutation).

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Metaphase arrest of the chromosome is Needed.
Probe tagged ē Flourscence isothiocyanate is Needed.

Date: Page: 289

FISH (FLUORESCENCE IN SITU HYBRIDIZATION)

Cytogenetic technique that can be used to detect the presense or absense of specific DNA sequences (specific gene locus) QQ.

Modified version of DNA-DNA hybridization.

Can be used in → Rapid identification of chromosome during interphase. QQQ

Used in metaphase cells to detect specific microdeletions.

Diagnostic → Monitoring the Success of bone marrow transplantation; QQ

Research → Gene Mapping; QQ

Study of 3D chromosome organization in interphase Nuclei. QQ

ONE-LINER QUESTIONS

Enzyme "Alglucerase" is used in T/t of → "Gaucher's disease"

UV-visible spectroscopy (UV-sis) can distinguish b/w enantiomers by showing a distinct cotton effect for each isomer.

two Method

Octant Rule — excition chirality Method.

Octant rule — excition chirality method

Method of study of oncogenes ⇒ Transfection. QQ

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

- "Spectrophotometer" ⇒ Measures the amount of light that a Sample absorbs.
  - ↳ amount of DNA/RNA can be quantified.

- Comparative genomic hybridization ⇒ used to detect Chromosomal differences b/w Neoplastic cells & their Normal counterparts.

- Starting material for production of Insulin from bacteria
  - ⇓
  - mRNA from β Pancreatic cells of human.

- Immunohistochemistry ⇒ Used in diagnosis of abnormal cells such as those found in tumors.
  - ↳ also used to understand the distribution & localization of biomarkers

- Gene of Interest is usually administered via either of two vectors :-

① Viral vectors → Retrovirus, Adenovirus, Lentivirus, Adeno-associated virus;

② Non-viral → Plasmids; Liposome (cationic-Lipid) complex
  - ⇓
  - M/c used vector
  - Most powerful cloning vector ⇒ Cosmid.

- Site-directed Mutagenesis ⇒ K/a "oligonucleotide-directed Mutagenesis"
  - ⇓
  - Can introduce alteration of selected Regions of DNA molecule i.e directed to specific site

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 241

It may involve single base change (point Mutation), Multiple base changes, deletion or insertion of selected DNA sequence.

Chromosome walking ⇒ A fragment Representing one end of a long piece of DNA is used to isolate another

⇓

It means Mutant gene is isolated by using the adjacent gene.

⇓

To locate the mutant gene walking starts at the closest gene

NEET'16

Human Genomic Sequences

Type I or gene Sequences (30%)		Type II or Transposons or Jumping genes or Moderately Repetitive Sequences (45%)	Miscellaneous Sequences (25%)
Exons (1.5%)	Introns (98.5%)		• Satellite DNA or Highly Repetitive Sequences or Simple Segment Repeats (3%)
		Lines	Sines

NEET'16
AIIMS Nov '11

Lipo Arabinomannan (LAM) Antigen in urine; Seen in Mycobacterium Tuberculosis

⇓

It is a lipopolysaccharide present in Mycobacterial cell wall.

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 242

LIPID STORAGE DISEASE

	Disorder		Enzyme defect
1.	Gaucher's disease	→	β glucosidase
NEET'16 2.	Niemann Pick disease	→	Sphingomyelinase
3.	Fabry's disease	→	α galactosidase
4.	GM1 Gangliosidosis	→	β galactosidase
NEET'15 5.	GM2 Gangliosidosis / Tay Sach's disease	→	Hexosaminidase A
6	Sandhoff's disease	→	Hexosaminidase A & B
7	Krabbe's disease	→	Galactosyl ceramidase
8.	Metachromatic leukodystrophy	→	Aryl Sulfatase A
9.	Farber's disease	→	Ceramidase
10.	Wolman's disease	→	Acid Lipase

* Dlo Related to Heme Synthesis :⇒

Features	Dubin Johnson Syndrome	Rotor Syndrome
Liver Appearance →	Black Pigmentation (dl+ accumulation of epinephrine)	Normal histology & Appearance
Gall Bladder visualisation on oral cholecystogram →	Can't be visualised	Can be visualised

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page 243

Features	Dubin Johnson Syndrome	Rotor Syndrome
Total coproporphyrin →	Normal but Coproporph, in-I is more than 80% of total coproporphyrin (Normal is coproporphyrin I < 25% of total)	Elevated but coproporphyrin I is less than 70% of total coproporphyrin.

* One Lineas Related to Lipid Metabolism ⇒

- Maxm Lipid content overall ⇒ Chylomicrons
- Minm Lipid content overall ⇒ HDL

- Maxm Triglyceride content overall ⇒ Chylomicrons
- Maxm exogenous (Dietary) Triglyceride content overall ⇒ Chylomicrons
- Maxm endogenous triglyceride content ⇒ VLDL
- Transport of endogenous triglyceride ⇒ VLDL
- Minimum Triglyceride content ⇒ HDL

- Minimum cholesterol content ⇒ Chylomicrons
- Maximum cholesterol content ⇒ LDL

- Maximum phospholipid content ⇒ HDL
- Minimum phospholipid content ⇒ Chylomicrons

- Lipoprotein ē lowest density ⇒ Chylomicrons
- Lipoprotein ē Maxm density ⇒ HDL
- Lipoprotein ē Maxm (largest) size ⇒ Chylomicrons
- Lipoprotein ē Smallest size ⇒ HDL

- Lipoprotein ē Minimum Protein content ⇒ Chylomicron
- Lipoprotein ē Maximum Protein content ⇒ HDL (HDL2).

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Valine, Isoleucine

Propionyl Co-A (3C)

↓ Propionyl CoA Carboxylase → Propionic aciduria

D-Methyl Malonyl Co-A

↓ Racemase

L-Methyl Malonyl Co-A → Methyl Malonic Aciduria (def. of Mutase enzyme) → Urine

↓ Mutase / Isomerase (B_{12})

Succinyl CoA (4C)

↙

TCA

* Receptor	Distribution of Receptor	Apoprotein identified
LDL Receptor (Clathrin coating)	Hepatic & Extra-hepatic cells	Apo-B-100 as well as Apo E
LRP (LDL Receptor Related protein)	Hepatic	Apo E
Remnant Receptor	Hepatic	Apo E

* Apo (E) & Apo J (special type of Apoprotein) seen in Neuro-degenerative D/D (Alzeimer disease).

Teacher's Signature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page

* Antioxident Defense Mechanism

Preventive Measures

i) Efficiency of e- transport chain;

ii) Transition Metal sequestration

iii) Glutathion peroxidase

iv) Catalase

Interceptive Measures

- SOD ⇒ Mitochondria (Mn^{+2})
  cytosol (Cu^{+2})
  extracellular (Cu^{+2} & Zn^{+2})

- Non-enzymatic Substances ⇒
  Vit. E
  Vit. C
  β-Carotene

Others ⇒ Caffeine
Ceruloplasmin
Vit. A
Cysteine

* Iron containing Protein

Heme containing :- Hb / Mb
Cytochrome
Tryptophan pyllorase
Catalase
Peroxidase
NOS (Nitric oxide Synthase)

Fe-S complex :- complex II
SCD
Xanthine oxidase.

Non-heme containing :- Phenylalanine hydroxylase
Aconitase
Transferrin

Ferritin

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Enzyme Regulated by Ca^{+2}

- Adenyl cyclase
- Ca-Mg ATPase
- G3P dehydrogenase
- Glycogen synthase
- Phospholipase C
- Pyruvate carboxylase
- PDH
- Pyruvate kinase

* Mineral — Enzyme

Mg ⟶ Hexokinase, enolase; PFK; Glu-6-phosphatase; DNA Polymerase

Mn ⟶ Mn as a part of enzyme →
Arginase; Pyruvate carboxylase; Mt. SOD

Mn as an activator :-
- Glucosyl transferase, PEP Carboxykinase; Glutamine Synthetase
- Hydrolase, Kinase; Decarboxylase, Transferase

Mo ⟶ Xanthine oxidase
Aldehyde oxidase
Sulfite oxidase

Se ⟶ Glutathione Peroxidase; Iodothyronine deiodinase

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Sanger's Reagent (1-Fluoro, 2-4-Dinitrobenzene) ⇒ Used to determine AA Sequence.

Date
Page

2006

* Reactions or Test to Identify Specific Groups or Amino groups

⇒ Reactions — Specific group or Amino Acid

* Biuret Rxn ⟶ Two peptide Linkages.
* Ninhydrin Rxn ⟶ α-AA
* Xanthoproteic Rxn ⟶ Benzene Ring of Aromatic Amino Acids.
* Millon's Rxn ⟶ Phenolic group (Tyrosine)
* Hopkins-cole Rxn ⟶ Indole Ring (Tryptophan)
* Sakaguchi Rxn ⟶ Guanidine group (Arginine)
* Nitroprusside Rxn ⟶ Sulfhydryl groups (cysteine)
* Sulfur test ⟶ Sulfhydryl group (cysteine)
* Pauly's test ⟶ Imidazole Ring (Histidine)
* Folin Coicalteau's test ⟶ Phenolic group (Tyrosine)

* Properties of An Amino acids @ Isoelectric pH are ⇒
  - Maximum precipitability;
  - Minimum buffering action (Maxm buffering action is when the pH=pI & Not @ Isoelectric pH
  - Minimum ... Solubility
  - No ... Mobility ... in an electric field.

Teacher's Signature ...

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Date
Page

* **Amino Acids & their Biological Amines :⇒**

Amino Acids		Biological Amines
Histidine	→	Histamine
Tyrosine	→	Tyramine
Tryptophan	→	Tryptamine
Lysine	→	Cadaverine
Glutamic Acid	→	GABA
Serine	→	Ethanolamine
Cysteine	→	β-Mercapto Ethanolamine

* **CATABOLISM OF GLYCINE**

- By **Glycine cleavage system** :⇒ consists of three enzyme & an "H-protein".
  - Glycine dehydrogenase
  - Amino Methyl transferase
  - Dihydrolipoamide dehydrogenase

* **Use of Recombinant DNA technology**

A. In Medicine :- Insulin; Growth hormone; TNF; IL-2; Pegasparase; Taxol; Interferon; DNA vaccine; Hepatitis B vaccine; Antibiotics; Monoclonal Ab

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

B. Agriculture ⇒ Crop ↑ Insecticide Resistance ; delayed Ripening ; Nutritious.

C. Animal Husbandry ⇒ More Milk production
DOLLY : Transgenic clone.

D. Gene Library / DNA Library.

Teacher's Signature .....

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Pathology

Handwritten Note

MBBS Help

http://mbbshelp.com

http://www.youtube.com/mbbshelp

http://www.facebook.com/mbbshelp.com

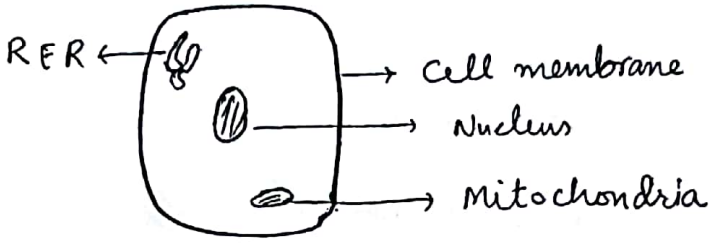
Name: _____

Subject: **Pathology**

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Cell Injury

4 parts of a cell which are vulnerable to injury.



Causes of cell injury

1) Hypoxia (MC)*
   - (a) Ischemia* — Atherosclerosis, Thromboembolism, vasospasm
   - (b) Anemia
   - (c) Cardiopulmonary failure.
   - (d) CO poisoning
2) Infections
3) Genetic disorders
4) Hypersensitivity reactions
5) Autoimmune diseases
6) Physical agents - heat, cold, trauma, radiation
7) Chemical agents
8) Nutritional imbalances — Deficiencies (Vit, PEM); Excess (Vit ADEK, Fats)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Outcomes of cell injury

1) Irreversible cell injury / cell death

Necrosis — Necroptosis
Apoptosis — Pyroptosis.

2) Reversible cell injury

Hydrophic degeneration (cloudy swelling)
Fatty denaturation

3) Cellular adaptation

Hypertrophy — Atrophy
Hyperplasia — Metaplasia

* Dysplasia is not a cellular adaptation. It is a premalignant condition.

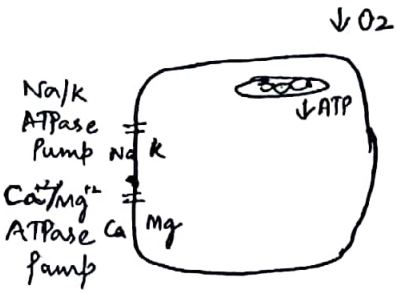
4) Intracellular accumulation & pathological calcification

Proteins
Fats
Glycogen
Pigments - Lipofuscin

Dystrophic Cal.
Metastatic Cal.

5) Cellular ageing

Mechanism of cell Injury (Reversible)



(a) Pump failure due to lack of ATP.

↳ Efflux of K from cell

↳ Na, Ca influx into the cell

↓

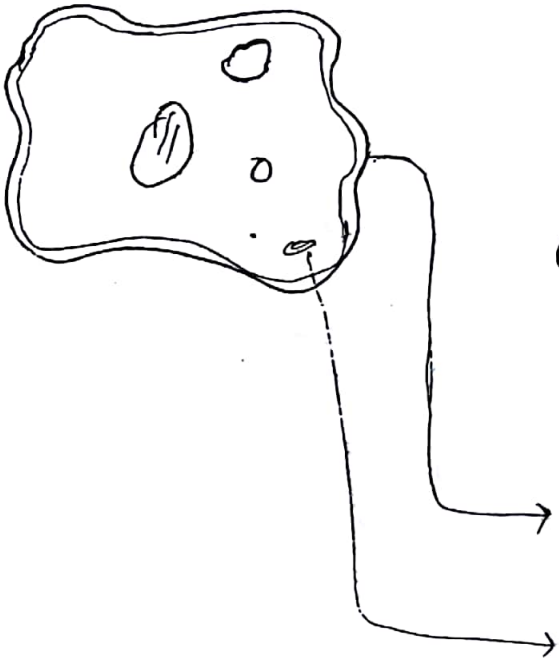
↑ Osmotic load (H_2O enters the cell)

↓

Cellular swelling

Hydrophic changes

Organelles also swell up.

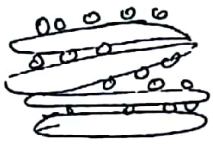


→ Cell membrane blebs are formed

→ Myelin figures are formed

↳ Due to accumulation of water b/w membrane phospholipids

(b) If ATP is absent - Protein synthesis stops.



↓ ATP

Dispersion of Ribosomes from RER

- Protein synthesis stops
- ↑ lipid synthesis & storage

⇓

Fatty changes

Switch over

(c) to Anaerobic glycolysis

Glycogen in cytoplasm is consumed

Lactic acid is produced

⇓

↓ pH of the cell

Nucleus

↓ pH

Clumping of Nuclear chromatin

Mechanism of Irreversible cell injury

1) Severe mitochondrial damage

Important feature of irreversible cell injury:-

Ⓘ ⇒ NO ATP production by mitochondria

Ⓘ Ⓘ ⇒ Large amorphous flocculant densities in mitochondrial matrix

Composed of
Calcium &
Phospholipids

2) Severe membrane damage

↑ permeability of plasma membrane

- leakage of important intracellular enzymes & proteins.
- Influx of Ca^{++} into the cell

3) Release of lysosomal enzymes

↓pH
↑↑ Ca^{++} in cytosol
→ Lysosome receptor irritation
→ Acid hydrolase are released

- Phospholipases → Break membrane phospholipids
- Proteases → Break enzymatic & cytoskeletal proteins
- RNAses → Break RNA
- DNAses → Break the DNA in Nucleus

DNAses

↓

Cause random breaks in the DNA

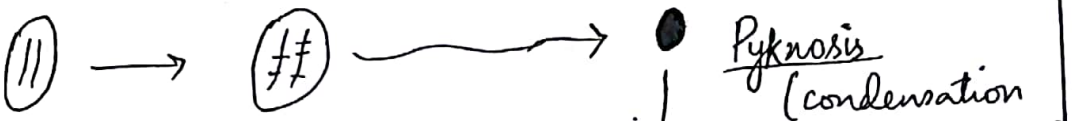
↓

Extract this DNA and do an agaros gel electrophoresis

↓

Smear pattern

Nuclear Changes



H&E

- Stains Nucleus
- Stains cytoplasm & extracellular Connective tissue

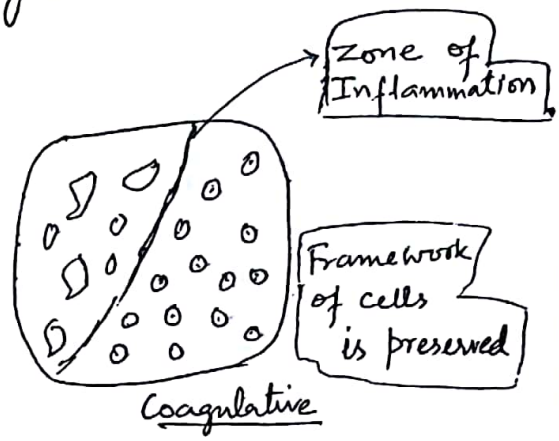
Necrosis

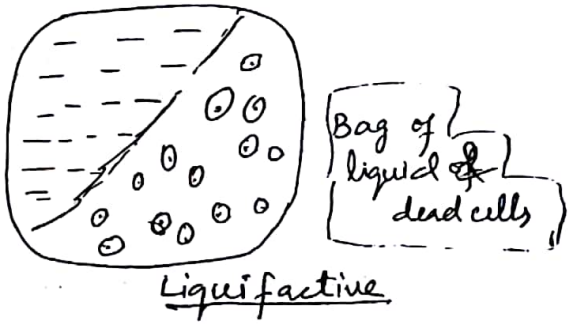
Def. cell death in living tissue

2 Processes that underlie necrosis are (Mech.)

(a) Enzymatic digestion of cells by lysosomal enzymes.

(b) Denaturation of proteins





(1) Coagulative Necrosis

→ Due to denaturation of structural proteins of cells.

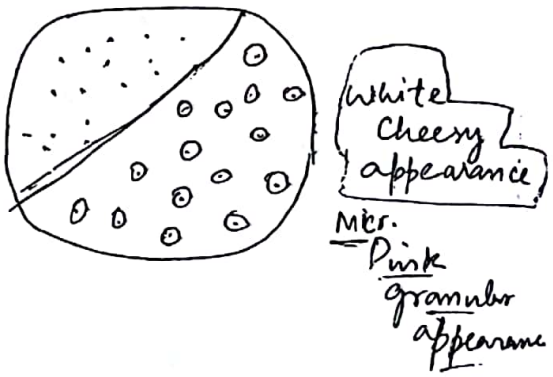
Mc type of Necrosis

a) Mc cause of Coagulative necrosis is Hypoxia except Brain

b) 2nd cause is Severe burns.

c) 3rd Dry gangrene.

d) Zenkers degenerations → Coagulative necrosis of muscle like rectus abdominis seen in pts with severe toxemia e.g typhoid



H/E staining

- Cell outline is preserved but cells do not have a nucleus
- ↑ cytoplasmic eosinophilia → due to denaturation of proteins
  ↘ loss of blue nucleus
- Cytoplasm has a glassy appearance due to loss of glycogen
- Cytoplasm has a "Moth eaten" appearance due to loss of organelles.

M/C organ where coagulative necrosis is seen – HEART (MI)

Others – Liver
Kidney
Spleen

Infarct

⇒ Area of necrosis, usually coagulative produced due to ischemia.

Infarcts are wedge or triangular shaped.

2 types

White Infarct
(also called as pale/anemic Infarct)
Seen in solid organs with single blood supply
e.g. In Heart, kidney, spleen
Liver (in hypovolumic shock)

Red Infarct
(also called Hemorrhagic Infarct)
Seen in spongy organs
Organs with dual blood supply
Lung
Liver (Red More common)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

organs with collaterals
e.g Intestines
Torsion of Testis/ovaries.

2) Liquifactive Necrosis (colliquative Necrosis)

Due to **enzymatic digestion** of cells by lysosomal enzymes.

Dead tissue is converted into a bag of liquid.

e.g brain hypoxia (always Liquifactive Necrosis)

Abscess cavity < Bacterial / Fungal

Wet gangrene.

3) Caseous Necrosis

Dead tissue has a **white**, **cheesy** appearance and it is friable.

Miscroscopically – Pink granular appearance

Causes
- M. Tuberculosis (Mycolic acid)
- Syphilis
- Fungal infections — Histoplasmosis / Coccidoidomycosis

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

4) Fat Necrosis

Enzymatic fat Necrosis

- Seen in pts with acute pancreatitis
- Abdominal cavity
  - ↳ Messentry
  - ↳ Omentum
  - ↳ Retroperitoneal fat

Lipase released from pancreatic acinar cells attack the fat cell membrane

FFA released from fat cell membrane

↓

FFA + Ca

↓

Chalky white deposits of fat necrosis

↓

Sponification of fats

Traumatic fat Necrosis

⇒ Breast

⇒ Subcutaneous tissue

↳ Due to trauma

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

5) Fibrinoid Necrosis

Areas of fibrinoid necrosis has a homogenous pink appearance due to deposition of fibrin

[H & E Staining]

Causes

(a) Vasculitis e.g. PAN.

(b) Malignant HTN

(c) Peptic ulcers

(d) Aschoff nodules of RHD

Fibrinoid Necrosis in the centre surrounded by Caterpillar cells. L. Pc

(e) AID → SLE → vasculitis

→ R A → Rheumatoid nodules contain fibrinoid necrosis

Free Radicals

Molecules with unpaired electrons in the ordermost orbit.

$O_2 \longrightarrow O_2^{\cdot -}$ (Superoxide)

$H_2 \longrightarrow H_2O_2 \Rightarrow \boxed{OH^-}$ Most Powerful free radicle

$Cl \longrightarrow HOCl^-$

$N \longrightarrow ONOO^-$ (Peroxynitrite)

Causes of free radical generation

1. Normal Oxidation & reduction reaction occuring in the cells
2. Radiation → Hydrolysis → Free radicals
3. Oxygen toxicity.
4. Infections.
5. Drugs and chemicals.
6. Reperfusion injury → Heart, Brain

Free radicals damage cells in 3 ways.

1. Lipid Peroxidation of membranes (Most imp. action)
2. DNA Damage (oxidative)
3. Oxidative damage to proteins in cytoplasm

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Two reactions that generate ~~Peroxide~~ Free Radicals

Fenton's Rxn

$$H_2O_2 + Fe^{2+} \longrightarrow \boxed{OH^{\cdot}} + OH^- + Fe^{3+}$$

Haber weiss Rxn

$$O_2^{\cdot} + H_2O_2 + H^- \longrightarrow O_2 + H_2O + \boxed{OH^{\cdot}}$$

Three enzymes that generate Free Radicals.

1. NADPH oxidases (Pagocytic oxidase)
2. Xanthine oxidase
3. Superoxide dismutase [Generates and also inactivates free Radicals]

Free Radical Removal Mechanisms

1. Antioxidants → Vit A, C, E
   Selinium
   Cystein & glutathione containing compounds.
2. Enzymes
   (a) Superoxide dismutase (SOD)-Inactivates Superoxides.
   - Cu Zn SOD (SOD I) [Found in Cytosol]
   - Mn SOD (SOD II) [Found in Mitochondria]

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

$O_2^{\cdot-} \xrightarrow{SOD} H_2O_2 + H_2O$

Generates H_2O_2.

(b) Catalase — Found in peroxisomes

Inactivates H_2O_2

Peroxisomes are organelles where free radicals are generated and inactivated.

(c) Glutathione peroxidase → Cytoplasm
→ Mitochondria

Inactivates — H_2O_2
— $OH^{\cdot}$

(3) Serum Proteins

Albumin ⟶ binds Fe & Cu

Lactoferin ⟶ Fe binding

Transferrin ⟶ Fe binding

Ceruloplasmin → Cu binding.

∴ ⇒ Free radicals can cause cell death by

- Necrosis
- Apoptosis
- Necroptosis

Brain is protected from Free Radical injury by CuZn SOD (SOD I)

Mutation → Amyotrophic Lateral Sclerosis of Brain

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Most important Ion involved in cell injury - Ca^{++}

First ion involved - Na

Most susceptible to ischemic injury - Neurons (3-4 min)
followed by Cardiac tissues (20-40 min)

Tissue least susceptible to ischemic Injury - Fibroblasts
followed by Skeletal muscle

First sign in all types of cell injury except apoptosis - Hydrophic Change

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Apoptosis

- (Programmed cell death)
- Active process.
- Death of single cell or small group of cells.
- No surrounding inflammation around apoptotic cells.

e.g:

Physiological

- Embryogenesis
- Involution of hormone dependent organs upon hormonal withdrawal
  - ⇒ Breakdown of endometrium during menstruation
  - ⇒ Ovarial follicular atresia following menopause
- Cell death in rapidly proliferating cells like cells in GIT, Skin, Respiratory tract.
- Death of cells that have served their purpose e.g death of neutrophills at the end of acute inflamation.
- Elimination of harmfull self reactive lymphocytes

Pathological

- DNA damage
- Accumulation of misfolded proteins
- Viral infections — Adenovirus/HHV, Viral hepatitis
  ↓
  Councilman bodies (Apoptotic hepatocytes)
- Duct obstruction of organs produces atrophy and apoptosis
  e.g: Salivary gland
  Pancreas
  Kidney (ureter obstruction)

Morphology

2 enzymes that bring about apoptosis are

Caspases

Caspases break the framework of the cell → cell will shrink & tight packing of organelles

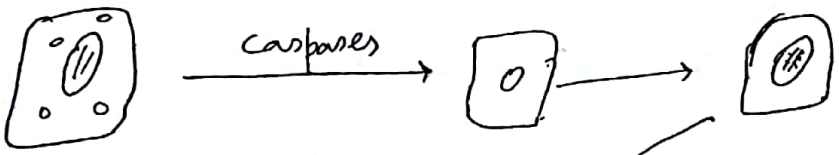
Endonucleases

(Ca, Mg dependent enzymes)

Endonucleases break DNA at specific sites (Internucleosomal Regions)

↓

180–200 bp DNA fragments are produced

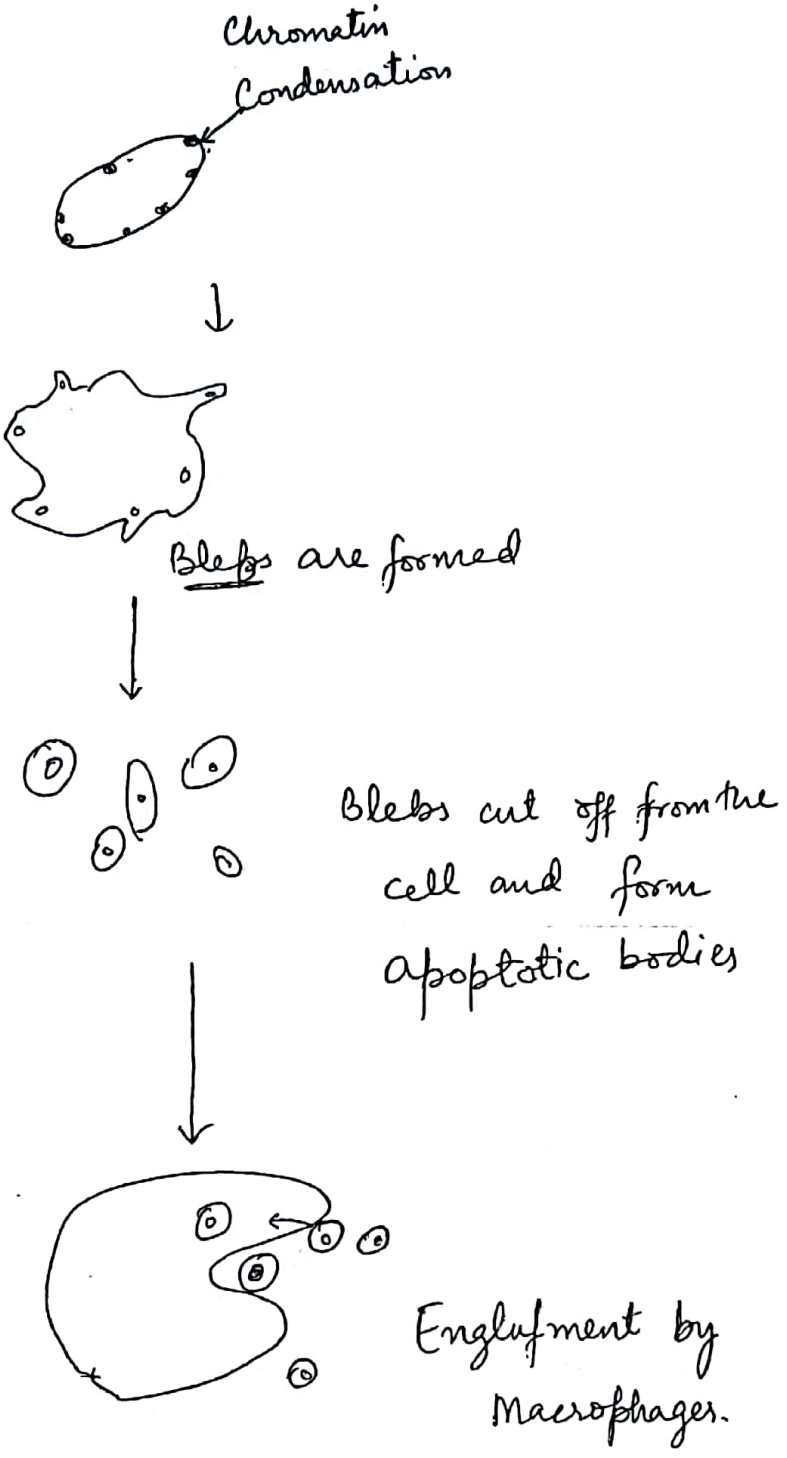


Chromatin Condensation — most characteristic feature — Pyknosis

Agarose gel ← electrophoroses

LADDER PATTERN

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

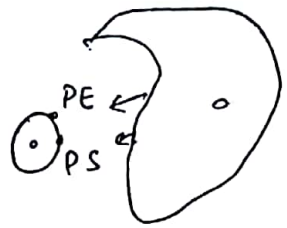


Apoptotic bodies are removed by Macrophages because.

⇒ Apoptotic bodies express Thrombospondin I on their outer leaflet. and macrophages have receptor for Thrombospondin II (absent in normal cells)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

- Apoptotic bodies express phosphatidyl serine (PS) and phoshatidyl ethanolamine (PE) on their outer surface & Macrophages have receptors for PS & PE



Annexin V is a marker of cells undergoing apoptosis.

↓

It is an immunostain that stains PS & PE which are expressed on outer leaflet of apoptotic body.

Normal cells have PS & PE on Inner leaflet thus remain unstained by Annexin V

Microscopically
- Shrunken
- Hypereosinophilic
- Chromatin condensation below the nuclear membrane / Pyknosis in nucleus.

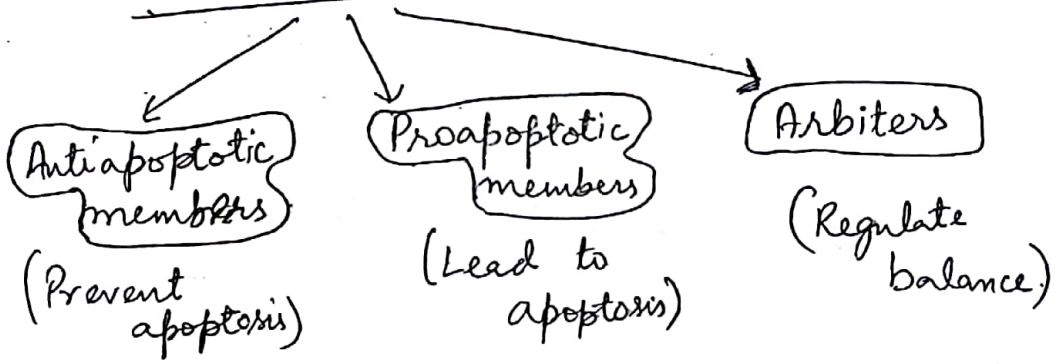
Pathways of Apoptosis

1) Intrinsic / Mitochondrial Pathway
2) Extrinsic / Death receptor initiated Pathway
3) p53 Pathway
4) Perforin granzyme dependent killing.

① Intrinsic / Mitochondrial Pathway

Brought about by BCL2 family of gene.

20 members in the family.



Antiapoptotic members

BCL2 BCL-XL, MCL-1

They reside in the outer mitochondrial membrane, ER membrane & cytosol

↓

Keep the permeability of the membranes Intact

↓

Prevent leakage of Cytochrom C ⇒ No Apoptosis

Proapoptotic members.

BAX BAK

They increase the permeability of outer mitochondrial membrane (drills holes in OMM)

↓

Leakage of cytochrome C from mitochondria into cytosole

↓

which activates Apaf-1 (Apoptosis activating factor-1)

↓

Apoptosome is formed.

↓

Binds and activates Pro Caspase 9.

⇓

Apoptosis

Arbiters of apoptosis

BIM BID BAD PUMA NOXA

Also called as [Sensors of cellular stress] & [BH_3 only proteins]

Function is to regulate balance b/w above two groups

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Inhibitors of intrinsic pathway

(IAP → Inhibitor of apoptotic pathway proteins)

↓

Inhibits Procaspase 9

Smac/Diablo – Mitochondrial proteins.

Pro apoptotic

They Inactivate IAP

↓

Thus promoting Apoptosis

Caspases

Initiator Caspases

Caspases 8, 9, 10

Intrinsic → Caspase 9

Extrinsic → Caspase 8, 10

Executioner Caspases

Caspases (3), 6, 7

→ Most important

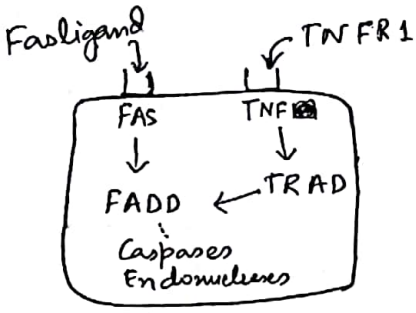
Common for both the pathways

Extrinsic/Death receptor initiated pathway.

Death receptors start this pathway

↳ Belong to TNF receptor family

- FAS (CD95)
- TNFR1



FADD → Fas associated Death domain

TRAD - TNF Receptor 1 Associated Death domain.

Inhibitor of extrinsic pathway

FLIP ⟶ Inhibits procaspase 8

Produced by viruses & normal cells.

p53 Pathway

Tumor suppressor gene

Chromosome 17p 13.1

Calledas – (Molecular Policeman)
(Guardian of Genome)
(Critical gate keeper)

It applies Emergency breaks and causes G1 arrest of cells.

Cells with damaged DNA enter the cell cycle

↓

Sensors of DNA damage are activated.
(ATM and RAD family of proteins)

↓

Sensors activate transducers
(CHEK kinase family of proteins are transducers)

↓

p53 activated

↓

p53 recruits p21 (Inhibitor of cyclins & CDKs)

↓

p21 causes G_1 arrest of cells.

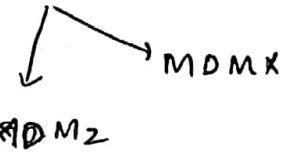
⇓

Now p53 assesses DNA Damage

Too much DNA damage → Induces Apoptosis via mitochondrial pathway by BAX.

Little DNA damage → DNA repair gene GADD45 is Recruited & DNA repair done.

$t_{1/2}$ of p53 → 20 minutes



Loss of p53 (both copies) → Li Fraumen's syndrome

↓

↑ risk of developing carcinomas, Sarcomas, lymphomes, etc.

Gene most commonly mutated in humans carcinoma is p53.

Perforin Granzyme Dependent killing

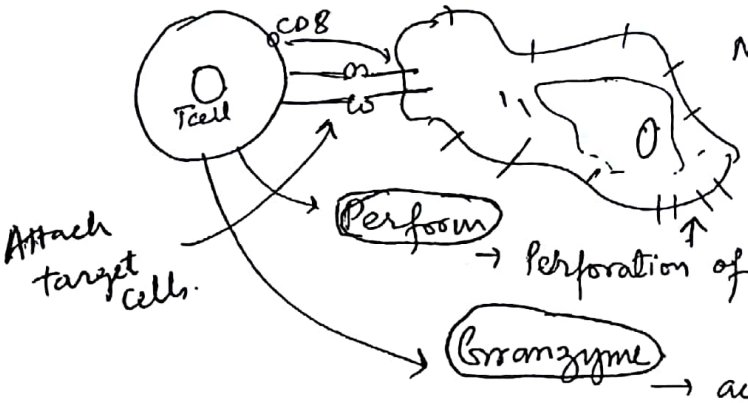
Pathway used by NK cells and Cytotoxic Tcells (CD8 cells)

⇓

Induce apoptosis of target cells.

↓

Virally infected cells & Tumor cells.



→ Perforation of cell membrane

Granzyme → activates Caspases & endonucleases & leads to apoptosis

Autophagy – cell eats its own contents

Seen in nutrient deprivation.

Membrane of autophagic vacuole is derived from ER

Autophagic vacuole fuses with lysosome

Lysosomal enzymes degrade the contents → used as source of nutrient.

LC3 is a marker of cells undergoing autophagy

(Light chain) Microtuble associated

→ Identifies targets of autophagy

→ Formation of autophagic vacuole.

Differences b/w Necrosis & Apoptosis

Necrosis	Apoptosis
- Passive process	Active process.
- Death of large no. of cells or large parts of the organ.	- Death of single cell or small groups of cells.
- Cells swell up	- Cells shrink.
- Cell membrane permeability is increased	- Cell membrane permeability remains intact.
- Surrounding Inflammation is present	- No surrounding Inflammation is seen.
- DNA is broken by DNAses ↓ Smear pattern	- DNA is broken by endonucleases ↓ Step ladder pattern
↳ Pyknosis ↳ Karyohexis ↳ karyolysis	Pyknosis < Chromatin condensation below the clear nuclear membrane.
- Pathological process	- Both physiological & pathological.

Necroptosis

Programmed cell death

Active process.

Also called ~~protosis~~ Programmed Necrosis

Hybrid of Necrosis and apoptosis.

↳ Starts similar to extrinsic pathway

⇓

TNF + TNFR 1

↓

Multiprotein complex called **Necrosome** is formed.

[Necrosome → RIP 1, RIP 3 & Procaspase 8]

RIP

[Receptor Interacting Protein kinase]

~~Procaspase~~

↓

Necrosome (Procaspase 8 is not activated)

↓

Metabolic alteration in cell

↓

↓ ATP

↑ ROS

↓

DNA & protein damage

Membrane damage (by lipid Peroxidase)

↑ membrane Permeability & leakage of contents

⇓

Cell death like Necrosis

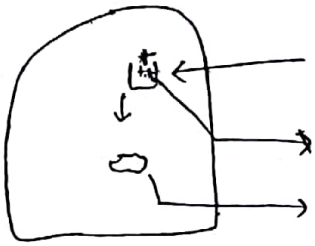
Examples of Necroptosis.

Physiological — Occurs during formation of bone growth plate.

Pathological — Cell death in Steatohepatitis, acute pancreatitis, reperfusion Injury, & Neurodegenerative diseases e.g. Parkinson's disease.

Pyroptosis

Active process
Programmed cell death.
Also called as pyrogen induced apoptosis.
[accompanied by fever]



Receptors of innate immunity
Microbial products are added
Inflamasome (multiprotein product)
↓
Activates Caspase I (AKA IL 1β converting enzyme)
↓
IL 1
↙ Fever
↘ Inflammation.

⇒ Caspase I & Caspase II induce cell death similar to necrosis

Cellular Adaptations

① Hypertrophy

↑ size of cells → ↑ size of organ
↓
↑ in functional capacity of the organ.

Size of cell increases due to increase in proteins and organelles in the cell.

Cause → ↑ Functional demand
→ ↑ Growth factor / Hormonal stimulation.

Physiological

⇒ Gravid uterus increases in size due to estrogens.
Hypertrophy >> Hyperplasia.

⇒ Skeletal muscles in weight lifters.
⇒ Lactating breast ↑ in size due to Hypertrophy.

Pathological

⇒ Cardiac hypertrophy / LVH due to HTN or aortic valve disease.

Different isoform of myosin in hypertrophic heart
Switch of contractile protein from adult (α myosin) to fetal form (β myosin) which produces slower and energitically economical contractions.

α → β myosin

(2) Hyperplasia

↑ in no. of cells ⟶ ↑ in size of organ
↓
↑ in functional capacity.

Physiological

↙ ⟶ Compensatory Hyperplasia seen in liver.

Hormonal Hyperplasia
Seen in breast during puberty & pregnancy

Pathological

Due to excessive hormone or GF stimulation.

↙ ⟶

Endometrial Hyperplasia
due to excessive estrogen

BHP
due to androgen.

Pathological hyperplasia can lead to carcinoma.

Endometrial hyperplasia ⟶ Carcinoma
⇒ ± Endometrial adenoca can arise in background of endometrial hyperplasia
⇒ ± Endometrial adenoca can arise in background of endometrial atrophy also.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

③ Atrophy

↓ in size of cells (due to loss of proteins & organelles)

↓

↓ size of organs

↓

↓ in functional capacity of organ.

Causes

↓ work load

↓ Loss of Nerve supply

↓ blood supply

Inadequate Nutrition

Loss of hormonal stimulations

Ageing (Senile atrophy)

Atrophic cells →

- ↓ Protein Synthesis
- ↑ protein degredation by ubiquitin proteosome pathway
- Show autophagy.

Example Brown atrophy of heart.

[Atrophy + Lipofuscin accumulation]

(4) **Metaplasia** - One type of adult cell is replaced by another type of adult cell because another one is better suited for the environmental condition.

- Due to stem cell reprogramming.

e.g.: (a) Columnar to squamous metaplasia
Seen in smokers & Vitamin A deficient patients (Respiratory Tract)
Protective function of epithelium is lost.

(b) Squamous to columnar metaplasia in Barrett's esophagus in pt of GERD.

(c) Mesenchymal metaplasia → Bone is formed in soft tissue in foci of injury e.g.: Myositis ossificans.

Stain used is Mucin

Intracellular accumulations and Pathological Calcification

Pathological Calcification

Dystrophic Calcification

- Seen in dead/damaged tissue.
- Serum Ca. (N).
- Ca metabolism (N)

e.g – dead parasites
- areas of Necrosis
- damaged heart valves (as in RHD)
- Blood vessels — Atherosclerotic plaques
  - Monckeberg's medial Calcific sclerosis: Calcification in media of medium sized arteries in old ages
- Psammoma Bodies – Concentric calcification on necrotic tumor cells.

Metastatic Calcifications

- Seen in normal tissues due to hyper-calcemia
- Serum Ca ↑
- Ca metabolism deranged

Sites
MC – ① Alveolar Septae of lungs
② kidney
③ Gastric mucosa
④ Walls of systemic arteries and pulmonary veins

Causes
① CRF
② Hyperparathyroidism
③ Vit D intoxication
④ Milk alkali syndrome.
⑤ Sarcoidosis
⑥ Paget's diseases Bone disease
⑦ Bone tumor (M.M).

* Calcification starts in mitochondria of all cells except kidney, where it starts in the basement membrane of tubules.

Stains for Calcium → Von Kossa (Black)
→ Alizarine Red S (Red)

* Calcein is another stain for calcium.

(Tetracycline labelling index) is done to detect bone mineralization.

Intracellular accumulations:

(1) Proteins → (Russel bodies) in Plasma cells in M.M.

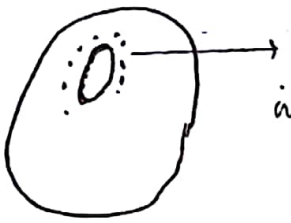
→ Intracytoplasmic accumulation of Ig in PC cytoplasm
→ (Resorption droplets) in PCT cells in nephrotic syndrome

(2) Fat → Triglyceride accumulation → Fatty liver.
→ Cholesterol accumulation → Xantomas
→ Atherosclerotic plaques

(3) Glycogen → glycogen storage diseases
→ seen in PCT cells of kidney
in Pts c DM → ARMANI EBSTEIN Lesions.

(4) Pigments

→ Lipofucin
Lipochrome pigment
Brown in colour
↳ Pigment of ageing
↳ Wear and Tear pigment.
↳ Sign of Free radical injury to cells.



→ accumulates in perinuclear in the lysosomes in the cytoplasm.

→ Hemosiderin
Iron containing pigment
⇒ Stain – Perl's prussian Blue reaction
H & E – golden brown in colour
Accumulation in conditions of Iron overload.
e.g Severe hemolytic anemia (Thal major)
Areas of hematoma
Hemochromatosis

Cellular Ageing

Telomeres

Ends of chromosomes by which chromosomes are attached to nuclear membrane.

Also called as Biological clocks because with each cell division there is telomere shortening And when telomers are shortened beyond a critical limit → Cellular Senescence (terminal non dividing state of cell)

Telomerase

Maintains the length of telomeres.

Not found in somatic cells

Found in
- Stem cells
- Germ cells
- Embryonic cells
- Cancer cells.

Telomere lengthening → Carcinogenesis

90% human cancers are +ve for telomerase enzyme

Werner's Syndrome → Premature ageing
Def. of enzyme DNA helicase
↓
Needed for DNA unwinding & regain.

Calorie restriction promotes longivity.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Calorie restriction promotes longevity

↑ Sirtulins (SIR)

↓ Signaling through IGF pathway
↓
↓ cell growth &
↓ cell metabolism
↓
↓ cell damage.

Sirtulins

NAD dependent protein deacytylases.

Distributed in different components of cell

7 different types known (SIR 7)

⇒ Prevent free radical damage
↓ Apoptosis
Stimulate protein folding
Inhibit cell metabolism

} Promotes Longivity

Associated with ← Ageing
DM
Cancer.

Sirtulins & Lipofucin

Tissue processing

[Paraffin Embedding] (10-12 hrs)

Steps

① **Fixation**

MC fixator used is 10 % Neutral buffer formalin

② **Dehydration**

Putting tissue in ↑ grades of ethyl alcohol.

(30 % Ethanol → 50% → 70% → absolute alcohol)

③ **Clearing**

- Makes the tissue optically clear.
- Clearing agent is miscible with paraffin wax.

MC (Xylene)

④ **Embedding**

Molten paraffin wax enters the tissue and it hardens the tissue

⑤ **Sectioning**

Cut 4-6 microns thick sections and place them on slides → Stain ē H & E.

Fixatives

(1) M/c used fixature for HPE – 10% neutral buffered formaline.

(2) EM → Fixative is 2.5% glutaraldehyde
↓
Followed by post fixation in Osmium Tetraoxide
↓
Ultra thin sections are cut (1-2 micron)

Stain → Uranyl acetate
& observed in EM.

(3) PAP smear fixed in 95% ethanol (Absolute alcohol)

(4) IF examination → fixed in Normal Saline
↓
Frozen section is cut
↓
Section placed on Slide
& stained by IF stains &
↓
Observed in UV light.

⑤ Fixatives for Peripheral Smear and FNAC.

↳ Methanol.

Uses of Frozen Section

Also called as Cryosection
or
Intraoperative biopsy

Tissue is frozen at -20° to -30°C in a cryostat.

Frozen section ① ⇒ Can descriminate benign from malignant

② ⇒ Can analyse resection margins.

③ ⇒ Can detect metastatic deposits in sentinal nodes.

④ ⇒ Used for demonstration of fat in tissue.

⑤ ⇒ Immuno fluoresence examination
- Tissue cut by frozen section.

Special Stains

① MC stain used is H & E

② Fat — Oil Red O (Red)
— Sudan Black
— Orcein

③ Glycogen — PAS

Colour - Pink/Rose Pink

⇒ glycogen is PAS +ve and diastase sensitive -

Amyloid ⇒ PAS +ve diastase resistant.

PAS +ve substances

Glycogen
Glycolipids
Glycoproteins
Mucins
Colloid
Amyloid
Basement membrane
All fungi
Russel bodies.

GGG CAMBRA

Used in

Diagnosis of

Glycogen storage disorder
Staining of macrophages in Whipple's disease
Demonstrating fungi
Mucins in adenocarcinoma of large intestines.
Seminoma, rhabdomyosarcoma, Ewig's sarcoma — contain glycogen
Lymphoblasts in AML (Block PAS +ve)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

④ **Mucins** (glycosylated proteins – plasma membrane, mucous membrane)

3 Stains → Alcian blue
→ PAS
→ Mucicarmine – Magenta

– Can stain Cryptococcus Capsule also only not the whole fungi, (Red coloured)

& ⑤ **Basement membrane Stains**

– PAS
– Silver Stain (Black colour)

⑥ **Connective tissue Stains**

→ collagen – Massons Trichrome (Blue colour)
→ Reticulin fibre – Silver Stain (Black)
→ Elastic fibers – Verhoff stain

⑦ **Fibrin & Muscle**

PTAH (Phospho Tungstic Acid Hematoxylin)

⑧ **Fat/lipids**

Oil Red O (Best), Sudan black & Orcein

⑨ **Calcium**

Von kossa (Black)
Alzarin Red s (Red)
Calcein

(10) Melanin pigment

Masson Fontana — BLACK (Silver Stain)

Dopa reaction.

(11) Stain for Copper

Rubeanic acid

Rhodamine

Orcein

(12) Hemosiderin pigment

Perl's Prussian Blue reaction

↓

Hemochromatosis

(13) Bile pigment

& Fouchet's Technique (green)

(14) Mast cells

Toluidine Blue

Frozen section - Toluidine Blue.

(15) Stains for Microorganism

(a) Mycobacteria Ziehl Neelsen Stain

(b) Lepra Bacilli (Fite Stain).

(c) Fungus PAS (Deadonly) → Best

GMS (Gomori Methamine Silver) → Live & Dead

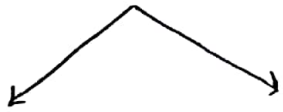
(d) Spirochetes Warthin Starry (Silver Stain) for H pylori

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Inflammation

- It is Response of vascularized connective tissue to injury.
- Protective Injury



Acute — Chronic

Exudate is formed

Exudate	Transudate
- Inflammatory edema	Non Inflammatory edema
- Formed due to increased vascular permeability	- Formed due to increased hydrostatic pressure.
- Rich in proteins & cells	- Poor in proteins & cells.
- Sp. gravity > 1.020	- Sp. gravity < 1.012
- LDH ↑	- LDH ↓

Acute

1. Sudden onset
2. Lasts for a short duration
3. 2 characterstic features
   - extravassation of neutrophils
   - exudate formation
4. Local signs & symptoms are prominent.
5. Usually self limiting
6. Tissue injury is mild.

Chronic

1. Insideous onset.
2. Lasts for long duration (weeks - months - years)
3. 2 characteristic features
   - infiltration of tissue by mononuclear cells
   - Tissue destruction.
4. Local signs & symptoms are not prominent.
5. Progressive
6. Severe & may lead to fibrosis.

Acute Inflammation

- Events of acute inflammation
- Mediators of acute inflammation.

Events of acute inflammation.

- Seen in post capillary venules
  - → Vascular events
  - → Cellular events.

(I) Vascular events

(1) Transient vasoconstriction

↓

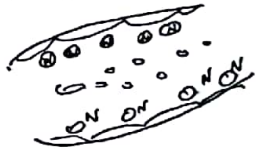
(2) Massive vasodilation

↓

(3) Increased vasular permeability. → exudate formation (Most imp)

↓

(4) Stasis of cells in Blood vessels.



↓

(5) Leucocyte margination to the periphery.

(II) Cellular events

- Phagocytosis
- Chemotaxis
- Adhesion & transmigration

Mechanisms of ↑ vascular permeability

(1) Endothelial contraction (M/c mech)

(occurs in post capillary venules)

Mediators → Histamine
→ Bradykinin
→ Substance P
→ Leukotriene

⇒ Immediate Transient response

② Endothelial retraction / Junctional reorganisation

(venules & capillaries)

Delayed type of contraction

Mediators (cytokines) → IL-1
→ TNF α

⇒ ② Delayed, sustained response

③ Direct Injury

(Seen in venules, arterioles, capillaries)

Severe Injury

e.g Severe burns
Chemicals
Toxins

↓

Cells undergo necrosis & detach.

↓

Fluid leakage which starts immediately

↓

Leakage continues till a new cell regenerates

⇒ ① Immediate sustained response

Mild Injury

e.g mild sunburn.

↓

endothelial cells die after a few hours due to apoptosis.

↓

Fluid leakage starts after few hours

↓

Leakage continues till a new cell regenerates

⇒ ① Delayed sustained response

Transplant Rejection

For a transplant HLA matching is done b/w donor and receipient.

HLA antigens that should be matched are.

HLA DR
HLA B
HLA A

HLA matching is not done for liver, heart, lungs, & cornea because other factors like

- anatomical combatibility
- Severity of underlying disease
- Need to minimize the time of organ storage

Immunosuppressive therapy

1. Steroid - Reduce Inflammation
2. Mycophenolate mofetil - Inhibits lymphocyte proliferation
3. Tacrolimus (FK 506) - Inhibits Phosphatase Calcineurin which is required for activation of NFAT (Nuclear Factor of Activated T cells)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

NFAT not activated
↓
No IL 2
↓
T cell inhibition

(4) T & B cell depleting antibodies

(5) Pooled IV immunoglobulins.

Complication of organ transplant.

(1) Infection (MC)

⇒ (CMV) most common infection
Cells show owl eye intranuclear inclusions.

⇒ Polyoma BK viral infection
Decoy cells – PCT cells & intra-nuclear basophilic inclusion.

(2) Transplant rejection

(3) GVHD

(4) ↑ risk of malignancies
- → HPV associated SCC skin
- → EBV ass. lymphomas
- → HHV8 ass. Kaposi's Sarcoma.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Transplant Rejection

Solid organ transplant

Recipient is immunocompetent.

3 types of Rejection.

① Hyperacute rejection
occurs within minutes (< 48 hours)

It is due to preformed antibodies in the recipient.

↳ seen in
- Multiparous women
- Multitransfused individuals
- Past H/o transplant rejection.

* ABO & RH incompatibility can also cause hyperacute rejection.

Gross

Slightly swollen + mottled + cyanosed

kidney — Anuric
Filters few drops of blood urine or no urine at all.

M/E

① Neutrophilic infiltration in glomerular capilaries, arteriales & peritubular capillaries

② Fibrinoid necrosis & thrombosis in the vessels

③ Thrombosis leads to cortical necrosis

TYPE II Hypersensitivity Reaction.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Acute Rejection

Occurs from weeks – months (< 6 months)
or
later when immunosuppressive therapy is withdrawn.

2 types

Acute cellular Rejection

Brought about by
- CD4 Tcell
- CD8 Tcell

Type IV HR.

Responds to increasing the dose of immunosupressive therapy.

Acute Humoral Rejection

Brought about by antibodies that are produced after transplantation.

Type II > Type III HR.

Doesnot respond to increasing the dose of immunosupressive therapy but responds to B cell depleting agents.

Biopsy

↓

Microscopical Ex

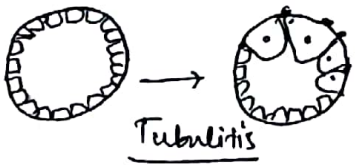
Three types are seen.

Type I / Tubulointerstiteal pattern

- Tubulitis
- Interstitial mononuclear cells Infiltration

(T cell/macrophage)

M/C Vasculitis ↓ Damage to glomeruli & small vessels



Thrombi in small vessels

Fibrinoid Necrosis in vessels

Type II vascular pattern
Endothelitis

Type III vascular pattern
Endothelitis
+
Necrosis in the vessel wall.

DIHC → C4d deposited in vessels
- glomerular Capillaries
- Peritubular Capillaries.

[in immunoperoxidase Stain]

Chronic Rejection

(Months – Years)

Can be due to antibodies or Tcells

More common – Type IV HR.

M/E - ① Obliterative intimal fibrosis of BV.
② Atherosclerosis of graft vessels
③ Glomerulosclerosis
④ Tubular atrophy
⑤ Interstitial fibrosis

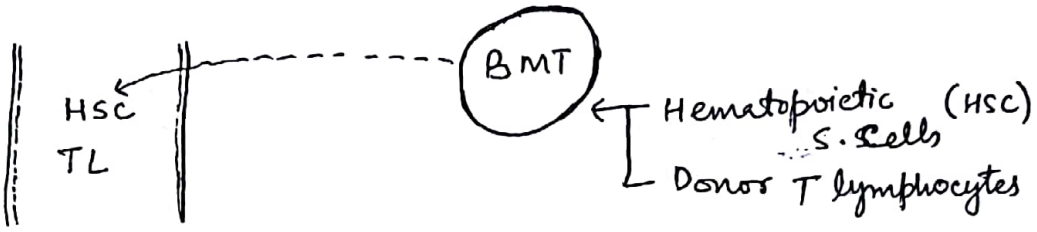
→ Transplant glomerulopathy.

GVHD

Graft versus host disease

It is a complication of Bone Marrow Transplant (BMT)

Type IV HR.



Recipient is immunocompromised

- Due to primary disease for which Transplant is indicated
- Due to Radiotherapy or chemotherapy that is given to form transplant bed.

GVHD

Acute (<100 days)

1. Skin (Mc)
   Rashes & ulcers
2. GIT Oesophageal & Intestinal ulcers
   Bloody diarrhea
   Malabsorption

Chronic (>100 days)

1. Skin
   Scleroderma like fibrosis
2. Strictures
   Malabsorption.

③ Liver

Cholestatic jaundice — Inflammation of bile duct

Destruction of the ducts — Cholestatic jaundice

④ Destruction of immune system of the recipient
e.g; LN, Thymus, spleen, etc.

T cell depleted B.M.T.

- No GVHD
- Increased incidence of graft failure
- Relapse of primary disease eg. Acute leukemia.

Also called as graft versus leukemia effect.

- ↑ incidence of EBV. related leukemias & lymphomas.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Neoplasia

- New growth
- Neoplasm - Tumor

Benign

Suffix "oma"

Epithelial origin → Adenoma
Epithelial origin → Papilloma

Mesenchymal origin ⇒
- Lipoma
- Fibroma
- Leiomyoma
- Rhabdomyoma
- Osteoma
- Chondroma

Malignant

Suffix carcinoma/sarcoma

Epithelial origin → Carcinoma
e.g Adenocarcinoma
SCC
Transitional Ca
BCC

Mesenchymal origin → Sarcoma
e.g Liposarcoma
Fibrosarcoma
Leiomyosarcoma
Rhabdomyosarcoma
Osteosarcoma
Chondrosarcoma.

Malignant tumors ~~c~~ Suffix "oma".

1. Hepatoma (HCC)
2. Seminoma
3. Melanoma (melanocytes)
4. Chordoma (Malignant tumor of Notocord)

Teratoma

Tumor of Totipotent cells

(a) Mature cystic teratoma [Benign tumor]

- Elements of all three germ layers
- All components are mature.

e.g.; Skin adnexal structures, bone, cartilage, blood vessels, tooth, fat, thyroid tissue

ovary → Dermoid cyst.

(b) Immature Teratoma [Malignant tumor]

Elements are immature or fetal type

e.g; immature cartilage or bone

immature Neural tissue is important

↳ for grading.

(c) Teratoma with malignant transformation

Malignat tumor

One of the component has become malignant.

Pleomorphic adenoma

- Benign tumor
- Salivary glands (M/C)
  (Parotid MC & Breast)

Epithelial component
- glands
- Sq. epithelium

Mesenchymal component
- Cartilage
- Fibrous tissue
- Bone
- Muscle

Cells of origin → Myoepithelial cell.

℞ Wide excision

As Tongues of tumor tissue are seen in the surrounding tissue.

NOT TRUE NEOPLASMS

Choristoma

- Ectopic rest of Normal tissue
- Normal tissue at abnormal location

e.g glial tissue in Nasopharynx
Adrenal rests in the kidney

Hamartoma

Normal tissue in normal location but in a disorganised arrangement.

e.g bronchial hamartoma.
Hemangioma
Lymphangioma.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Benign	Malignant
Well differentiated (Resemble the tissue from which they rise)	Poorly differentiated or well - moderate differentiated or Anaplastic ↓ (Complete lack of differentiation)
Slow growing & may regress on their own	Rapidly growing, have erratic growth.
Usually Encapsulated. Un encapsulated are as - Leiomyoma Hemangioma Lymphangioma	Malignant tumors that show spontaneous regression - R C C - Neuroblastoma - Retinoblastoma - Malignat Melanoma - Chorio Carcinoma.
	Uncapsulated or may show pseudo capsule (formed by compressed normal tissue)
No local invasion	Local invasion +
No metastasis	Metastasis +

Metastasis is most imp. feature that differentiate ~~that~~ bening from malignant

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Malignant tumors that show local invasion but no metastasis ⇒ BCC
Glioma

Features of Malignant cells

Large cells
High N:C ratio
Pleomorphism - variation in shape & size
Hyperchromatic nucleus
Abnormal mitosis

Dysplasia

Premalignant condition e.g. cervical dysplasia

Loss of polarity
Pleomorphism
High N:C Ratio
Abnormal mitosis
Hyperchromatic Nucleus

They are confined in the basement membrane

Cervical dysplasia

CIN I - Abnormal cells confined to 1/3rd of Cx

CIN II - occupy 2/3rd Cx epithelium

CIN III - occupy full thickness of cervical epithelium } BM intact.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Pathways for Spread.

(1) Lymphatic Spread

Preferred mode of spread for a Carcinoma

LN drainage of Ca. → Metastasis
→ Reactive hyperplasia

(2) Hematogenous spread

Preffered mode of spread of a Sarcoma

3 carcinomas first spread by Hemato-genous route:
- RCC
- HCC
- Choriocarcinoma

M/c Spread to - lungs > Liver

Venous invasion is more common than Arterial invasion

(3) Direct Spread

(a) Mesothelioma (MC) arises from mesothelial cells of pleura or peritoneum & spreads on the surface of pleura or peritoneum.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

(6) Pseudomyxoma peritonei

Seen in

Mucinous adenoCa Appendix

Mucinous adenoCa ovary

Mucinous adenoCa Colon

Mucin produced by tumor cells

↓

Causes adhesions b/w various organs in the peritoneal cavity.

Tumors that spread via CSF

Medulloblastoma

[Small round cell tumor]

[Childhood tumor]

Site - Posterior fossa (cerebellum)

Extremely radiosensitive

Spreads via CSF & produces

DROP METASTASIS

in Cauda equina

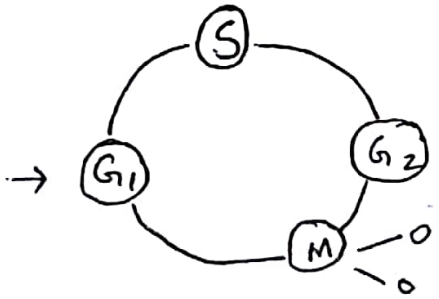
Ependymoma

Arises from ependymal lg lining of ventricles.

Small blue round cell tumors

1. Neuroblastoma
2. Retinoblastoma
3. Medulloblastoma
4. Embryonal rhabdomyosarcoma
5. Lymphoma (Lymphoblastic)

Normal cell cycle regulation.



Orderly progression of cell through cell cycle is brought about by cyclins & cyclin dependent kinases (CDKs) [Proto oncogenes]

Cyclins	CDKs	
Cyclin D	4, 6	G_1 to S transition
Cyclin E	2	G_1 to S transition
Cyclin A	2	G_2 to M transition
Cyclin B	1	G_2 to M transition

G_1 S transition — Cyclin D_CDK4 Most imp.
— Cyclin E - CDK2

G_2 M t — cyclin A/CDK2
— cyclin B/CDK1

Cyclin A/CDK_2 → Takes the cell through G_2 phase upto prophase of mitosis

Cyclin B/CDK_1 → Regulates all initial events of mitosis beyond prophase.

Inhibitors of cyclins/CDKs

↳ Inactivate cyclins/CDKs and stop the cell in the cell cycle — G_1 arrest, G_2 arrest.

CIP/KIP Family (CDKN1A-D)

- p21 → Induced by p53
- p27 → Induced by TGFβ
- p57

Non specific

INK4 family/(ARF) (CDKN2A-C)

p14, p15, 16, 18, 19

Specifically inhibit cyclin D/CDK

p16 - most imp.

p14 acts by ↑ing p53 by inhibiting MDM_2 activity.

Cell cycle Checkpoint

G_1 S Checkpoint

Sensors → ATM, RAD family

Transducers → CHEK kinase

Effectors → p53 dependent mechanism

G_2 M

Sensors → ATM RAD family

Transducers → CHEK kinase

Effectors → p53 dependent, p53 independent

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Rb gene

- Tumor supressor gene - on chromosome 13q14
- Also called as Governer of cell cycle
  or
  Molecular on-off switch of cell cycle.
- Rb causes G_1 arrest of cell cycle.

Rb is located on 13q14

↓

Produces Rb protein

Active form (NP)	Inactive form (P)
- Inhibits cell proliferation	- Allows cell proliferation
- Called under/hypo phosphorylated RB	- Called hyperphosphorylated RB.

⇒ Under phosphorylated RB has pockets in which it hides E2F/DP1 transcription factors - These factors are used in S phase for DNA synthesis.
Thus causes G1 arrest of cell

⇒ Under phosphorylated RB also Recruits enzyme Histone deacetylase causing Compaction of nuclear chromatin thus G1 arrest.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

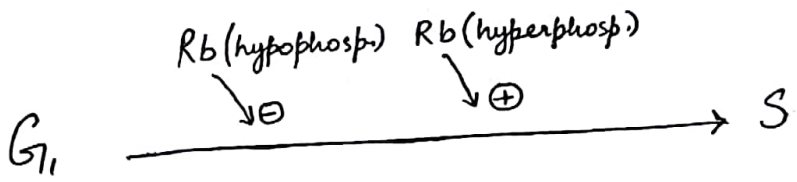
When the cell has to move from G_1 to S phase, a cyclin D/CDK4 phosphorylates the underphosphorylated Rb to hyperphosphorylated Rb

↓

releases E2F/GP1 TF from pockets

↓

Cell will proceed to S phase.



Loss of Rb gene produces
- Retinoblastomas
- Osteogenic sarcomas.

Regulatory genes.

4 classes of regulatory genes.

1. Proto oncogenes
2. Tumor suppressor genes/Anti oncogenes
3. Genes for apoptosis
4. Genes for DNA repair.

1. Protooncogenes → Cause cell proliferation
   Controlled cell proliferation

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Protooncogenes can be (GF), (GFR), (STP) (Signal Transduction) (NTP) (Nuclear Transduction Protein) (cyclins) & (CDKs)

(2) Tumor suppressor gene / Antioncogene

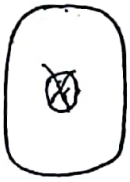
Inhibit cell proliferation by inhibiting

(3) Genes for Apoptosis

- Antiapoptotic: BCL2, BCLXL, MCL-1
- Proapoptotic: BAX, BAN
- Arbiters: BIM, BID, BAD, PUMA, NOXA

(4) Gene for DNA repair.

Molecular basis of Cancer



Regulatory gene damage → Undergoes 30 population doublings from a single ~~go~~ transformed cell.

↓

Kinetics of tumor cell growth

1 gm cancer ≅ 10^9 cells is formed

↓ 10 population doublings

1 kg Cancer cells ≅ 10^{12} cells is formed (Largest Ca mass compatible ≅ life)

Genetic damage lies at the heart of carcinogenesis

Regulatory genes are damaged, tranformed cell enters cell cycle & under goes population doublings leading to cancer.

↓

Tumor cells establish their own blood supply by producing — VEGF, bEGF, PDGF

(Tumor angiogenesis)

↓

Local invasion & distant metastasis

[Phenotypic attributes of Ca cell & are acquired in Step wise fashion]

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Mechanism of Metastasis

(1) Metastatic sub clone is formed, which shows decreased expression of E cadherin → loosens up from the main tumor.

(2) Metastatic subclone produces enzymes that degrade BM & extracellular connective tissue

e.g Type IV colagenase
Matrix metalloproteins
Plasminogen activator.

(3) Metastatic subclone shows expression of laminin & fibronectin receptors by which they attach to laminin & fibronectin in the connective tissue.

(4) Some cancers also produce autocrine motility factors which help in ca metastasis.

(5) Cancer cells enter the blood vessels where they attach to

⑥ Tumor emboli gets out of blood vessels at a distant site & produces metastatic deposits.

Epithelial to mesenchymal transition (EMT)

Cancer cells acquire a mesenchymal phenotype (e.g; spindle shape) for metastasis

2 genes for EMT → SNAIL, TWIST } ↓ Ecadherin.

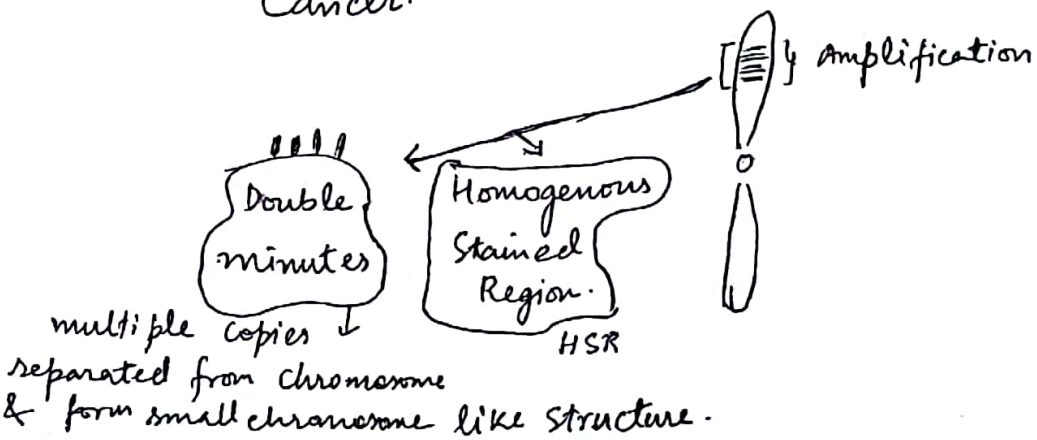
Regulatory genes.

① Proto oncogene (Controlled cell proliferation)

Activated Proto oncogene
↓
Oncogenes
↓
Produce onco proteins
↓
Cancer.

→ Translocation
→ Point mutation
→ Amplification
→ Over expression.

POTA



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

(I) Growth factors

- SIS (PDGF-β) — Overexpression → Astrocytoma
- HST 1 (FGF) — Overexpression → Osteosarcoma
- INT-2 (FGF3) — Amplification → Bladder Ca, Stomach Ca
- HGF — Overexpression → HCC, Thyroid Ca

(II) GFR (Growth Factor Receptors)

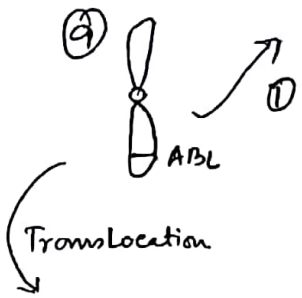
- EGFR (Epidermal Growth Factor Receptor)
  - ERB-B1 — Overexpression → Adeno Ca Lung
  - ERB-B2 (Her-2-neu) — Amplification → Breast Ca, Ovarian Ca

- RET — Point Mutation (Activation) → MEN 2A, MEN 2B, Medullary Ca Thyroid.
- RET — Point Mutation (Inactivation) → ~~Hirschsprung disease~~ HIRSCHSPRUNG Disease [Congenital Megacolon]
- KIT (CD117) — Point Mutation → GIST, Soft tissue tumors
- Alk — Translocation → Adeno ca lung, Lymphoma.

(III) Signal transduction proteins

(a) ABL —t(9:22)→ CML, ALL, AML (Latest)

ABL encodes for a protein with tyrosine kinase activity



Causes signal transduction through Myeloid & lymphoid cells.

→ BCR ABL Fusion gene

↓

Fusion protein ⇒ very high tyrosine kinase activity.

- Myeloid cells → 210 KD size → CML
- Lymphoid cells → 190 KD size → ALL

ⓑ RAS

→ Most common Oncogenic mutations in human Cancers → RAS Mutations.

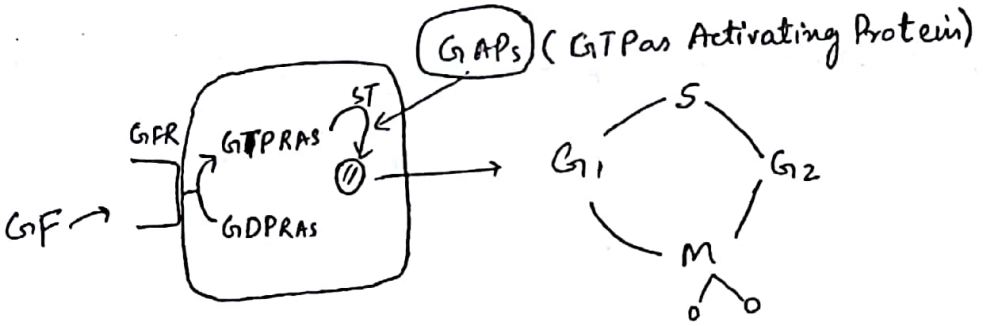
K RAS —PM→ Colon, lung, pancreatic Ca

H RAS —PM→ Urinary bladder & kidney tumor.

N RAS —PM→ Melanomas & hematopoietic tumors.

2 forms of RAS protein

Active	Inactive
GTP RAS	GDP RAS
Allows cell proliferation	Prevents cell proliferation



GF + GFR → GDPRAS is converted to GTPRAS

↓

Causes ST

↓

Cell proliferation

After limited cycles

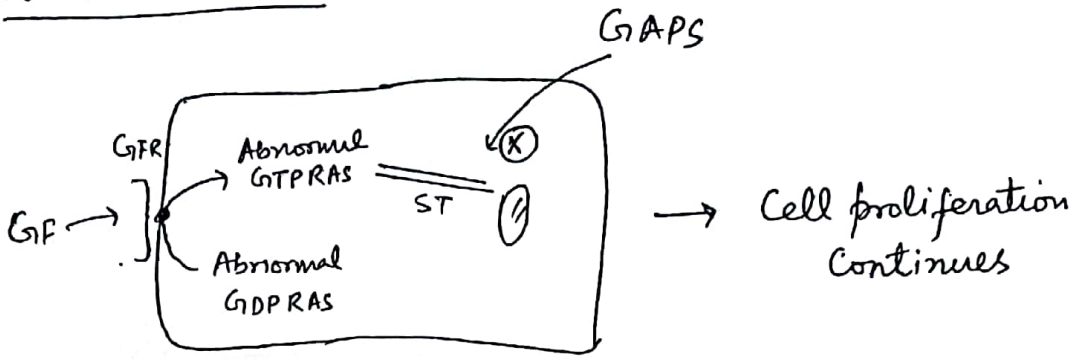
↓

GAPs → Pull the Phosphate group from GTP RAS & Converts in GDP RAS

↓

Stops ST → Stops cell proliferation

Point mutated RAS

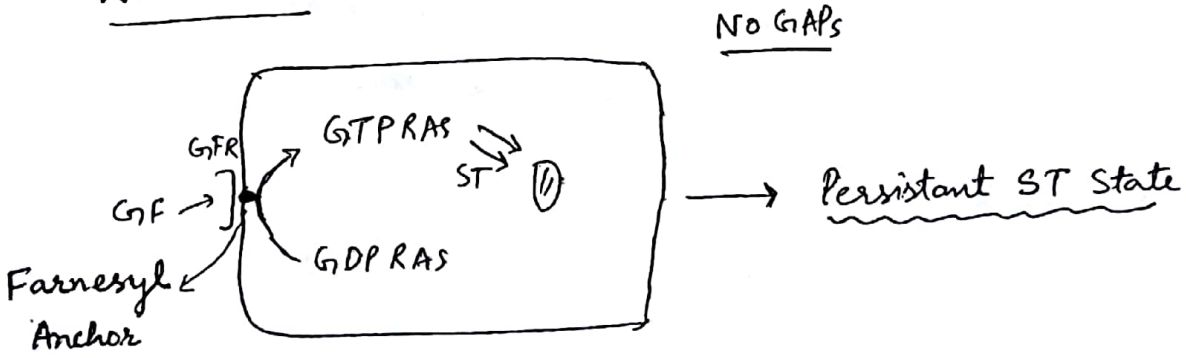


Due to point mutation in RAS, GAPs are unable to pull 'P' group from abnormal GTPRAS.

↓

RAS Remains in persistant Signal Transduction state & produces tumors.

NO GAPS



GAPs are produced by NF1 gene

↓

Loss of which leads to Persistant ST state & produces Tumors.

NF1 Syndrome

ⓒ BRAF

BRAF (V600) —PM→
- Hair cell Leukemia
- LCH
- Papillary Ca Thyroid
- Astrocytoma
- Colonic Ca.

HPLC A

Drug – Vemorafinib

ⓓ β Catenin

β Catenin —PM→ HCC
Hepatoblastoma.

ⓔ NOTCH

NOTCH —PM→ Leukemias
Lymphomas.

Ⅳ Nuclear Transcription Proteins

C MYC —t(8;14)→ Burkits Lymphomas

N MYC —Amplification→ Neuroblastoma.

(V) Cyclin / CDKs

Cyclin D_1 —t(11:14)→ Mantle cell Lymphoma.

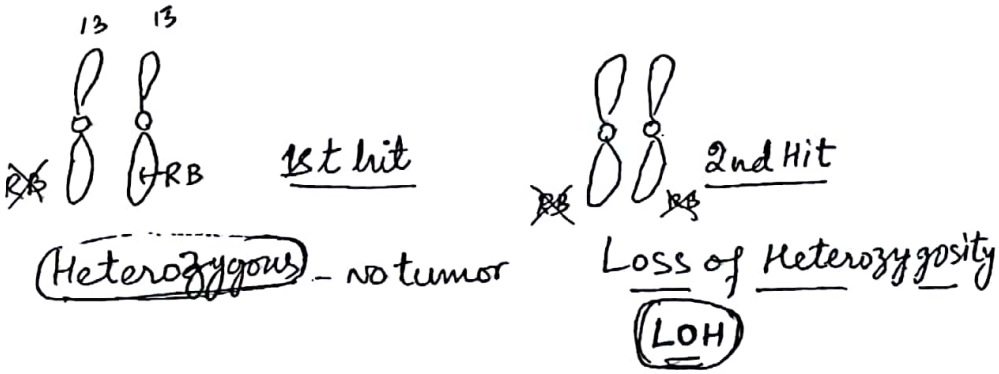
Cyclin E —Overexpression→ Breast Ca

CDK 4 —PM amplification→ Glioblastoma, Melanoma

(2) Tumor suppressor genes

Inhibits cell proliferation

Loss of both copies (Inactivation) of TSG produces Ca.



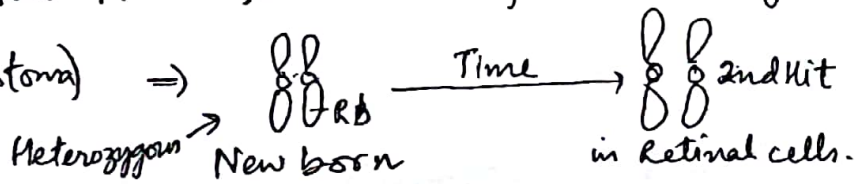
Heterozygous – no tumor

Loss of Heterozygosity (LOH)

1st tumor supressor gene is RB

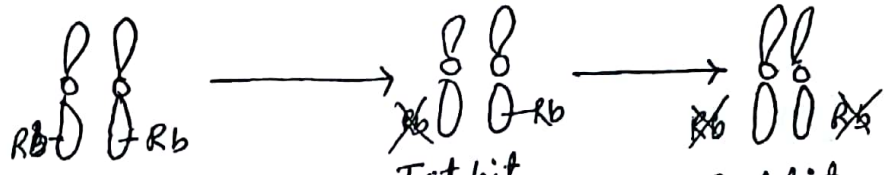
Loss → Retinoblastoma, Osteosarcoma

Knudson's TWO HIT HYPOTHESIS for Heriditary Cases (Retinoblastoma) ⇒



Heterozygous New born → in Retinal cells.

Sporadic cases



Normal at birth

Ist hit in Retinal cells of eye

2nd hit in Retinal cells of eye

↓

LOH

↓

Retinoblastoma.

(I) Cell surface

- TGF-β receptor — Function: Growth inhibition — Inactivation → Ca colon
- E cadherin — cell adhesion — Loss → Ca stomach

(II) Under the Plasma Membrane — NF-1 (Neurofibromin) or (GAPs) — Inhibits RAS Signal Transduction → NF 1 Syndrome or (Von Reckling hausen's disease)

GAPs are produced by NF-1

- ↳ Multiple Neurofibromas
- ↳ Cafe au Lait spots
- ↳ Lish nodules in Iris (hamartomas)
- ↳ ↑ risk of brain tumors (optic Nerve glioma)
- ↳ Juvenile myelomonocytic Leukemia (JMML)

(II) Cytoskeleton

NF 2 gene (Chr 22) → Cytoskeletal Stability —Loss→ NF2 Syndrome

MERLIN is produced by NF2 gene

B/L Acoustic Schwanoma Syndrome Meningiomas.

(III) Cytosol

APC gene (Chr-5) → APC protein → Inhibits ST by (WNT pathway) → Familial Adenomatous Polyposis Coli Syndrome (FAP synd.)

- Multiple adenomatous polyps in colon
- Minimum 100 polyps needed for diagnosis.

Polyps appear by teenage
↓
if untreated
↓
Risk of progression to Ca colon is 100%

(IV) PTEN (Chr-10) → Inhibits ST by (PI-3 kinase pathway) → Endometrial & prostate ca.

(V) Nucleus

Rb → Retinoblastoma
Rb → Osteogenic Sarcoma

p53 (Chr. 17) → Li Fraumeni syndrome

M/C gene mutated in human Ca → p53 gene.

WT-1, WT-2 } Chr. 11 → Wilms Tumor

p16 → Malignant Melanoma

ARF/INK4A

BRCA-1 (Chr. 17) → Heridiatary breast & ovarian Ca (females)
Prostate Ca

BRCA-2 (Chr 13) → Heriditary breast & ovarian Ca (females)
Prostate Ca.
Heriditary male breast Ca

(3) Genes for Apoptosis

BCL2 $\xrightarrow{t(14:18)}$ Follicular lymphoma.

Chr 14 – IgH gene

Chr 18 – BCL2 gene

(4) Genes for DNA repair

DNA repair defect syndrome

- Lynch / HNPCC syndrome — ADominant
- Xeroderma pigmentosa — ARecessive
- Ataxia Telangectasia — ARecessive
- Bloom's syndrome — ARecessive
- Fanconi's Anemia — ARecessive

Genes for DNA repair are of 3 categories

(I) Mismatch repair genes

Act as spell checkers when a strand of DNA is replicating

Loss of mismatch repair genes → Spelling mistakes accumulate in new strand DNA

the cell which gets this DNA is said to Have (RER phenotype) (Replication ERROR)

Spelling mistakes also produce microsatellite instability.

Microsatellites → Tandem repeats of 1-6 nucleotides scattered throughout our genome.

Fixed for a person & fixed for life.

Also called as Moleecular fingerprints.

Loss of mismatch repair gene is associated with Lynch Syndrome

(↑ risk of developing Colonic Ca)

(2) Nucleotide Excision Repair Gene (NER)

NER genes remove UV light induced pyrimidine dimers from DNA.

Loss → Xeroderma pigmentosa

- Photosensitivity
- 200 times of ↑ed risk of developing Cutaneous Ca

SCC
BCC &
M. Melanoma

T≡T dimers

(3) Genes for Repair by Homologous Recombination

Repair double Stranded DNA breaks which can be produced by ionizing radiation.

(a) (A)TM gene – Sensor of DNA Damage

Loss produces (A)taxia talangectasia

Cerebellar (A)taxia

Oculo cutaneous talengectasia

Def. of Ig (A) antibody

↓

(Repeated infection) cause of death

↑ed risk of developing Lympho reticular Tumors.

(b) Gene for enzyme BLM helicase

Loss → Bloom's Syndrome

growth retarelation

mental retardation

↑ed risk of developing lympho reticular tumors.

(c) Fanconi Anemia gene

Loss → Fanconi Anemia

Heriditary aplastic Anemia

Aplasia of radius & thumb bone

Hypoplastic kidney & Spleen.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

8 Hallmarks of Cancer & 2 enabling factors.

8 Hallmarks

(1) Self sufficiency of Growth signals.

(2) Insensitivity to growth inhibitory signals.

(3) Altered cellular metabolism

Warbug effect Also called as Aerobic glycolysis

It provides rapidly dividing Ca cells with metabolic intermediates that are needed for synthesis of cellular components.

Mitochondria manufactures ↓ other building blocks of Ca. cells

(4) Evasion of apoptosis

(5) Limit less replication potential – due to reactivation of telomerase

(6) Sustained angiogenesis

(7) Ability to invade and metastasize

(8) Ability to evade host immune response.

2 enabling factors

→ Genomic instability

→ Tumor promoting inflammation.

Carcinogens

Chemicals

Arsenic → Lung & Skin

Asbestos → Lung Ca, Mesothelioma
Oesoph., gastric, & colonic Ca

Benzene → AML

Beryllium → Lung Ca

Cadmium & its compounds → Prostate Ca.

Nickel & Chromium → Angiosarcoma, liver

Azo dyes → HCC

β Naphthylamine → Bladder Ca

Nitrosamine & nitrites → Oesophageal & gastric Ca

Aflatoxins → HCC

Carcinogens → Initiators → causes DNA damage
Carcinogens → Promoters → stimulate genetically damaged cells to proliferate.

e.g Promoters
Hormones like Estrogen, DES (diethyl Stilboestrol)
Saccharin
Phenol
Phorbol esters.

Complete Carcinogens
↳ Capable of both Initiation & promotion.

Carcinogens
↙ ↘
Direct acting
e.g alkylating agents
They require no metabolic conversion to become active carcinogen

Indirect acting.
e.g aromatic amines
benzo pyrines
They require metabolic conversion to become Ultimate Carcinogens.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Radiation

UV light

UVB Associated with cutaneous Ca.

Xeroderma pigmentosa are at ↑ risk of developing cut. Ca
- SCC
- BCC
- & M. Melanoma

Ionizing Radiation

All leukemia except CLL (MC)

Papillary thyroid Ca

Ca breast, Ca lung.

Ca salivary gland (Muco epidermoid Ca).

Biological Carcinogens:

Viruses

- DNA
  - HPV
  - EBV
  - HBV
  - HHV8
- RNA
  - HTLV-1
  - HCV

Bacteria

H. pylori
- MALToma
- gastric Ca

① HPV

70 serotypes are known

3 groups

Low risk serotypes — 6 & 11 ⇒ Venereal warts (condyloma accuminatum)

Intermediate serotypes — 31, 33

High risk serotypes — 16, 18 → Cancer

- Ca Cervix
- Ca Vulva
- Ca Vagina
- Ca Anal
- Canal
- Ca Penis
- Ca Larynx

Viral DNA encodes for 2 viral proteins

E6 —
- Inactivates p53 protein
- ↑ TERT + ↑ telomerase expression

E7 —
- Inactivates Rb protein
- Inactivates p21 & p27.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

② EBV — DNA virus

Infectious Mononucleosis
Oral Hairy Leukoplakia in HIV(+)
] Benign Reactive.

Tumors
Nasopharyngeal Ca
Burkitts lymphoma
Hodgkins lymphoma
Bcell lymphomas in immunocompromised.
Extranodal NK T cell lymphoma.

Produces 2 proteins responsible for excessive cell proliferation
→ LMP-1
→ EBNA-2

③ HBV → HCC

Repeated cycles of injury and regeneration lead to accumulation of mutation.

Some viruses have HBx gene
↓
Interferes with p53
↓
Ca

④ HHV8 [Kaposi's sarcoma Herpes virus 8]

Causes → Kaposi's Sarcoma
→ Primary effusion lymphoma (variant of DLBCL)

RNA Virus

① HTLV-1

Causes
- Arthritis
- Uveitis
- & Tropical Spastic Para paresis

Tumor – Adult T cell Leukemia/lymphoma.

HTLV-1 codes to TAX protein
↓
Causes uncontrolled cell proliferation.

② HCV
- HCC
- Splenic marginal Zone lymphoma

Paraneoplastic syndrome

① Endocrinopathies

(a) Hypercalcemia (MC)

Due to production of PTH related protein by tumor cells.

Tumors – SCC (lung, skin), Ca breast, RCC, Adult T cell leukemia/lymphoma.

(b) Cushing syndrome

Due to ACTH production

Tumor – Small cell Ca lung.

(c) SIADH

Due to ADH production

Tumor – Small cell Ca lung.

(d) Hypoglycemia

Due to production of Insulin or Insulin like substances.

Tumor
- Ovarian Ca
- Fibrosarcoma
- HCC

(e) Carcinoid Syndrome

Due to production of Bradykinin & Serotonin

Tumors
- Bronchial carcinoids
- HCC

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

(f) Polycythemia
Due to erythropoietin

Tumors — RCC
HCC
Cerebra Hemangioma.

(2) Nerve & muscle

Myasthenia gravis — Ca lung
Thymoma.

Immunologic in origin

(3) Cerebral degeneration

Ca lung
Hodgkins lymphoma

(4) Skin

Acanthosis Nigricans.
Due to production of epidermal growth factor.

Tumor — Gastric Ca
Lung Ca

(5) Hypertrophic osteoarthropathy - Ca lung.

⑤ Trousseau Syndrome
(Migratory Thrombophelibitis)

Tumor cells activate clotting

- Pancreatic Ca
- Lung Ca

⑥ Marantic endocarditis / Non bacterial Thrombotic endocarditis

In advanced Malignancies

Tumor Markers

① Hormones

(a) Calcitonin – Medullary Ca Thyroid.

(b) Catecholamine – Pheochromocytoma

(c) β HCG – Trophoblastic tumors of Chorio Carcinoma.

② Oncofetal antigens

(a) AFP (Alpha Feto Protein) – HCC, Hepatoblastoma
Yolk sac tumor
(no seminomatous germ cell tumor)

(b) CEA (Carcino Embryonic Antigens)
→ Ca colon, Pancreas, lung, Stomach

③ Specific Proteins

(a) Immunoglobulins — Multiple Myeloma.

(b) PSA — Prostate Ca.

④ Iso-enzymes

(a) PAP (Prostate Acid Phosphatase) – Prostate Ca

(b) Neuron specific Enolase — Neuroblastoma
Small cell Ca
Neuroendocrine tumors.

⑤ Mucins

CA 125 → Ovarian Ca

CA 19.9 — Colon & prostate Ca.

CA 15.3 — Breast Ca

⑥ Cell free DNA markers (LIQUID BIOPSY)

TP53, APC, RAS in Stool & serum – Colon Ca

TP53, RAS in stool & serum – Pancreatic Ca

TP53, RAS in Sputum & serum – Lung Ca

TP53, in urine & serum – Bladder Ca

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Tumor Markers detected in Tissue by IHC

(1) Carcinoma
- Cytokinin (M. imp)
- EMA (Epithelial Membrane Antigen)
- CEA (Carcinoembryonic Antigen)

(2) Lymphoma
- LCA (Leucocyte common Antigen)

(3) Sarcoma – Vimentin
- Ewing sarcoma – CD99
- Synovial sarcoma – CD99, BCL2
- Rhabdomyosarcoma – Desmin, MyoD1
- Leiomyosarcoma – Smooth Muscle Actin + (SMA)
- Osteosarcoma
  - Osteopontin
  - Osteonectin
  - Osteocalcin
- Chondrocytoma – S-100
- Liposarcoma – S-100

(4) Mesothelioma
- ~~S-100~~
- Cytokeratin 5/6
- Mesothelin
- Calretenin

(5) Malignant Melanoma
- HMB45
- Melan A
- S100

(6) LCH
- CD1a
- S-100
- Langerin (CD 207)

(7) Small cell Ca
Neuroblastoma
Neuroendocrine tumor
- Synaptophysin
- Chromogranein
- Neuro Specific enolase (NSE)
- S-100

(8) Schwan cells
Neurofibroma
Schwannoma — S-100

(9) TTF-1 (Thyroid Transcription Factor)
- Lung Ca < Adeno Ca, Small cell Ca
- Thyroid Ca

(10) HCC
- Arginase 3
- Hep Par 1

(I) Vascular events

(1) Transient vasoconstriction

↓

(2) Massive vasodilation

↓

(3) Increased vasular permeability. → exudate formation (Most imp)

↓

(4) Stasis of cells in Blood vessels.

↓

(5) Leucocyte margination to the periphery.

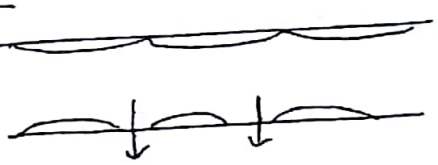
(II) Cellular events

- Phagocytosis
- Chemotaxis
- Adhesion & transmigration

Mechanisms of ↑ vascular permeability

(1) Endothelial contraction (M/c mech)

(occurs in post capillary venules)



Mediators → Histamine
→ Bradykinin
→ Substance P
→ Leukotriene

⇒ Immediate Transient response

② Endothelial retraction / Junctional reorganisation

(Venules & capillaries)

Delayed type of contraction

Mediators (cytokines) → IL-1, TNF α

⇒ ② Delayed, sustained response

③ Direct Injury

(Seen in venules, arterioles, capillaries)

Severe Injury

e.g Severe burns
Chemicals
Toxins

↓

Cells undergo necrosis & detach.

↓

Fluid leakage which starts immediately

↓

Leakage continues till a new cell regenerates

⇒ ④ Immediate sustained response

Mild Injury

e.g mild sunburn.

↓

endothelial cells die after a few hours due to apoptosis.

↓

Fluid leakage starts after few hours

↓

Leakage continues till a new cell regenerates

⇒ ① Delayed sustained response

④ Increased Transcytosis

⇒ Passage of liquid across the channels formed in the endothelial cell cytoplasm

⇒ Channels are formed close to the Junction

Mediator – VEGF

(II) Cellular events

① Adhesion and transmigration

Rolling ⟶ loose adhesions ⟶ firm adhesions

↓

Transmigration (Diapedesis)

Adhesion molecules ← - - - - - - - - - - ③

↓

Substances that coat the surface of neutrophills and surface of endothelial cells & help them to stick together.

4 Families of adhesion molecules

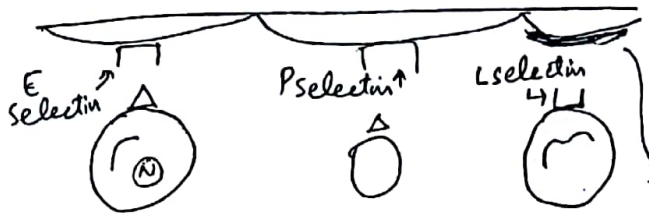
Ⓘ Selectins Bring about Rolling & loose adhesions

E selectin	CD 62E	Endothelium
P selectin	CD 62P	Platelets, endothelium
L selectin	CD 62L	Leukocytes

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Complementary molecules

↳ Sialyl Lewis X
(Sugar formed by fucose metabolism)
[E & P]



Sialyl Lewis X.
(on the surface of Leukocytes)

↳ Sialyl Lewis X in mucin like ~~glycolipids~~ glycoproteins that coat the endothelium.
(for [L])

Leucocyte Adhesion deficiency type II
(LAD type II)

⇓

deficiency of Sialyl Lewis x due to defect in fucose metabolism.

(II) Immunoglobulin Superfamily

ICAM → ① ②
(Intercellular Adhesion Molecule)
VCAM → ① ②
(Vascular cell Adhesion Molecule)

(III) Integrins

β_2 integrins
e.g LFA1 (CD11) / MAC1 (CD18)

β_1 integrins → VLA4

Both are found on endothelium — Found on leucocytes

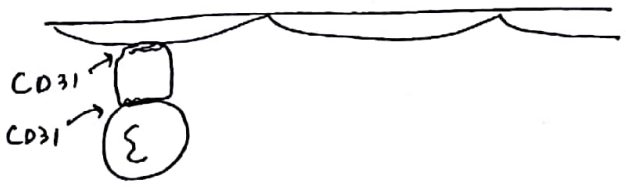
Responsible for FIRM ADHESIONS.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

(IV) CD31 / PECAM-1

(Platelet Endothelial Cell Adhesion) Molecule

- Transmigration
- Homotypic adhesion molecule
- CD31 is found on leukocyte & endothelium.



Neutrophils produce enzyme type IV collagenase
↓
breakes type IV collagen (Basement Membrane) & comes out of the vessel.

LAD type I

Autosomal recessive disorder

Deficiency of β_2 integrins LFA-1/MAC-1

There is mutation in MAC 1 (CD18) gene

C/F - Recurrent bacterial & fungal infection.
Impaired wound healing.
Delayed umbilical cord separation.
Leukocytosis (↑ TLC).

Mechanism of appearance of Adhesion molecules.

① Redistribution → P selectin

↓

Weibel Palade body in endothelial cell cytoplasm
[contains P selectin]

During inflammation

Mediators → Histamin
→ Thrombin
→ PAF

↓

Redistribute P selectin to endothelial cell surface within Few minutes

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

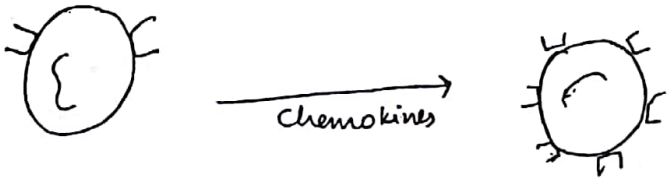
② Induction → Fresh synthesis during inflammation

- E selectin
- ICAM
- VCAM.

Mediators that induce → IL 1, TNFα

Time taken is hours.

③ Increased avidity of binding (Strength) ⇓ Integrins



↑ the no. of integrin molecules on leukocytes

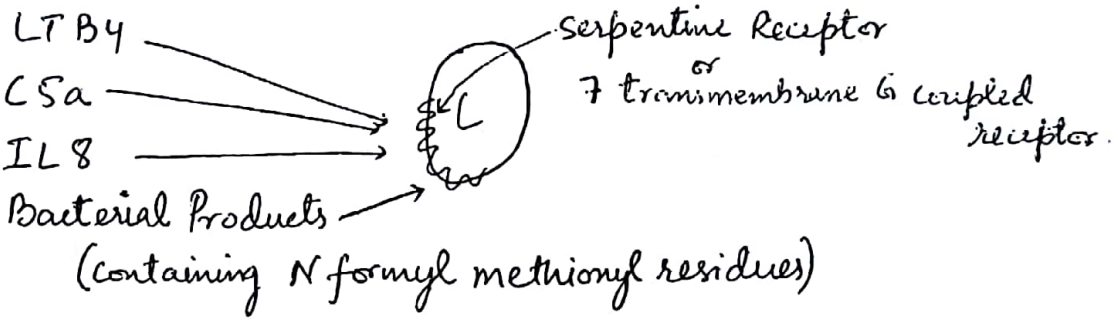
↑ the strength of binding of integrins many times.

⇒ Weibel Palade bodies are ultrastructural markers of endothelial cells (EM)

② Chemotaxis

Def. Locomotion orientend along a chemical gradient.

Chemotactic agents



When these ligands bind to 7 transmembrane G coupled receptors

↓

↑↑ Ca^{2+} in the cytosol

↓

Polymerisation of actin filaments at the leading edge

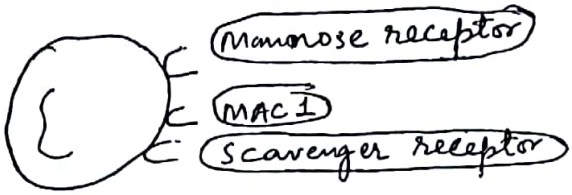
↓

Pseudopod formation

Defects In — DM, Malignancy, Severe burns, CRF

③ Phagocytosis

(a) Recognition & attachment.



3 receptors that help the neutrophil to recognize & attach to the bacteria

- Mannose receptor
- MAC 1 integrin (CD18)
- Scavanger receptor

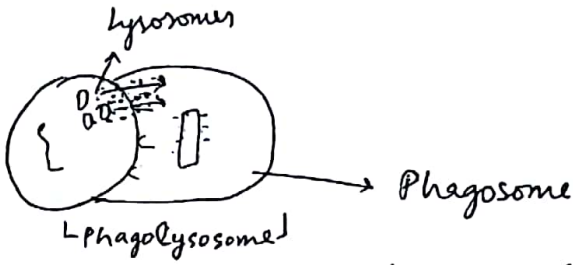
Opsonization

↑es the efficiency of phagocytosis.

Opsonins → Substances that coat the bacteria & make it tasty for neutrophil.

- C3b, C3bi (C4b, C4bi)
- IgG antibody
- Plasma proteins
  - CRP
  - Mannose Binding lectin
  - Fibronectin
  - Fibrinogen.

(b) Engulfment.



Pseudopods flow around the bacteria & bacteria is enclosed in a phagosome

Phagosome fuses with lysosome to form phagolysosome

All enzymes are discharged in phagolysosome.

Chediak Higashi syndrome – defect in engulfment

↘ Failure of fusion of phagosome & lysosome.

↳ Autosomal recessive disorder

C/F – Repeated infections
- Oculocutaneous albinism & Silvery grey hair.
- Nerve conduction defects.
- Platelet function defects leading to bleeding.

PBS Neutropenia with giant granules in leukocytes

⇒ Lyst gene mutation are seen.

↙

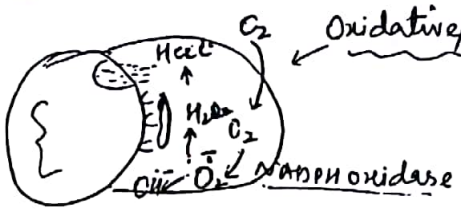
Absence of DOCKING PROTEIN

Needed for fusion of lysosomal membrane with phagosomal membrane.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

(C) Killing → O_2 dependent method (Main method)
→ O_2 independent method

Oxygen dependent method



$H_2O_2 \xrightarrow[Cl]{MPO} HOCl^-$ kills bacteria

By lipid peroxidation of bacterial membrane

Halogenation (bleaching)

H_2O_2 MPO - Halide system kills bacteria, fungi, & parasites

MPO is a lysosomal enzymes.

Defect → Chronic granulomatous diseases
↓
defect of enzymes NADPH oxidase
← XR (MC) (75%)
← AR (25%)

Test for diagnosis Nitroblue tetra zolieum Test. (NBT)

Oxygen independent killing

Lysosomal enzymes kill the bacteria

→ BPI Bacterial Permeability Increasing Protein
It is a phospholipase
↓
Breaks phospholipids & bacterial membrane

→ Lysozyme
It is a muramidase
↓
Breaks glycopeptide coat of bacteria.

→ Lactoferrin
Binds Iron
↓
Iron is unavailable for bacterial growth

→ Major Basic Protein
Found in eosinophil granules
↓
Toxic to parasites

→ Defensins
→ Cationic proteins. } Found in Neutrophils

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Mediators of acute inflammation

Cells

Preformed/Primary

- Histamine
- Serotonin
- Lysosomal enzymes

Newly synthesised/Secondary

- Aracadonic Acid mediators (Lipid mediators)
  - PAF
- Cytokines
- ROS (Reactive Oxygen Sp.)
- Chemokines
- Nitric oxide
- Substance P

Plasma

- Kinin cascade
- Complement cascade
- Coagulation cascade
- Fibrinolytic cascade

Preformed / Primary mediators

① **Histamine** — First mediator to be produced

Source → Richest source is Mast cell

Others – Basophils, Platelets

Stimuli for release

⇒ IgE Ab binding to receptors on mast cells

⇒ C3a, C5a } Anaphylotoxins (Post Cap. Venules)

⇒ IL-1, IL-8 }

⇒ Histamine Releasing proteins.

⇒ Physical agents like heat, cold & trauma.

Actions

① Vasodilation

② ↑ vascular permeability → causing Immediate Transient response.

③ Vasoconstriction (large vessels due to muscular layer presence)

④ Bronchospasm.

(2) Serotonine (5HT)

Richest source → Platelets

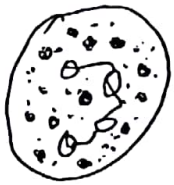
Others → Enterochromaffin cells.

Actions: Platelet aggregation

Other actions are same as histamine.

(3) Lysosomal Enzymes

Found in granules of neutrophils



Primary/Azurophilic granules

- Large coarse granules

- MPO
- BPI
- Acid hydrolases
- Neutral proteases
- Lysozymes
- Phospholipase A_2
- Defensin
- Cationic Proteins

P ANCA → MPO

C ANCA → Neutral proteases

Secondary/specific granules

- Small fine granules

- Lactoferin
- Alkaline phosphatase
- Type IV collagenase
- Gelatinase
- Lysozyme
- Phospholipase A_2
- Vit B12 binding proteins

ANCA Antibodies against enzymes found in primary granules of Neutrophils

- P ANCA → MPO
- CANCA → Proteinase3 (Neutral proteases)

Newly synthesised mediators.

① Platelet activating Factor (Lipid meddator)

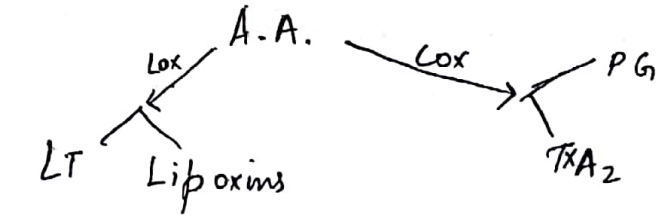
Source - All leukocytes & mast cells.

Actions
- Vaso dilation
- ↑ Vascular permeability
- Vasospasm
- Platelet aggregation
- Brochospasm
- Chemotactic
- Angiogenesis
- Cell to cell signal transduction.

② A. acid mediators

20 Carbon polyunsaturated Fatty Acid
Found esterified in membrane phospholipids.

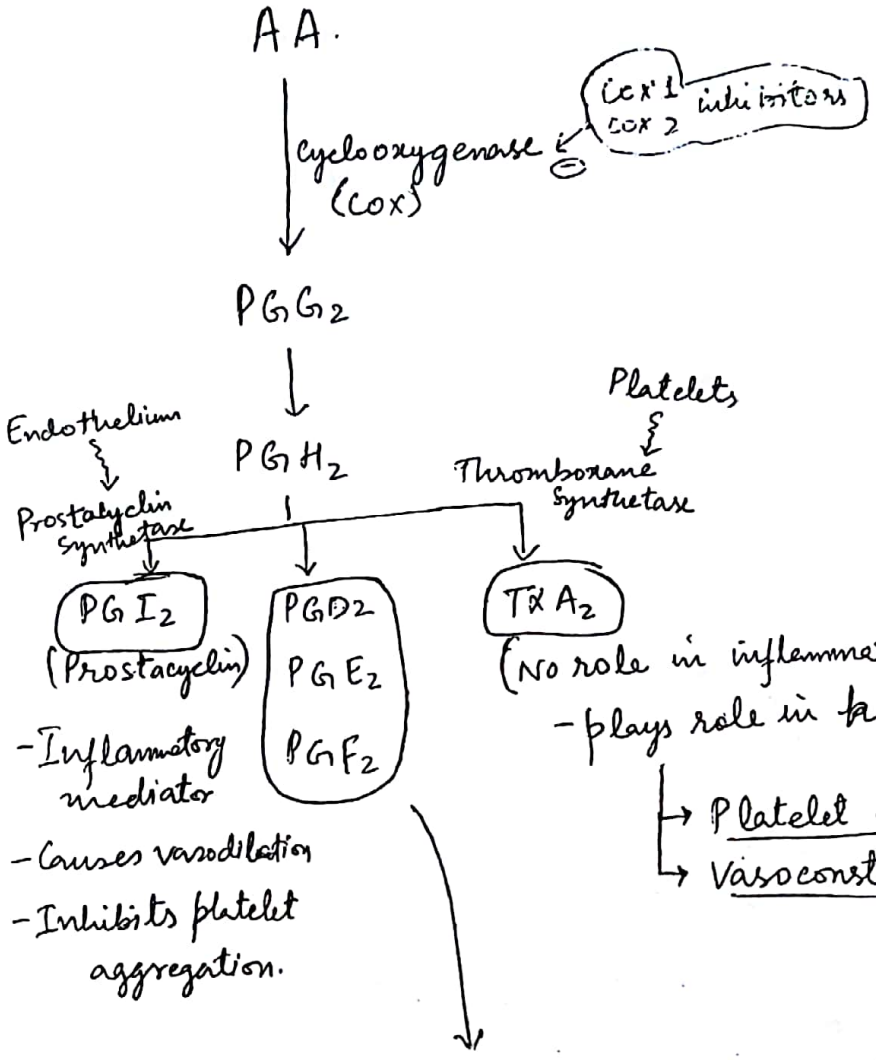
Membrane phospholipids
↓ Phospholipase



Eicosanides

Source - All leucocytes, mass cells, endothelial cells.

(Steroids) inhibit phospholipase



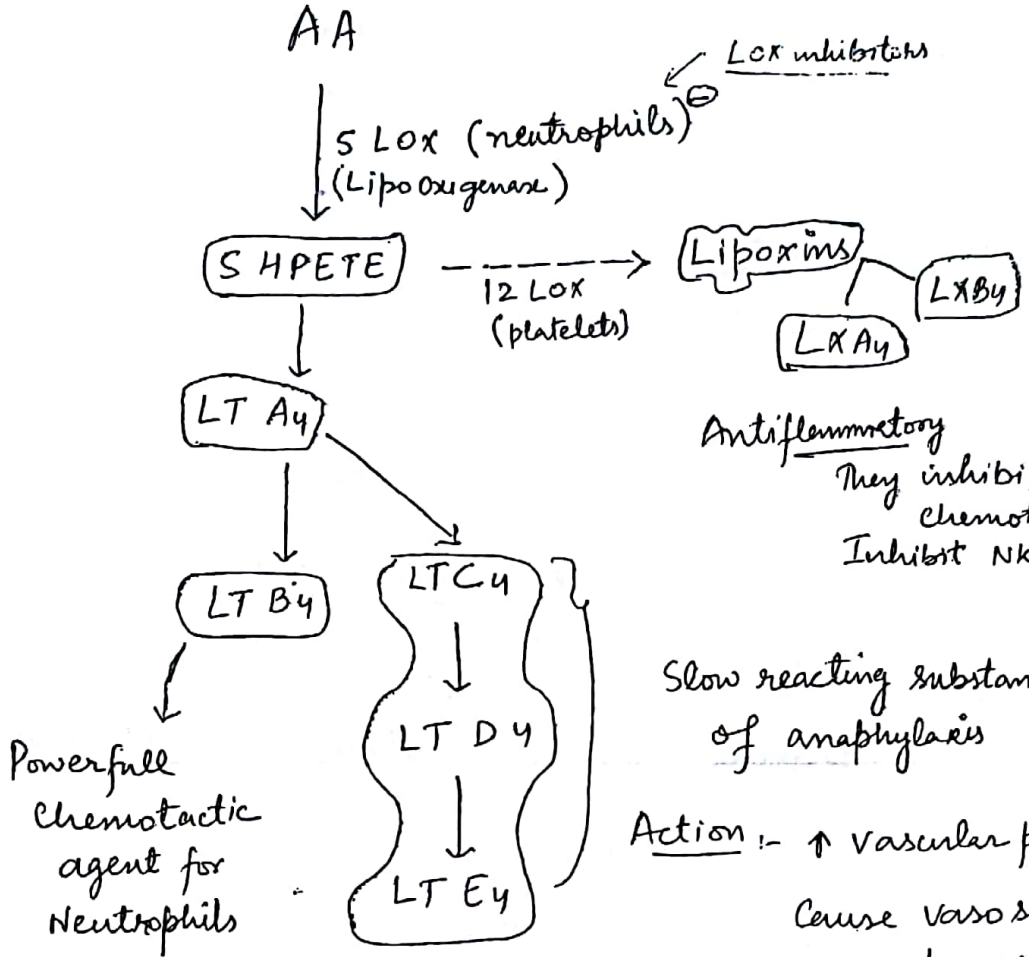
⇒ Increase vascular permeability

⇒ Cause vasospasm. & Bronchospasm.

⇒ Pain & Fever (PGE_2)

⇒ PGD_2 & PGF_2 ⇒ Chemotactic.

⇒ $PGF_{2\alpha}$ ⇒ Causes uterine smooth muscle contraction.



Lipoxins are produced by transcellular biosynthesis
↓
2 Cells are cooperating for production.

③ **Chemokines** Belong to family of cytokines

Short chain polypeptides that cause chemotaxis.

4 categories

(I) α chemokines / C x C chemokine

Chemotactic for Neutrophils

e.g.; IL 8

(II) β chemokines / C – C chemokines

Chemotactic for all except Neutrophils.

e.g.; Eotaxin → only for eosinophils

Rantes → eosinophils + Tlymphocytes.

MCP 1 ⟶ Monocytes

(Monocyte chemotactant Protein 1)

MIP-1α ⟶ Monocytes & Macrophages

(Macrophage Inflametory Protein)

(III) gamma chemokines / C – chemokines.

e.g.: lymphotactin → Lymphocytes.

(IV) C X_3C Chemokines

Only one member – Fractalkine – chemotactic for monocytes

Chemokine receptors → (CXCR4, CCR5) act as co receptors for HIV

③ Cytokines

Source → Macrophage & dendritic cells.

IL-1, TNFα } TNFα in addition is also produced by T cells & mast cells.

Action –

Ⓐ Systemic acid phase reaction

IL-1, TNFα, IL6 → Mc.

Fever, Increased sleep,
↓ appetite
↑ TLC
↑ ESR
↑ CRP

TNFα also regulates energy balance by causing lipid and protein mobilization & suppressing appetite
↓
thus causing ↑ TNF levels
⇓
Cachexia

Cancer cachexia → TNFα.

Ⓑ Endothelial activation

↑ expression of endothelial adhesion molecules

↑ production of mediators – cytokines, chemokines & AA mediators

↑ procoagulant activity

(III) Leukocyte activation

TNF ⟹ Microbicidal activity of leukocytes

(IV) Fibroblast activation

IL 1 - Fibroblast proliferation & Synthesis of collagen.

(5) Nitric Oxide

Arginine $\xrightarrow{\text{NO synthetase}}$ NO

NO synthetase is found in → endothelial cells

Endothelial cells → (eNO) → Vasodilation

Macrophages → (iNO) (inducible) → Produced during inflammation - Microbicidal gas.

Neurons in brain → (nNO) (neuronal) → Neurotransmitter in Brain.

⑥ Substance P (Neuropeptide)

Source - Leukocytes
Sensory Nerves. (CNS & PNS)

Actions
Pain
↑ vascular permeability
Regulation of BP

PAIN mediators.
PGE2
Bradykinin
Substance P → M.Imp

Mediators comming from Plasma

① Kinin Cascades [generate bradykinin]

Prekallikrein —(XIIa (Hegeman factor))→ Kallikrein

Kallikrein ↓

High M.W kininogen ↓

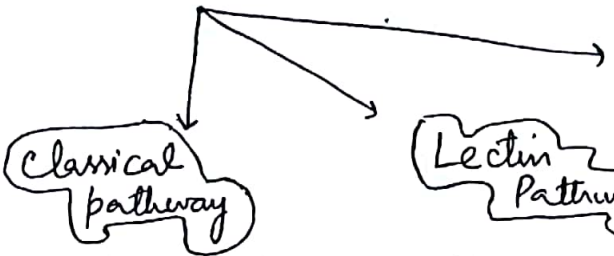
Bradykinin

Action
- Pain
- ↑ vascular permeability (↳ M. Imp)
- Vasodilation
- Vasospasm
- Bronchospasm.

② Complement Cascade

[Set of 20 proteins found in plasma]

3 pathways for complement activation



Classical pathway
- Starts ē activation of C1
- C1 is activated by Ag–Ab complex.

Lectin Pathway
- Starts ē activation of C1
- C1 is activated by bacterial lectins and mannose binding lectins

Alternate Pathway
- Starts ē activation of C_3.

No participation of C_1, C_2, C_4

- C_3 is activated by
  - LPS (LipoP.S)
  - Cobra venom
  - Aggregates of IgA antibody.

Mediators produced

C3a, C3bi } Opsonins

C3a, C5a } Anaphylotoxins (cause release of histamine from mast cells).

C5a } Chemotactic for Neutrophils, eosinophils & monocytes

C5-9 } Membrane Attack Complex (MAC)

③ Coagulation Cascade

Mediators

ⓐ Fibrinogen → Opsonin

ⓑ Thrombin → Main link b/w inflammation & coagulation.
Causes redistribution of Pselectin.
Induces COX enzymes in Endothelial cells.
↑ expression of adhesion molecules on endothelial cells.

ⓒ Fibrinopeptides → Vascular permeability
→ Chemotactic

④ Fibrinolytic Cascade

Plasminogen
↓ Tissue plasminogen Activator (TPA), Urokinase, Streptokinase
Plasmin
↓
clot
↓
Fibrinogen Degradation Products
FDP → ↑ vascular permeability
Chemotactic

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

NETs

Neutrophil Extracellular Traps.

Extracellur Fibrillar Network formed by Neutrophills to trap bacteria.

Formed from the nuclear chromatin of Neutrophils

Lysosomal enzymes are discharged in the NETs & kill the bacteria

At the end of NET formation, neutrophils die.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Chronic Inflammation

① Infiltration of tissue by mononuclear cells (monocytes, lymphocytes, & plasma cells)

② Tissue destruction.

Macrophages

⇒ Main cells of chronic inflammation

⇒ Derived from blood monocytes which are produced in bone marrow.

* Resident macrophages eg kupfer cells in liver, microglial cells in brain are derived from stem cells in yolk sac & life span is in years.

⇒ Also called as Histocytes

Liver → Kupfer cells

Brain → Microglial cells

Bone → Osteoclasts

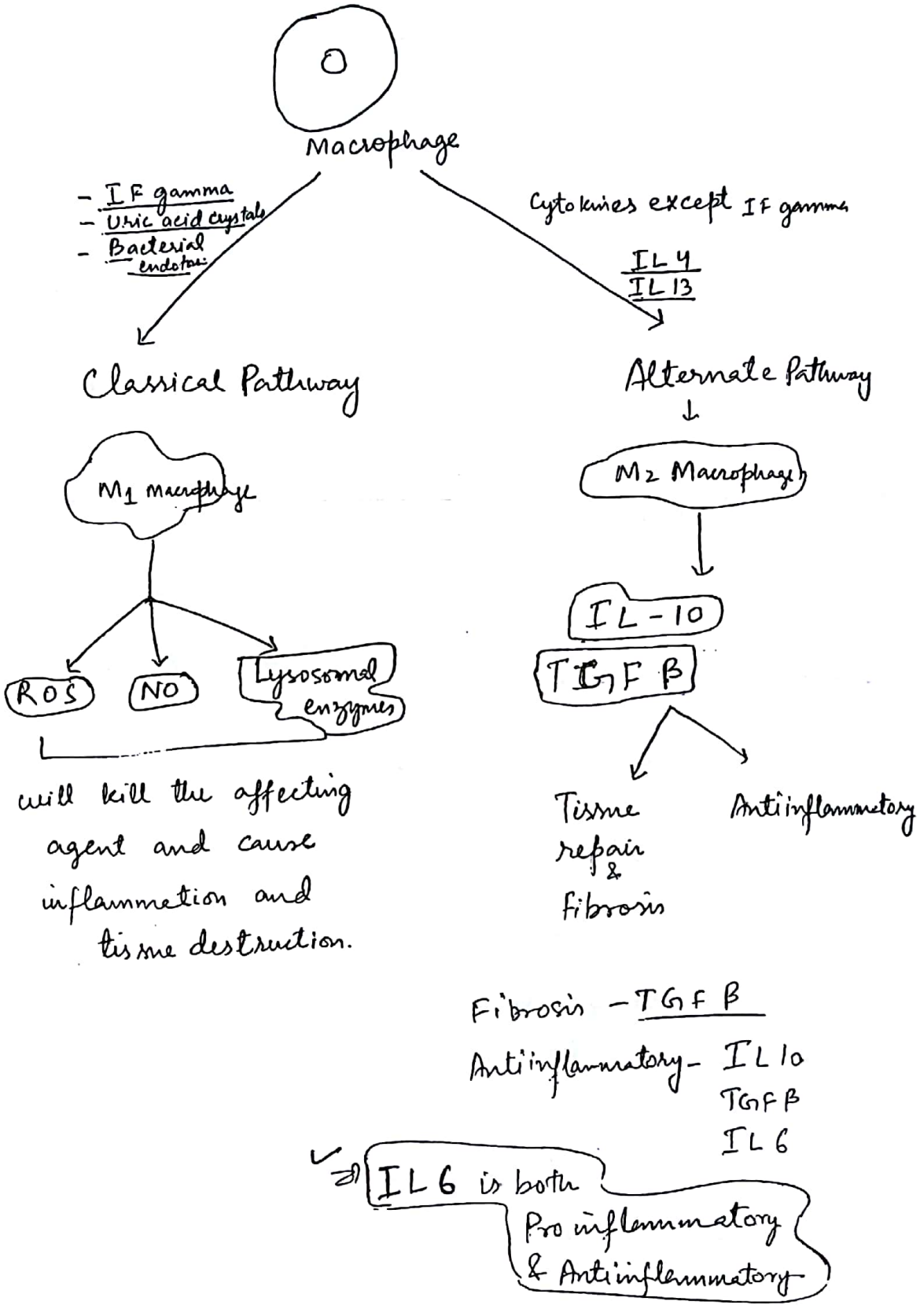
Spleen → Littoral cells
Spleen → Sinus histiocytes

LN → Sinus histiocytes

Lungs → Alveolar macrophages

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

In chronic inflammation macrophages are activated to kill the bacteria.



Fibrosis - TGF β

Antiinflammatory - IL 10
TGF β
IL 6

IL 6 is both Pro inflammatory & Antiinflammatory

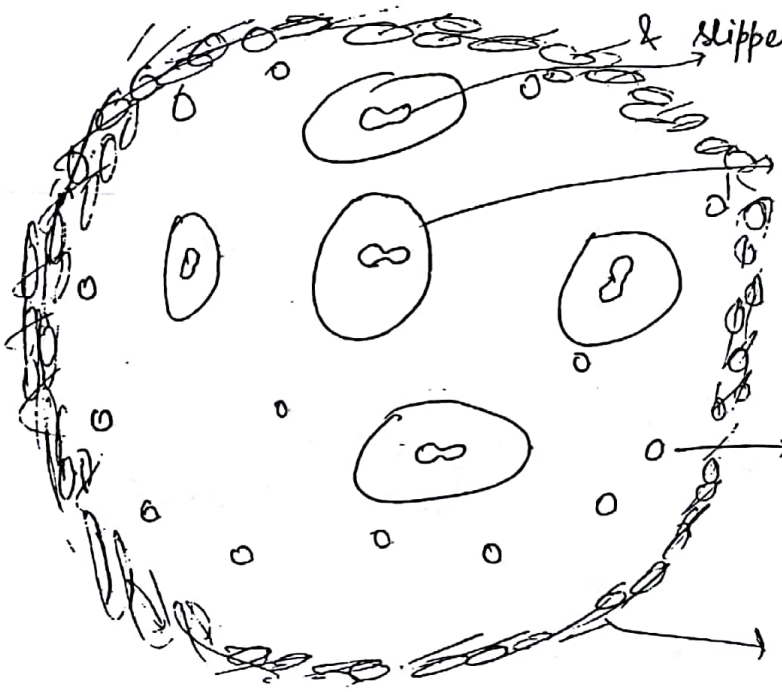
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Chronic granulomatous inflammation

Special type of chronic inflammation characterised by granuloma formation.

→ Collection of specialized macrophages called epithelioid cells

↳ Have abundant cytoplasm & slipper like nucleus.



2 types → Immune granuloma
→ Foreign body granuloma.

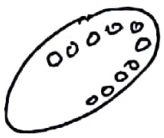
(1) Immune granuloma — ~~Found~~ Formed in type IV HR.

→ IFN gamma & TNF α plays an important role.

Causes: TB, Sarcoidosis, Leprosy, LGV, Cat scratch disease, Syphilis, Crohn's disease, Hodgkin lymphoma

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Immune granulomas may show gaint cells
e.g Langhan's gaint cell.



Multiple nuclei arranged in C or horse shoe shap

⇒ Caseating Granuloma

Caseous neerosis in centre

TB
Syphilis
Fungal infection ← Histoplasmosis
Coccidoidomycosis

⇒ Non Caseating

TB
Sarcoidosis (naked granulomas)
↳ No lymphoid & PC surrounding

Hodgkin's lymphoma
Leprosy (tuberculoid)

⇒ Stellate granulomas → Star shapped granuloma
→ Neutrophilic granuloma

LGV
Cat scratch disease

⇒ Necrotising granuloma
(Small vasculitis) Wegner's granulomatosis

⇛ Eosinophilic granulomas
Churg Strauss
(small vessel vasculitis)

⇛ Durck granulomas
Cerebral malaria.

(2) Foreign body granuloma
Formed around a foreign body eg: talc, suture material, dead parasites, uric acid crystals.

↳ Contains foreign body gaint cell (numerous)

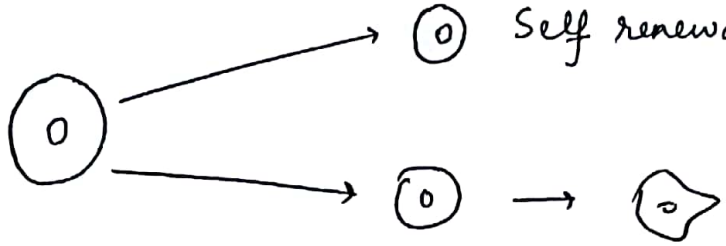
Multiple nuclei arranged in haphazard way
May contain foreign body

Cytokines for Fever
1. IL1 Most imp.
2. IL6
3. TNF α
4. PG E2
5. Ciliary Neurotrophic factor

Cytokines for Septic Shock
- TNF α

Fibrosis - TGF β

Stem Cells



Capacity to generate differentiated cells by asymmetrical replication

2 types

① Embryonic stem cells — Isolated from blastocyst

Totipotent - can generate all tissues of body.

② Adult or Somatic stem cells

Found in Adult/Normal tissues in special microenvironments called Niches

Can be Pluripotent/Multipotent/Bipotent.

(a) Bone marrow

Hematopoietic stem cells

- Pluripotent - give rise to all Blood cell lineages.
- Can be obtained from
  - (I) Umbilical cord blood
  - (II) Peripheral blood after injecting GM-CSF
  - (III) Bone marrow

Marrow Stromal stem cells

- Mesenchymal SC
- Pluripotent

give rise to adipocytes, endothelial cells, osteoblasts, chondrocytes

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Mesenchymal stem cells are also found in abdominal fat.

b) Liver

Called "Oval cells"

Found in Canals of Hering.

Bipotent — Hepatocytes
Bilary cells.

c) Brain

Called Neuronal S.C.

Multipotent.

Oligodendrocytes.
Neurons
Astrocytes

Location → Subventricular zones
→ Dentate gyrus of hippocampus.

d) Skin

Found in adnexa

Hair follicle bulge
Sebaceous glands

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

e) Limbus of cornea

f) Crypts of Intestine

g) Satellite cells - Sc associated with Cardiac & skeletal muscles.

Use of Stem cells

Used to repopulate the damaged tissue

Wound Healing

Regeneration	Repair
Dead cells are replaced by same cells	Dead cells are replaced by fibrous connective tissue.

① Labile cells/Actively dividing cells

They are in G1 phase of cell cycle.

eg epithelia ⇒ Skin, GIT, Resp. tract, urogenital tract.

Stem cells

Hematopoietic cells

Cancer cells

② Stable cells — In (G0) phase of cell cycle

They have low replicative potential.

e.g.; i) Parenchymal cells of organ

Hepatocytes
PCT, DCT of kidney
Adrenocortical cells.

(ii) Mesenchymal cells

Adipocytes
Osteoblasts
Chondrocytes
Smooth muscle cell
Endothelial cells.

③ Permanent/Non dividing cells

They have left the cell cycle.

They cannot divide at all.

e.g.: - Neuronal
- Skeletal muscle
- Cardial muscle

Repair occurs by formation of granulation tissue

Pink, moist & has granular appearance.

M/c → Chronic inflammatory cells/Macrophages
lymphocytes, plasma cells.
→ New blood vessels
→ Fibroblasts that synthesize collagen.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Wound healing by Primary intention

Seen in clean, surgical wounds where the edges can be approximated

0 hours → Incision is filled c blood clot.

c in 24 hours →
- Neutrophils from margins infiltrates the clot.
- Mitosis begins in the basal layer of epidermis.

24 - 48 hours → Continuous thin layer of epithelium is formed below the scale/scab.

Day 3 →
- Neutrophils are replaced by macrophages
- Granulation tissue appears.
- Collagen fibers are evident at the margins of the incision.

Day 5 →
- Abundant granular tissue*
- Neovascularization is maximum.
- Collagen fibers bridge the incision (i.e they lay down longitudinally)
- Epidermis regains full thickness c surface keratinization.

2nd week → ↓ edema, ↓ inflammation
↓ vascularization
→ Proliferation of fibroblasts and accumulation of collagen.

↳ Blanching begins due to ↑ collagen deposition & regression of vascularity

3rd week → Scar is formed ē maximum fibrosis.

Wound Strength

1st week → 10% of normal unwounded skin.

3rd month → Maximum wound strength
70 – 80% of unwounded skin.
(100% wound strength is never regained).

⇒ Wound contraction is absent in primary intention healing.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Healing by secondary intention.

Seen in large wounds where wound edges cannot be approximated.

Large amount of granulation tissue is formed

Large scar is formed.

↓

Scar reduces in size – this is called as wound contraction

Brought about by Myofibroblasts.

⇒ Wound contraction is seen in healing by Secondary intention.

Defects in wound healing.

Hypertrophic scar :- Raised scar produced due to accumulation of excessive amount of collagen.

⇒ Seen in thermal / traumatic injury.

⇒ Grows rapidly & regresses over several months.

Keloids :- Scar tissue grows beyond the boundaries of the original wound.

⇒ Do not regress

⇒ Genetic predisposition

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Exuberent granulation tissue (Proud flesh)

Formation of excessive amount of granulation tissue which protrudes above the level of surrounding skin and blocks the re-epithelialization.

Removed by cautery or surgical excision.

Desmoid / Fibromatosis

Excessive proliferation of fibroblasts and other connective elements on site of injury or surgical scar.

Contrature

Exaggeration of wound contraction produces contracture

Common after severe burns

Site – Palm, sole, anterior thorax

Factors that impair wound healing.

1. Infection
2. DM
3. Poor nutritional status ← Zn def., vit C, PEM
4. Mech. factors ← Local, Torsion
5. Poor perfusion due to ← atherosclerosis, DM, impaired venous drainage
6. Foreign body
7. Type of injury & site of injury

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Positive acute phase proteins

Also called as Acute Phase Reactants.

Production increases during inflammation.

- CRP
- Fibrinogen
- Mannose binding Lactin

} Opsonins

- SAA [Serum Amyloid Associated]
- Ceruloplasmin
- Heptoglobin

} Inhibits the growth of microbes.

- Thrombin
- Factor VIII
- vWF

} Bring about coagulation

Negative acute phase proteins

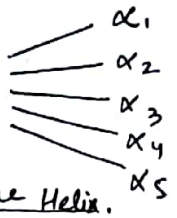
Production by liver decreases during Inflammation.

- Albumin
- Transferrin
- Transthyretin
- Trans cortin
- Retinol binding proteins.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Collagen

⇒ Triple Helix



→ any three make the Helix.

Vitamin C is essential for crosslinking of collagen fibres.

Type I collagen

Most abundent
Has high tensile strength
Found in skin, bones, tendons, internal organs & blood vessels.

Type II collagen

Cartilage & Vitreous humor

Type III collagen

Granulation tissue
Embryonic tissue
Uterus
Keloid

Type IV Collagen

Basement membrane.

Composition of basement membrane

Laminin
Type IV collagen
Fibronectin
Proteoglycans.

Amyloidosis

Group of diseases that have in common - deposition of abnormal proteinaceous substance extracellularly.

H & E → Pink homogenous appearance

Physical Nature

1) Electron Microscopy

- Long non branching fibrils
- Indefinite length fibrils.
- 7.5 – 10 nm diameter.

2) X ray crystallography & infrared spectroscopy ⇒ β pleated sheet conformation

Chemical Nature

- Fibrillar protein
  - Constitutes 95% of amyloid
  - 15 different types of Fibrillar proteins discovered.
- P-component Glycoprotein
  - Constitutes 5% of amyloid.
  - ⇒ PAS +ve & diastase resistant.

Classification

- Localized amyloidosis
- Systemic amyloidosis — Multisystemic disorder.

Localized Amyloidosis

1) Medullary carcinoma thyroid. — ACal → Amyloid; Calcitonin.
2) Alzheimer's disease — Aβ
3) Isolated atrial amyloidosis — AANF → Atrial Natriuretic Factor
4) Type II DM
   ↳ Amyloidosis in pancreas — AIAPP → Islet Associated Pancreatic Peptide
5) Prion disease — Misfolded prion particles.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Systemic / Generalized Amyloidosis

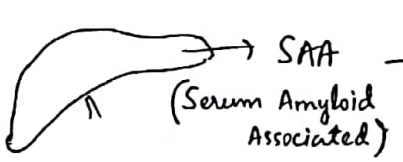
① Primary amyloidosis seen in patients of Multiple myeloma & other plasma cell tumors.

AL (Light chains) type of amyloidosis.

(λ light chains) are more prone to settle down as amyloid

Site - Heart, Kidney, GIT, etc.

② Secondary amyloidosis Also called reactive systemic amyloidosis



Site - kidney, liver, spleen, lungs, etc

M/C organ involved in amyloidosis ⇒ KIDNEY

Causes → Older days - TB, DM, Lung abscess, Bronchi abscess.

Now → Ankylosing spondylitis
RA
Ulcerative colitis
RCC

③ Hemodialysis Associated Amyloidosis.

Seen in patients who are on long term hemodialysis for chronic Renal Failure

β_2 microglobulin → ($A\beta_2$)

Sites - Joints, tendons, synovium

↳ Carpel tunnel syndrome.

④ Senile Amyloidosis

Seen in old age

Site - Heart liver, Spleen, etc

Transthyretin (TTR) is deposited as amyloid → (ATTR)

↳ (N) serum protein that transports thyroxine & retinol.

⑤ Familial Amyloidosis

Familial Amyloidotic Polyneuropathy

⇒ ATTR derived from TTR is deposited as amyloid

⇒ Site < Sensory Nerves, Autonomic Nerves

⇒ Mutated Transthyretin is deposited as amyloid

⇒ AD. disorder

Familial mediteranean Fever

⇒ AR disorder. (Recessive)

⇒ AA derived from SAA is deposited as amyloid in many organs.

Fever, effusions seen

* Pyrin gene mutations are seen

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Diagnosis

FNAC

Abdominal Fat aspiration

Biopsy

Abdominal Fat aspiration

Rectal biopsy

Gingival biopsy

kidney biopsy is done only when kidney involvement is suspected.

Stains

① H&E → Pink homogenous appearance

② PAS → PAS +ve · diastase resistant

③ CONGO RED → Most important stain *

Light microscopy (LM) → Brilliant Pink Colour of amyloid.

Polarized light → Apple green bire fringence

↓

is due to β pleated sheet conformation of amyloid.

Metachromatic stains

Crystal violet & methyl violet.

↓

Megenta coloured amyloid.

Thioflavin T AS

UV light ↘

Secondary fluoresence.

Immunohistochemistry

ORGAN → Site

Liver ⟶ 1st site is Space of Disse & causes pressure atrophy of hepatocytes.

ITO ↓ Storehouse of Vit A & synthesis collagen.

Kidney ⟶ 1st site is Mesengial matrix

Walls of capillaries of glomerulus, arteries ,. peripherial capillaries

↘ Sub endothelial deposits.

Heart ⟶ Sub endocardium

Between the Myocardial fibres

Will cause Arrythemias (bundle branch block)

Restrictive Cardiomyopathy

C.C.F

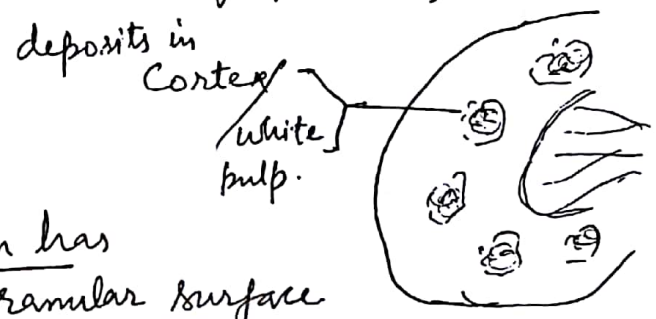
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

GIT ⟶ Anywhere from mouth to anus.

Tongue — Macroglossia
\ Amyloid tumor of tongue.

Spleen — Sago Spleen
\ Lardaceous Spleen

SAGO SPLEEN Amyloid deposition in white pulp in lymphoid follicles in cortex.



On cross section ⇓ Gray Translucent bodies like grains of Sago.

// Spleen has granular surface

LARDACEOUS SPLEEN

Amyloid deposition in walls of splenic sinusoids ⟶ produces large map like areas of amyloidosis (& Red Pulp)

LARD → animal Fat.

IMMUNITY

⇒ Self defence

Innate Immunity

- First line of defence
- Function - Prevention & erradication of infection.
- Innate immunity is non specific
- Innate immune response doesnot become better with each exposure
- No memory cells

Components

1) Epithelia - Skin, GIT, Respiratory Tract.
   - Mech Barrier
   - Produce antimicrobial substances eg: defensins
   - Intra epithelial lymphocytes

Adaptive Immunity

- 2nd line of defence
- Function - eradication of infection
- Adaptive immunity is specific
- Adaptive immunity response becomes better with each response
- Memory cells present.

Components

- T Lymphocytes → Cell mediated immunity
- B lymphocytes → Humoral immunity

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

2) Cells -

- Neutrophils } Extracellular bacteria & fungi
- Macrophages }

- & NK cells — First line of defence against virally infected cells and tumor cells.
- Dendritic cells.
- Mast cells.

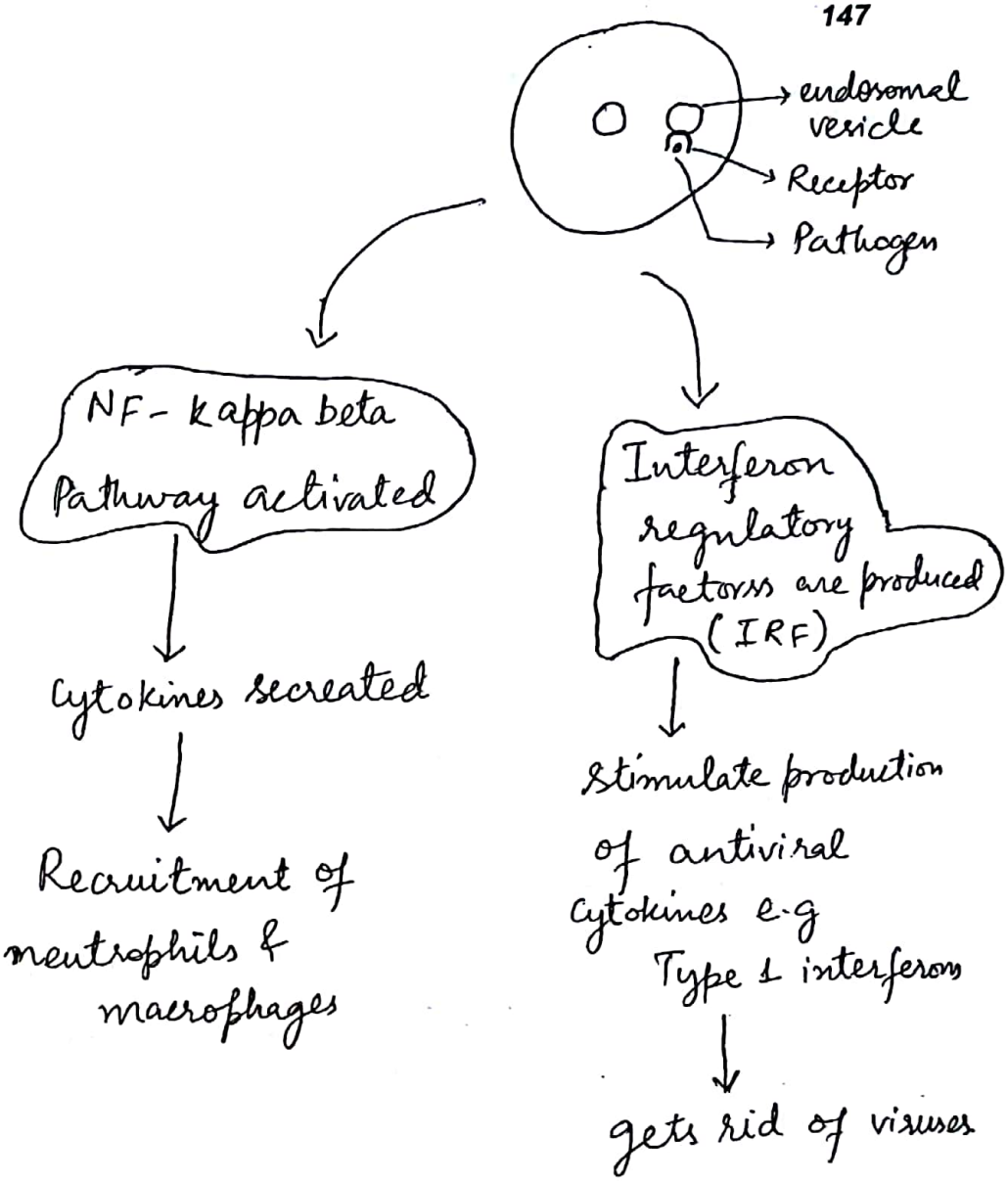
3) Plasma proteins

- Mannose binding lectin
- CRP
- Complement < Lectin pathway, Alternate pathway
- Lung surfactant

Pattern recognition receptors.

Cells that participate in innate immunity have receptors that recognize microbial components that are shared by microbes. These are called Pattern Recognition Receptors.

Location — Plasma membrane
Endosomal vesicles
Cytosol



Pattern ~~Rago~~ Recognition receptors.

① Toll like receptors - (TLRs)

Found on — Plasma membrane
Endosomal vesicles

11 TLRs are recognized Till date

e.g TLR-2 — gram +ve bacteria
Fungus
Leptospira

TLR-4 — gram +ve bacteria

Founder member "TOLL" discovered in Drosophillia

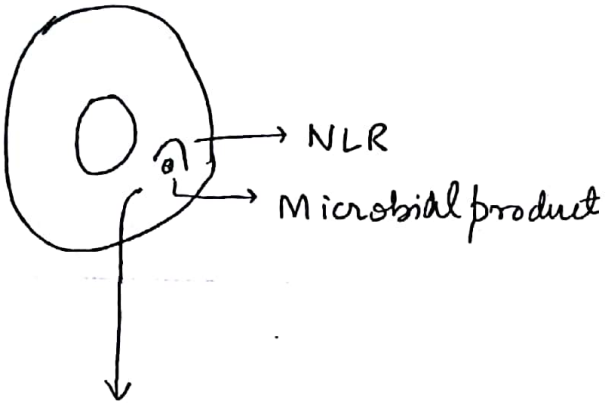
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

2) NOD like receptors (NLR)

Location - cytosol

Recognize wide variety of substances

- Microbial substances e.g.; Shigella & Salmonella
- Metabolic biproducts e.g.; uric acid
- Recog. ion disturbance
- Necrotic cells.



Inflamasome (multi protein Complex) → activates Caspase I (IL-1β converting enzyme)

↓

IL - 1

↙ Fever

↘ Inflammation

* ⇒ Gain of function mutation in NLR gene leads fever periodic fever syndrome called auto inflammatory syndrome which responds to treatment with IL 1 antagonist.

③ C-type Lectin receptors

Found on plasma membrane

Detects Fungal glycans and leads to inflammation → gets rid of fungi.

④ Rig like receptors

Found in cytosol

Detects viral nucleic acid

↓

IRF are produced

↓

Type I interferons.

⑤ 7 transmembrane G protein coupled receptors

Recognize bacterial products ≈ N formyl methionyl residues → stimulates chemotaxis.

⑥ Mannose Receptors

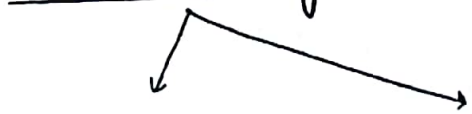
Recognize mannose sugar in bacterial wall

↓

Stimulate phagocytosis.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Adaptive Immunity.



T cells (CMI) — B cells. (HMI)

Lymphocytes are antigen specific

Mature lympocytes that have not encountered antigen or immunologically inexperienced are called

Naive Lymphocytes

- **Effector cells**
  - Function- eliminate microbe
- **Memory cells**
  - Live in a state of heightened awareness
  - Rapidly combat the microbe if it returns.

Lymphocytes are antigen specific - Lymphocytes of same specificity form a clone.

When an antigen enters, it selectively recruits antigen specific clone, this is called clonal selection.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Natural killer cells (NK cells)

Non B & Non T cells

Do not have TCR/BCR.

⇒ Also called large granular lymphocytes.

Function.

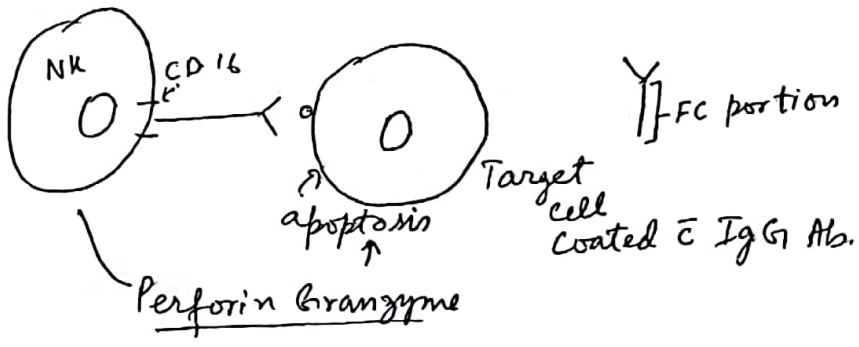
① Innate Immunity — First line of defence against virally infected cells and tumor cells.

② Adaptive immunity — Play a role in ADCC (antibody dependent cellular Cytotoxicity).

Location → Constitute 5-10% of P.B Lympocytes.

Markers → CD 16 → FC receptor for IgG Ab.

CD 56 → Function Not Known.



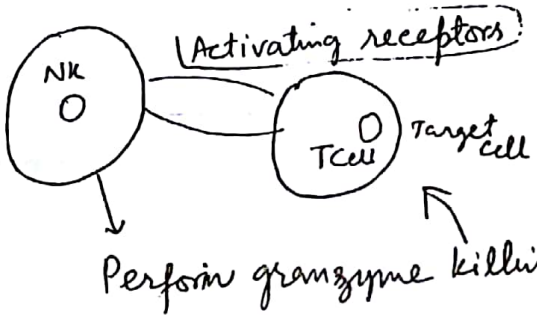
FC Portion of IgG Ab fits into CD16 on NK cells.
NK cells release perforins & granzyme & Kill the Target cell.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Role in Innate Immunity

- Kills virally infected cells & tumor cells.
- NK cells are not MHC restricted.
- NK cells have 2 types of receptors.

① Activating receptors
Activate NK cells to kill the target cells.
- Belong to NKG2D family.



- NK cells attach to target cells by activating receptors & kill the target cells by Perforin granzyme dependent killing.

② Inhibitory receptors.
Prevents NK cells from killing Normal cells.
Inhibitory receptors belong to
- CD 94 family of Lectins
- KIRS (CD96) (killer cells Ig like receptors)

Cytokines produced by NK cells – IFN gamma.

↓

activates macrophages by classical pathway

Cytokines that regulate NK cell activity

- IL2
- IL15

Stimulates NK cell proliferation.

IL12

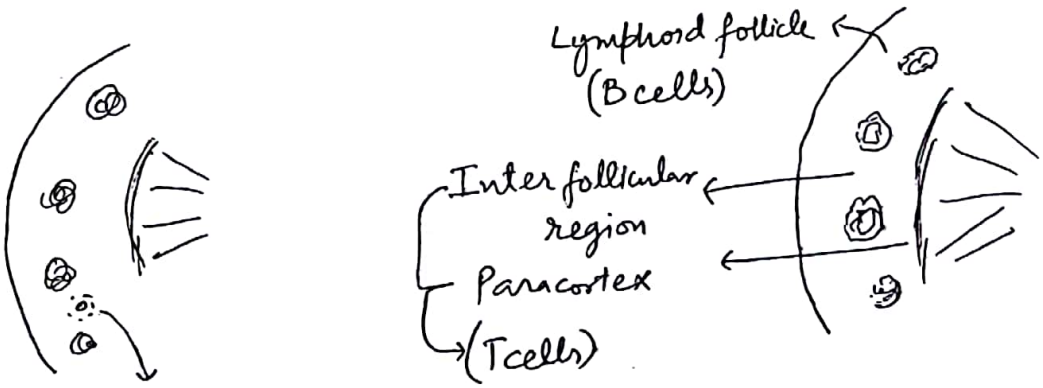
Activates killing & secreation of IFN gamma by NK cells

T cells

Play a role in cell mediated immunity.

Location - · Peripheral blood

60-70% of P.B. lymphocytes.



Periarterioral sheaths of spleen

⇒ Found in Paracortical, Interfollicular region of LN

⇒ Found in Paracortical region & periarterioral sheaths of spleen

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

T cell Markers

TCR (T cell Receptor)

CD1, CD2, CD3, CD4, CD5, CD7, CD8, CD28.

TCR

- Antigen specific
- 2 types
  - αβ TCR – Found on 95% T cells
    - MHC Restricted.
  - γδ TCR – Found on 5% T cells.
    - Not MHC Restricted.
    - Found in the epithelia like skin, GIT, urogenital etc → provide protection against microbes that try to enter through the epithelia.
    - Do not have CD4 & CD8 on their surface. (γδ)

CD3

⇒ Signal transduction is function
→ Lineage specific T cell marker
⇒ Pan T cell marker

CD7

Pan T cell marker
Not lineage specific.

CD4
CD8 } Found on two mutually exclusive subsets of Tcells.
(CD4 : CD8 :: 2:1)

CD1a — Thymocytes & Langerhan cells.

Tcells

Helper Tcells
CD4 + Tcells
Master regulators

Function
- Help B cells to produce antibodies
- Help macrophages to kill or destroy microbes.

Cytotoxic Tcells
CD8 + Tcells
2nd line of defence against virally infected cells and
→ Tumor cells.
Kill Target cells by Perforin granzyme dependent killing.

Regulatory Tcells.
CD4 + Tcells.
FOX P3 +ve (Transcription Factor)

Function.
Regulate immune response & prevent reaction to self antigens.

Helper T cells

TH1 TH2 TH17

TH1

Cytokine produced – IFN gamma
(Biggest producer, Signature cytokine)

Function

IFN gamma
- Activates macrophages by classical pathway
- Stimulate B cells to produce IgG antibody.

Host defense against – Intracellular microbes

Role in disease – Chronic Auto immune disease
e.g.: IBD, Psoriasis

TH2

Cytokines produced
- IL 4 (signature cytokine)
- IL 5
- IL 13

Function

IL4 stimulates B cells to produce IgE antibody
Activates Macrophages by Alternate pathway

IL5 – Stimulates B cells to produce IgA Ab.
Activates mast cells & eosinophils.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

IL 13 → Activates macrophages by alternate pathway
→ Activates epithelial cells to produce mucus

Host defense against – Helmeinthic parasites

Role in disease – Allergies.

TH 17

Cytokines produced — IL 17, IL 22, Chemokines

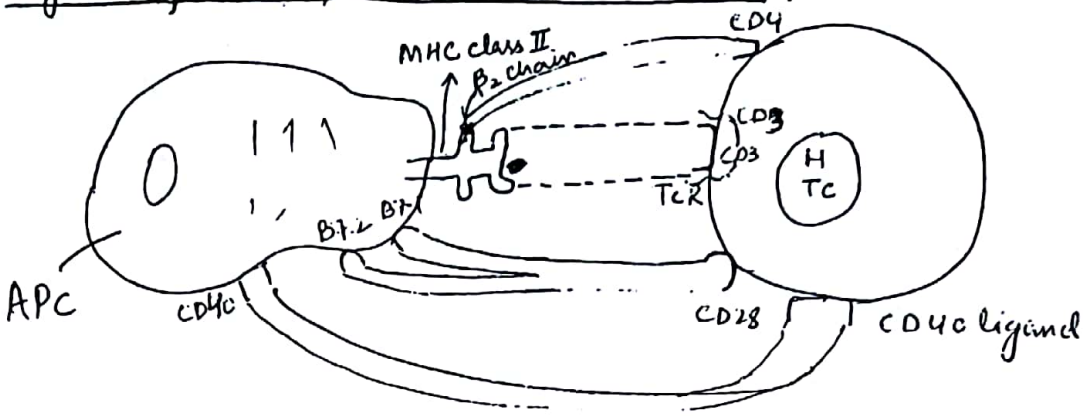
Function — Recruitment of neutrophils and monocytes/macrophages

Host defense against. — Extracellular bacteria & fungi.

Role in diseases — Chronic AID like IBD, Psoriasis & multiple sclerosis.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Signals for Helper T cell activation.



Signal 1

(a) TCR (Tcell) binds to antigen which is presented by APC in context of MHC class II

(b) CD4 of T cells attaches to β_2 chain of MHC class II

Signal 2 (also called- Co- stimulatory signal)

CD28 (Tcells) attaches to [B7.1 (CD 80) / B7.2 (CD86)] of APC

Signal 3

CD40 ligand (Tcells) attaches to CD40 on APC.

To stop T cell (helper) activation

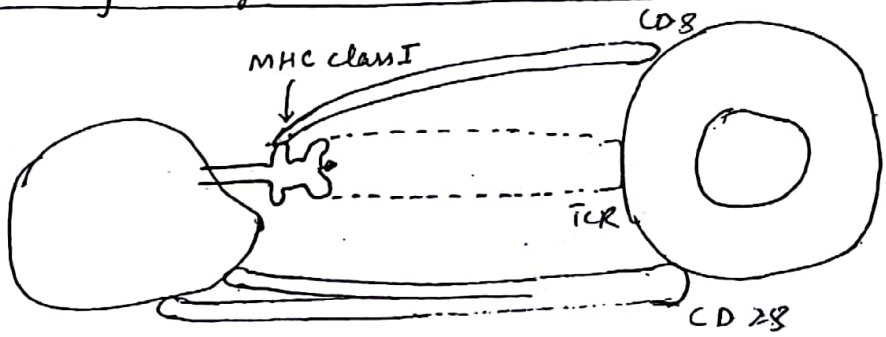
by Co inhibitory receptors ← CTLA-4, PD-1

↓

Stops helper T cell activation

Belongs to CD28 family, blocks signals from TCR and CD28 & terminates T cell response.

Signals for Cytotoxic T cell activation.



Signal 1 (a) TCR (T cells) attaches to antigen that is presented by APC in context of Class I MHC

(b) CD8 (T cells) attaches to α_3 chain of MHC class I.

Signal 2 Co stimulatory signal

CD28 (T cells) attaches to B7.1 CD80 & B7.2 CD86 of APC

→ CD8 T cell kills Target cells by Perforin granzyme killing.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

B cells

Humoral immunity

Sites
- PB → Constitute 15-20% of PB lymphocytes
- Found in lymphoid follicles in LN, Spleen, Peyer's patches, BM, tonsils, etc.

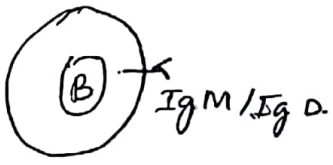
Bcell Markers → BCR (B cell Receptor)

CD19, CD20, CD21, CD22, CD23, CD10 (CALLA)

Igα (CD79a) Igβ (CD79b)

BCR IgM/IgD antibody (Intramembranous)

- Antigen Specific.



Igα (CD79a)
Igβ (CD79b)
} Signal transduction (like CD3 of Tcells)

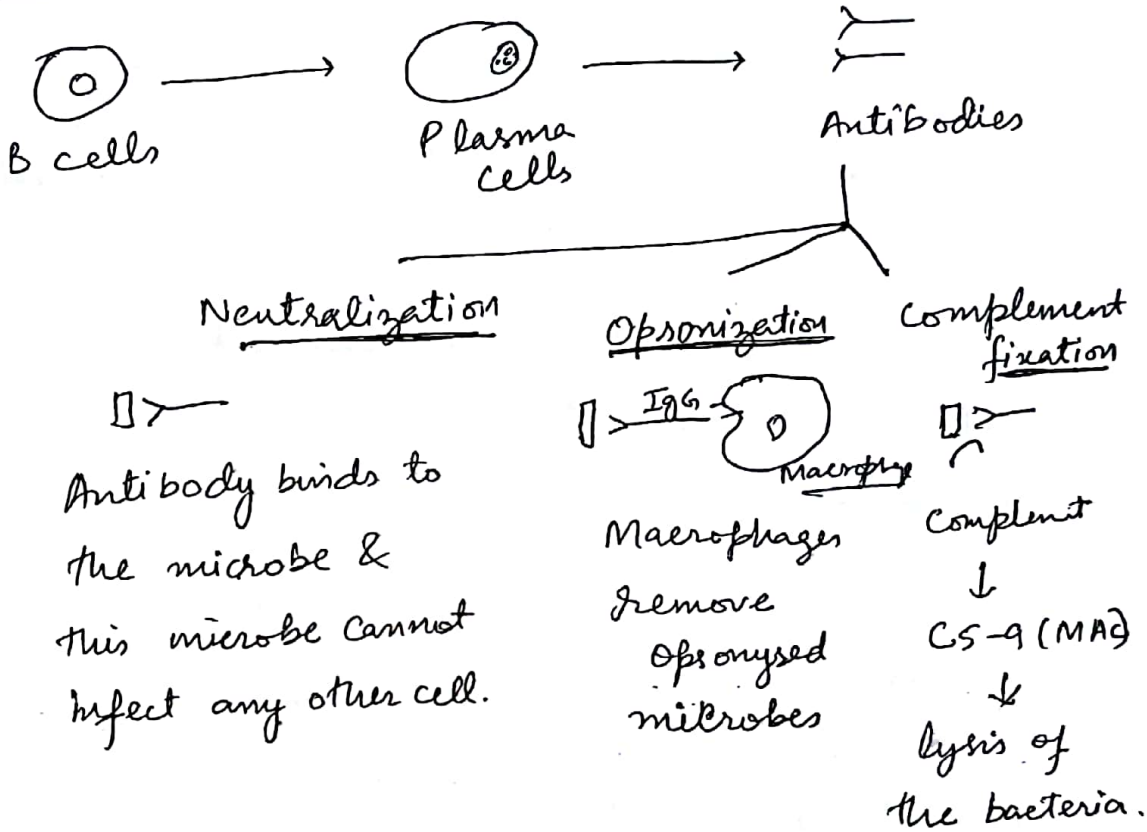
CD19 Pan B cell marker
Lineage specific

CD20 Lineage specific IHC

CD21
- Compliment Receptor (CR2)
- EBV receptor

CD40 site where B cells receive signals from Helper T cells.

Function



↳ IgG antibodies cross placenta and provide passive immunity to new born.

↳ IgE antibodies → Parasitic infection

↳ IgA antibodies are produced in the mucosal surface → provide protection on mucosal surface.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

2 pathways for Ab production by B cells.

T Independent Pathway

Polysaccharide & lipid antigen occupy a number of antigenic determinants (i.e BCR) on B cells

↓

B cells → PC → IgM

No help of T cells (HelperT) is taken.

T Dependent Pathway

Protein antigens stimulate B cells which bind to HelperT cells and then B cells produce

↓

IgG
IgA
IgE

Class of Ab

Help from HelperTcells is taken.

This is called isotype or class switching.

Helper T cells also stimulate B cells to produce antibodies with high affinities for antigen. This is called as affinity maturation.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Dendritic cells

- Antigen presenting cells - Best APC.

Best APC because

① Located at the right place where antigens are encountered.

② They have fine hair like processes that trap antigens.

③ Each Rich in MHC class I & II.
& can present antigen to < CD4 Tcell / CD8 Tcell

④ They are also rich in Co molecule B7.1 & B7.2

Dendritic cells

Interdigitating DC

Present Ags to Tcells

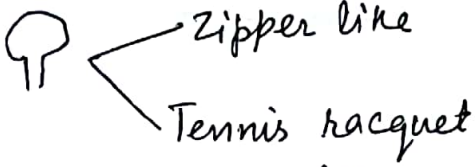
Location -
Skin Langerhan cells.
Interstitia of organs
e.g Lungs, GIT, heart liver. etc.

Langerhan cells
CD1a
S100
Langerin (CD207)

Follicular DC

- Present Ags to Bcells
- Location -
In centre of Lymphoid follicles

E/M Birbeck granules in their cytoplasm



MHC antigens

RBC do not have MHC Ag.

MHC class I

HLA A
HLA B
HLA C

⇒ Found on all cells except RBCs

CD 8 T cells mount an immune response in context of class I MHC.

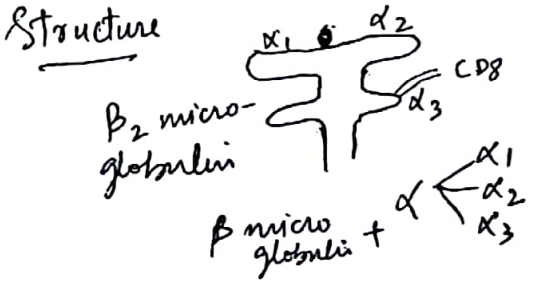
MHC class II

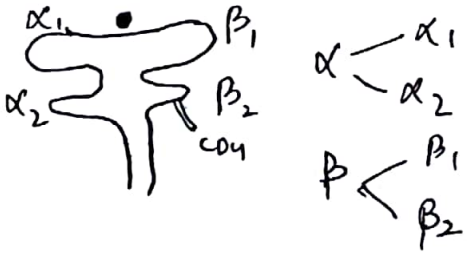
HLA DP
HLA DQ
HLA DR

Found on APC i.e; dendritic cells, B lymphocytes, Monocytes/Macrophages

CD4 T cells mount an response in context of class II MHC.

Structure





Antigen binds in the cleft b/w α_1 & α_2

α_3 is the site of CD8 attachment.

Antigen binding cleft is b/w α_1 & β_1

β_2 is the site of CD4 attachment.

Genes for MHC antigen are found on the short arm of chromosome no. 6.

APC

Professional APC

- Dendritic cells
- Monocytes & Macrophages
- B cells

Non Professional APC

Thyroid follicular cells
Thymic epithelial cells
Fibroblasts
Glial cells
Endothelial cells.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Hypersensitivity Reactions

Injurious immune reactions are called Hypersensitivity Reactions.

Type I

Rapidly occuring reaction which occurs within minutes of binding of antigen to IgE antibody on the mast cells in a previously sensitized individual.

eg:

- **Localized** (ATOPY) [Genetic predisposition.]
  - Bronchial Asthma, Hay Fever
  - Allergic conjunctivitis, dermatitis & allergic rhinitis
  - Food allergies
- **Systemic** Anaphylactic Shock
  - Drugs e.g Penicillin
  - Hormones
  - Antisera

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Bronchial Asthma

Pollen Antigen binds to APC (dendritic cells)

↓

APC presents Ag to Naive Tcells

↓

TH2 Subset

↓

TH_2 binds to Bcells

↓

Bcells → PC → IgE Ab

IgE antibodies attach to the Fc receptor on mast cells.

↓

Pollen Ag causes cross linking of IgE antibody on mast cells

↓

Mast cells degranulate & release Mediators

Preformed/Primary

Brings about initial phase of Bronchial Asthma

C/F → Vasodilation
→ ↑ Vasular permeability
→ Bronchospasm.

⇒ Histamine, Lysosomal enzymes (Proteases) serotonin.

Newly synthesised or Secondary mediators

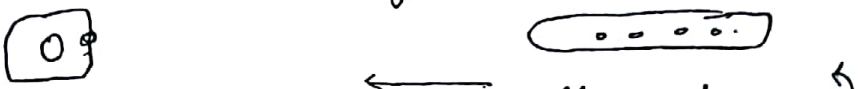
- Bronchospasm
- Leukocytic infiltration
- Epithelial damage

⇒ PAF, AA mediators (LTB4, LTC4, LOX, PGO2) Cytokine, Chemokine

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Type II

- **Antibody Mediated** (IgG/IgM)
- Brought about by antibodies which are directed against fixed antigens



Antigen can be fixed on cell membrane or Connective tissue.

(a)- Antibody attaches to fixed antigen on cellmembrane & causes destruction of Target cell.

(or)

(b)- Antibody attaches to fixed antigen & causes disregulation of function of target cell.

e.g Grave's Disease
Myasthenia gravis

Type V (in Micro)
& Type II here

Destruction by — Opsonisation
Compliment fixation

Antibody attaches to Basement membrane
↓
Activate Compliment
C3a C5A
↓
Enzymes released
↓
Breakdown of Basement membrane
↓
Good Pasture Syndrome

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

e.g. AIH Anemia.
AI granulocytopenia
AI Erythroblastosis fetalis.
Mismatched blood Transfusion reaction.
Pemphigus vulgaris
Pernecious anemia (antibodies against Parietal cells)
Aute Rheumatic Heart disease

↓

No IF
↓
Meg. Anemia.

Type III

[Called Immune complex disease.]

Antigen is not fixed.

3 stages

① Formation of immune complexes (Ic)

Antigen —5days/1week→ IC

Most pathogenic complexes are
- Small/medium size
- Found in antigen excess

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

② Settling down of IC

Favoured site → Kidneys, Joints, Walls of Blood vessels, Skin, etc

③ Tissue destruction by Abs

Activation of Complement
Activation of Hageman factor.
→ Tissue destruction

eg.
- Localized → Arthus reaction
  - → APSGN, GN (T. pallidum)
  - → Reactive Arthritis (Yersinia)
- Systemic
  - ① → Serum sickness
  - ② → SLE
  - ③ → PAN (Medium vessel vasculitis & IgG Containing IC are deposited in vessel wall).
  - ④ → HSP (Small vessel vasculitis IgA containing IC are deposited in vessel wall)

SLE → All visceral lesions are type III rxn (IC disease)
→ All hematological lesions are Type II — AIHA, AI granulopenia, AI Thrombocytopenia

Type IV

Brought about by T cells (Cytokine mediated)

- CD4 T cells → Delayed HR
  - e.g; Tuberculin Reaction
    Immune granulomas
    Contact dermatitis
- CD8 T cells → Destruction of Virally infected cells & tumor cells.

Both CD4 & CD8 ⟹

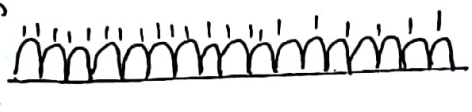
1. Rheumatoid Arthritis
2. IBD
3. Type I DM
4. Psoriasis
5. Multiple sclerosis.

Acute cellular graft Rejection

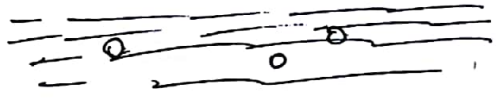
Graft versus Host disease.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Respiratory System

A {  epithelium

B { Mucus gland layer

C {  Cartilage

$$\text{Reid's Index} = \frac{B}{A+B+C}$$

{ N = 0.4
↑ sed = Mucus gland layer

Asthma - Airway Remodelling

1. Sub Basement membrane fibrosis [Type III and Type I collagen]
2. Mucus gland hyperplasia
3. ~~Goblet cell metaplasia~~
3. Goblet cell metaplasia
4. Smooth muscle hypertrophy + hyperplasia

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

ARDS

[Respiratory failure occuring ε in 1 wk of a known clinical insult ε b/L opacities on chest imaging, not fully explained by effusion atelectasia cardiac F. or F. overload]

M/C/C — Sepsis > Pneumonia

IL-8, IL-1 and TNF α is involved.

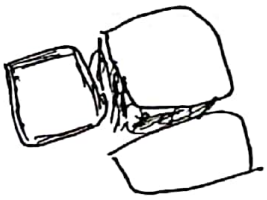
↓

(Chemokine for neutrophils) → So, neutrophils are M/I culprit responsible for ARDS.

→ IL 8 rises ε in 30 minutes of injury

→ Cells damaged - endo & epithelial cells

leakage of fluid + cellular debris + leaked plasma proteins



↓

Hyaline

↓

Along the alveoli

↓

making membrane

→ Diffused alveolar damage - Histological Hallmark (DAD)

Coal worker's Pneumoconiosis

→ Pneumoconiosis → To describe non-neoplastic lung reaction to inhalational if mineral dust mainly at workplace ; also includes organic as well as inorganic particulates, chemical fumes & vapours

MC - Silicosis (quartz)

↓

Collagenous nodule in lung ⇒ egg shell Calcification (lymph nodes classically)

Asbestos Related Disease

1. Pleural Plaque (MC manifestation)
2. Pleural effusion
3. Diffuse Pul. fibrosis → [Asbestosis]
4. Lung Ca – [MC Ca in asbestos exposure]
5. Mesothediona → (Most specific Ca) (25-40 yrs)
6. Laryngeal Ca
7. Ovarian Ca
8. Colon Ca

→ Latent period (10-15 yrs)

Giant Cell → Golden brown fusiform/beaded particles

ASBESTOS BODY [Coated c Iron & Proteinaceous material

↓

Perls' Stain +ve

Any other particle coated c Iron & proteinaceous material

↳ FERRUGINOUS BODY

In Anthraconosis → Pigment laiden macrophages are seen

Coal Macule → Aggregated Macrophages (1-2mm)

↓

Coalese to form Nodule

↓

Progressive massive Fibrosis of lung parenchyma

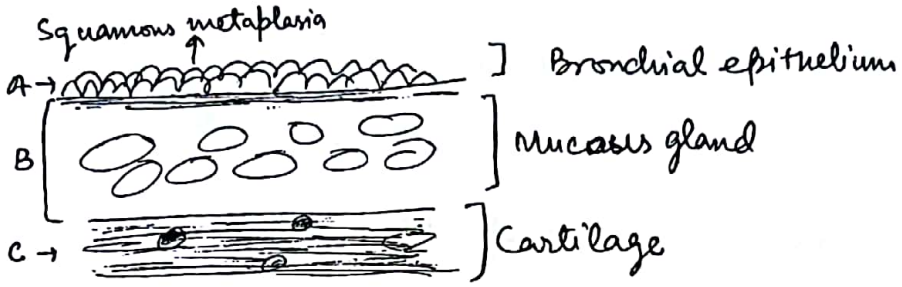
↳ Risk of cancer is more in domestic use of coal i.e; Bituminous coal.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Chronic Bronchitis

MC cause – Smoking

Earliest change – MUCUS HYPERSECREATION



$$\text{REID's Index} = \frac{B}{A+B+C}$$

↓

done in autopsy (N) = 0.4

↑ed in → ↑ Mucous gland.

Manifestations in Pneumoconiosis

(1) Localised fibrous plaques, or rarely diffuse pleural fibrosis (MC menifestation)

(2) Recurrent Pleural effusion

(3) Parenchymal interstitial Lung fibrosis (Asbestosis)

(4) Lung Ca (MC)

(5) Mesothelioma (most specific)

(6) Laryngeal, ovarian, colon Ca.

(7) ↑ risk of autoimmune disease

(8) CVS disease.

LUNG Ca.

Histological classification (WHO 2015)

① Adeno Ca
- Acinar, papillary, Micropapillary, Solid, lipidic, predominant, Mucinous subtypes.

② Sq cell Ca
- Non keratininsing
- Keratinising
- Basaloid

③ Large cell Ca

④ Neuro endocrine Ca
- Small cell Ca
- Large cell neuroendocrine Ca
- Carcinoid Tumor

Adeno Ca

- Pre invasive lesions → Atypical Adenomatous Hyperplasia
  → Adeno Ca insitu
- Minimally invasive Adeno Ca
- Invasive Adeno Ca

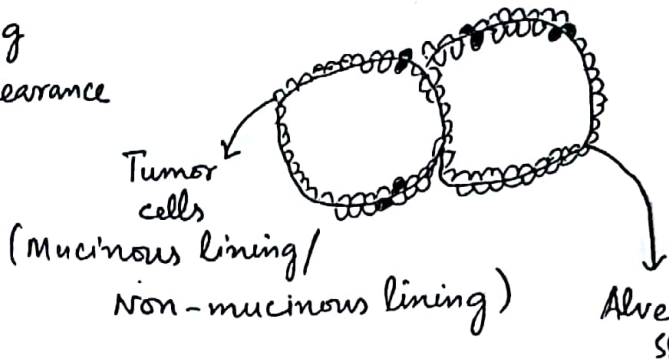
Adeno Ca In situ (AIS)

Previously known as Bronchoalveolar Ca.

→ < 3cm
No stromal invasion
No Pleural invasion
No Lymphovascular invasion.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

⇒ Butterfly sitting on Fence Appearance



(No desmoplastic Stroma) LEPIDIC PATTERN OF GROWTH

Minimally Invasive

< 5mm stromal invasion & < 3mm in size.

No pleural invasion

No lymphovascular invasion.

→ Basophilic Psamoma bodies

Squamous cell Ca → Keratinising (New) → Eosinophilic
→ Non keratinising
→ Basaloid (New)

Neuroendocrine Origin

Histology | IHC | E.Microscopy.

Salt & Pepper Chromatin/ Stippled Chromatin

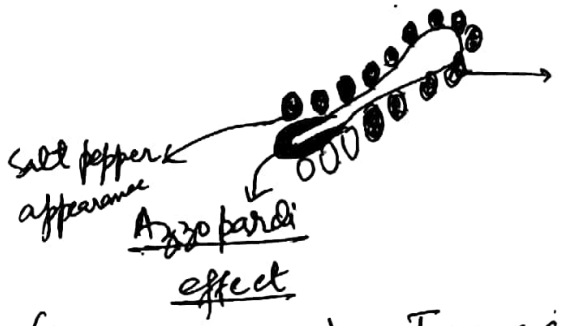
Synotophysin, Chromogranin & CD56, CD57 +ve

→ Dense Core Neurosecretory granules

In High Gr- Hyperchromatic

Small cell Carcinoma

[Oat cell carcinoma]



Tumor cells have a high turnover & and are fragile ⟶ dissupt easily

↓

Their DNA gets encrusted upon vessel wall [BLUE]

Purplish Blue Powdery discolouration of vessel walls

⇓

Azzopardi effect

Carcinoid [Carcinoma like epitheloid tumor]

	Grade	Mitotic count
Typical	I	< 2/10 HPF
Atypical	II	2-10/10 HPF

HPF = High Power Field
~ 40x

Fibrous Septae making nests of ~~cytoplasm~~ Tumor cells.

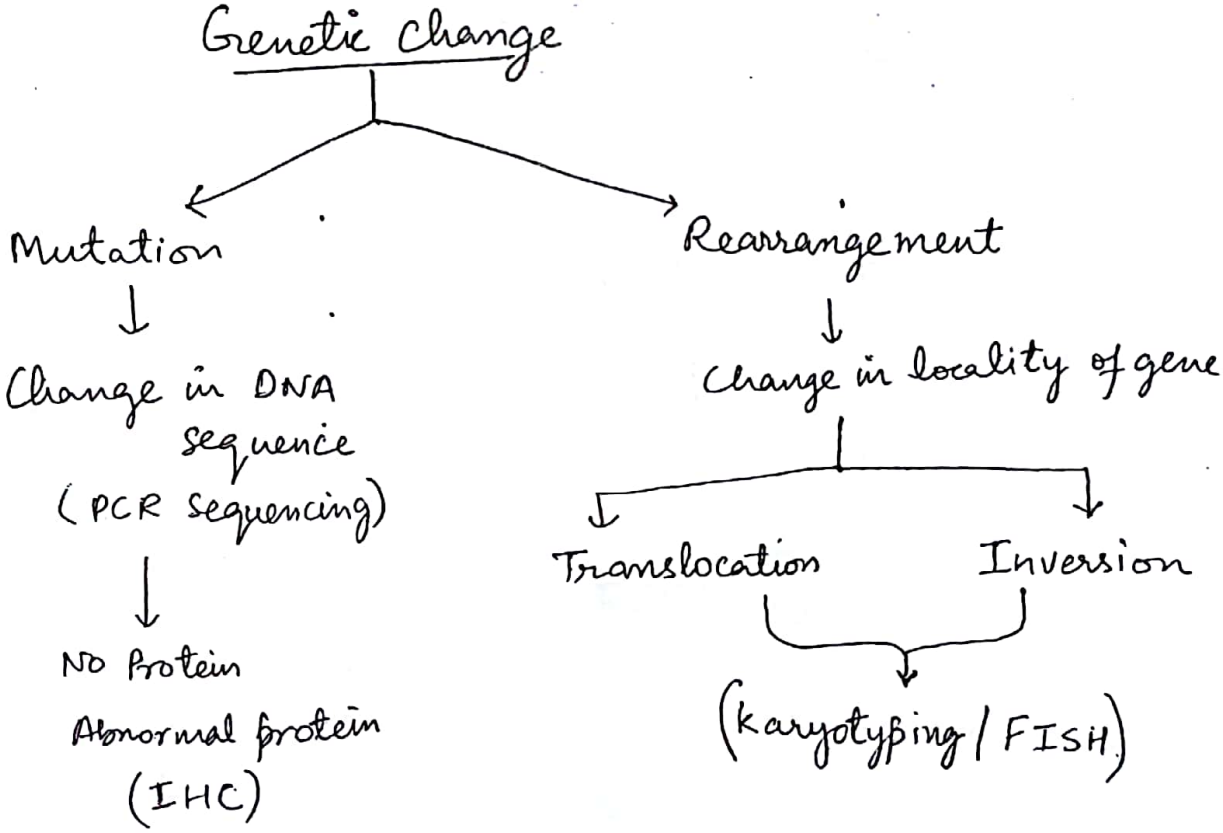
Tumor genetics

Small cell	Squamous cell	Adeno
Rb mutation	P53 mutation	EGFR mutation > amplification
P53 mutation	EGFR mutation > amplification (more than mutation)	KRAS mutation
myc amplification	FGFR$_2$ amplification	ALK rearrangement

Amplification is checked by FISH

↓

Overexpression is checked by IHC



Due to Translocation & inversion

① gene 1 + gene 2

↓ Transcription

(Fusion Transcript)

(Fused mRNA) (RT PCR)

↓

(ONCOPROTEIN)

(IHC) [↑ed function than before] → e.g BCR ABL

or

[↓ed function than before]

② gene 1 gene 2 (promoter)

↓

gene 1 ↑↑ed (FISH)

(overexpressed)

↓

Overexpression (IHC)

FISH

A
B
] Normal

Deletion or Monosomy

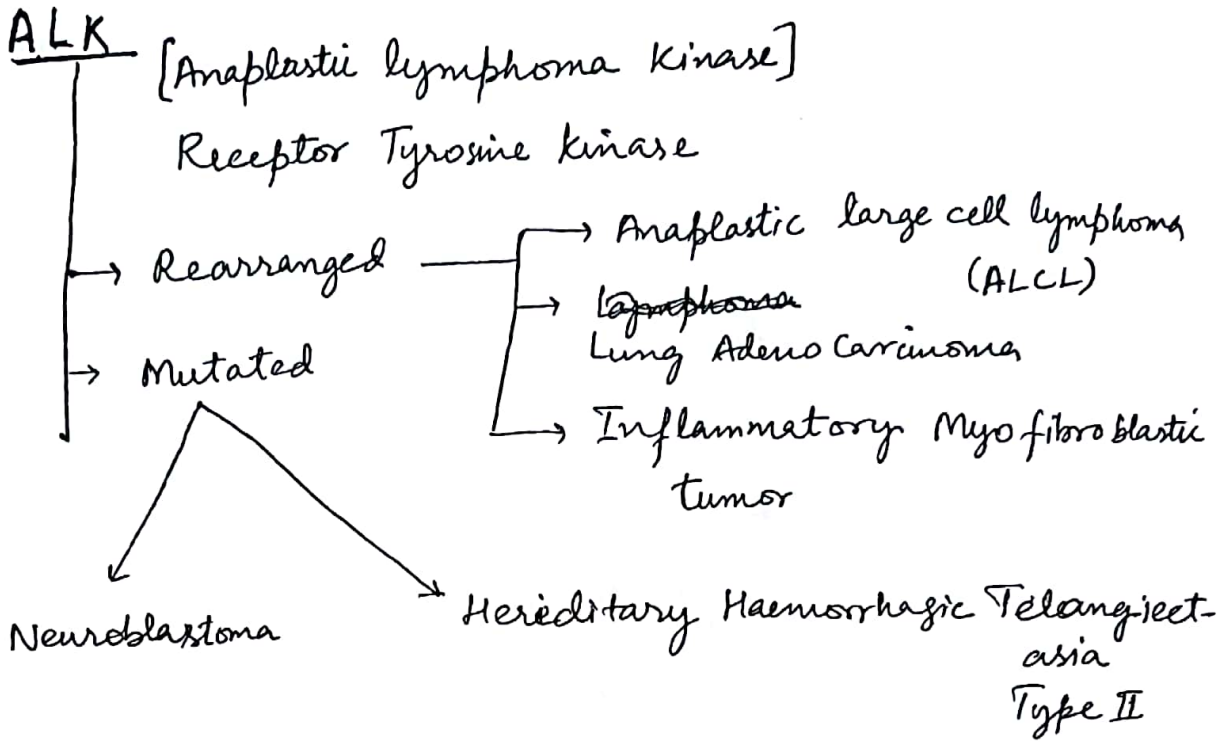
Trisomy

Amplification

Fusion

FISH INTERPRETATION

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp



In lung Adenocarcinoma

EGRF & ALK can be targetted

[EGRF & KRAS are mutually exclusive]

In non smokers & women → EGRF mutation.

IHC of lung Cancer

	Small cell	Squamous	Adeno
Thyroid Transcription Factor (TTF-1)	+	−	+
NAPSIN-A	−	−	+
Other markers	Synaptophysin Chromogranin CD56/CD57	P63	CK7 + CK 20 −

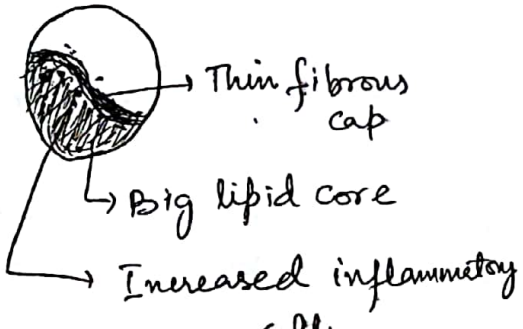
	Mesothelioma	Adenocarcinoma
PAS	−	+
Carcinoembryogenic antigen	−	+
TTF1	−	+
NAPSIN A	−	+
CK7	(+)	(+)
CK5/6	+	−
Calretinin	+	−
WT1	+	−
Electron microscopy	Long slender microvilli	Short Stubby villi

Adenocarcinoma	Squamous cell carcinoma	Small cell carcinoma
- Most common lung Cancer world wide In women In non smokers	- Most common lung Cancer in India in Smokers	- Strongest association with smoking.
- Peripheral location	- Central location	- Central location
- Most common gene mutated is KRAS	- Most common para-neoplastic syndrome is – Hypercalcemia	⇒ Most common Para-neoplastic syndrome. is SIADH.
⇒ Most common Para-neoplastic syndrome is Hematological	⇒ Cavitation (Also in large cell ca)	⇒ SVC obstruction
⇒ Clubbing is seen	⇒ Pancoast Tumor ↓ HORNER's Syndrome	LAMBERT EATON Synd.
		⇒ Worst Prognosis
		⇒ Max Risk of Metastasis
		⇒ Clubbing is Rare.

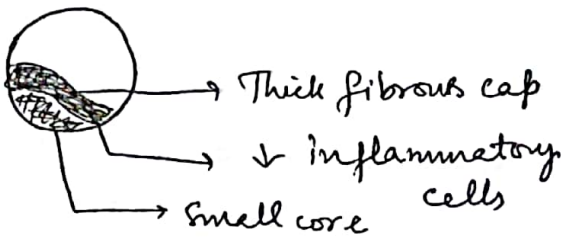
Lung cancer most commonly metastasises to BRAIN & most specifically to Adrenals.

VASCULAR PATHOLOGY

(1) **Atherosclerosis** : Atheroma/Atheromatous plaque.



VULNERABLE PLAQUE



STABLE PLAQUE

(2) **Monckeberg Medial calcific Sclerosis**

- No luminal obstruction
- clinically insignificant

3. Arteriosclerosis :→ Hypertensive changes

Site → arterioles

Benign

Hyaline Arteriosclerosis

- Wall thickening
- Narrowing of lumen
- Kidney → Benign Nephrosclerosis
- Granular kidney: Leather Grain Appearance

~~Kidney → Malignant~~

Malignant

Hyperplastic Arteriosclerosis

PAS stain → Onion skin appearance

New Basement membrane

Kidney → Malignant Nephrosclerosis

Pinpoint Hemorrhages

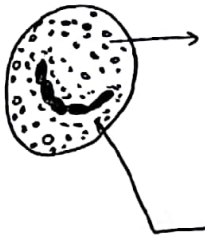
↓

Flea bitten Appearance

Vasculitis → Infectious / Non Infectious (Immune)

Mechanisms

1. Anti endothelial or Anti Smooth muscle antibody
2. Immune complex deposition
3. T- cell Mediated Response (granulomatous)
4. ANCA (Anti neutrophilic cytoplasmic Antibody)



→ cytoplasmic : Proteinase-3 (PR3) (diffused)
Antibody against these (c ANCA or PR3 ANCA)

→ Perinuclear - Myeloperoxidase (MPO)
Antibody against these (p ANCA or MPO ANCA)

Leucocyte Activation → Surface exposed to these granules
↓
If ANCA Present (Susceptible individuals)
↓
Binds to the surface granules
↓
Degranulation of Neutrophils
↓
Enzyme Leakage → Tissue damage.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

CHAPEL HILL CONSENSUS CLASSIFICATION

Large Vessel
- Giant cell arteritis (Pulse less disease)
- Takayasu arteritis

Medium vessel
- Polyarteritis Nodosa
- Kawasaki disease

Small vessel

Immune Complex vasculitis
- IgA Vasculitis (Henoch schonlein Purpura)
- SLE

ANCA associated vasculitis
- ⇒ Granulomatosis with Polyangiitis (Wegner's Granulomatosis)
- ⇒ Eosinophilic Granulomatosis with Polyangiitis (Churg Strauss Syndrome)
- ⇒ Microscopic Polyangiitis

& Variable vessel
- Becket's disease
- Cogan syndrome.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Giant cell Arteritis

> 50yrs

Head & Neck arteries

Temporal – Headache (MC)

Facial → Jaw claudication

Ophthalmic → Blindness

[Most specific]

Diagnosis

Biopsy → Segmental involvement ∴

3–5cm → adequate biopsy Required.

or

at least 1cm

Takayasu Arteritis

< 50yrs

Aorta & Branches

↳ (Aortic arch)

Most commonly: Subclavian

② Common carotid

③ Abdominal aorta

∴ ④ Renal

⑤ Aortic arch or root

∴ ⑥ Coeliac axis

⑦ Coronary

& ↳ (least common)

Diagnosis

Arteriography.

CT Angio

Etiology

Anti endothelial &

Smooth cell antibodies

(?)

Cytokine mediated Response

Granulomatous

Inflammation

Histopathology.

Giant cells (granulomas)

Smooth muscle

Intimal hyperplasia.

Internal Elastic lamina

(Fragmentation)

[Van Geison Stain for Elastin]

Polyarteritis Nodosa (PAN) [Mc - Kidney involved]

(P)AN
(P)ATCHY → (entire circumference of vessel wall is not involved)
(P)ULMONARY ARTERY SPARED
[Bronchial vessels may be involved]

Features

Transmural (Through out wall) : Aneurysms, Fibrosis

Necrotising : Fibrinoid Necrosis

Inflammation : < Acute, Chronic] All stages of activity can be seen at the same time (ongoing Injury)

Associated ⊂ Hep-B. → Immune complex deposition.

⇒ The pattiology in the kidney in classic polyarteritis nodosa is that of arteritis without glomerulonephritis

⇒ May involve bronchial vessels but not pulmonary vessels.

⇒ Renal & Visceral arteries are very commonly involved. (Muskuloskeletal)

⇒ No granulomas. No eosinophilia

Giant cell Aortitis → Aortoarteritis

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Kawasaki Disease

- < 5 years
- Anti endothelial cell antibodies ⊕
- Acute Necrotising Vasculitis (Transmural)
- Febrile illness
- Strawberry Tongue
- Cervical lymphadenopathy
- Mucocutaneous ulcers

⇒ MUCOCUTANEOUS LYMPH NODE SYNDROME.

Strawberry cervix → Trichomonas infection

Cholesterolosis → Strawberry Gall bladder

- Most common artery involved ⇒ **Coronary** → Thrombosis, MI, Aneurysms } MC cause of cardiac mortality in Children.

ANCA associated

Wegener's

- c ANCA > p ANCA
- URT + LRT involvement
- Renal involvent
- Necrotising &/or granulomatous vasculitis

Churg Strauss

- p-ANCA
- Asthma
- Allergic Rhinitis
- Nasal polyps
- Peripheral eosinophilia
- Necrotising &/or granulomatous vasculitis.

MPA (Microscopic Poly-Angiitis)

- Hypersensitivity or P ANCA
- LEUCOCYTOCLASTIC VASULITIS ↓ (WBC – Breakdown) → Apoptotic Neutrophils.
- NO granulomas
- Fibrinoid Necrosis

URT – Upper Respiratory Tract involvement

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Vascular Tumors

↓

Endothelial cell origin

IHC → PECAM / CD31

Benign

Hemangioma

- Capillary Hemangioma

- Cavernous Hemangioma

Boderline

Kaposi sarcoma

HHV-8

1. Classical
2. Endemic (Africa)
3. Transplant associated
4. Immunodeficiency associated

Malignant

Angiosarcoma

1. **Hepatic**
   - Exposure to Polyvinyl chloride & Thorium contrast dyes
2. **Cardiac**
   - Most common cardiac primary malignancy in adults.

Microabscesses (Misc)

- Neutrophil Microabscesses in TAO
- Neutrophil crypt abscess in IBD
- Pautrier's Microabscess (Tumor lymphocytes in mycosis Fungoids)
- Munroe Microabscess of Neutrophils in Psoriasis

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

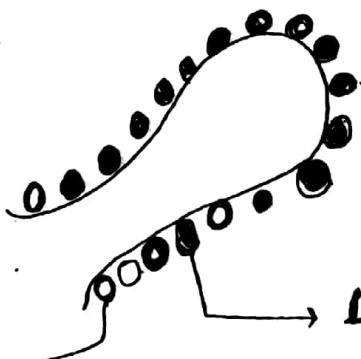
Thyroid Cancers

- **Follicular origin**
  - Papillary : most common
- **Parafollicular origion (C-cells)**
  - ↓
  - CALCITONIN
  - ↓
  - **Medullary**
    - Amyloid (ACal)
    - CEA
    - MEN2 syndrome

Papillary Ca Thyroid

Most common subtype | overall
Children
Thyroglossal cyst
Post Radiation
Hashimoto Thyroiditis

⇒ Lymphatic Spread
⇒ Best prognosis



ORPHAN ANNIE - EYE NUCLEI

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Follicular Ca

Most common subtype to arise in multinodular goiter

⇒ Capsular or vascular invasion

⇒ Cytology (FNAC) will not help

⇒ Histopathological examination (No biopsy is done) ← FNAC
↳ also in Testicular mass.

↓

[Hemithyroidectomy to be done]

⇒ Hematogenous spread (Bones & lungs)

Anaplastic Ca

Bizarre cells

Fibrosis ↑↑

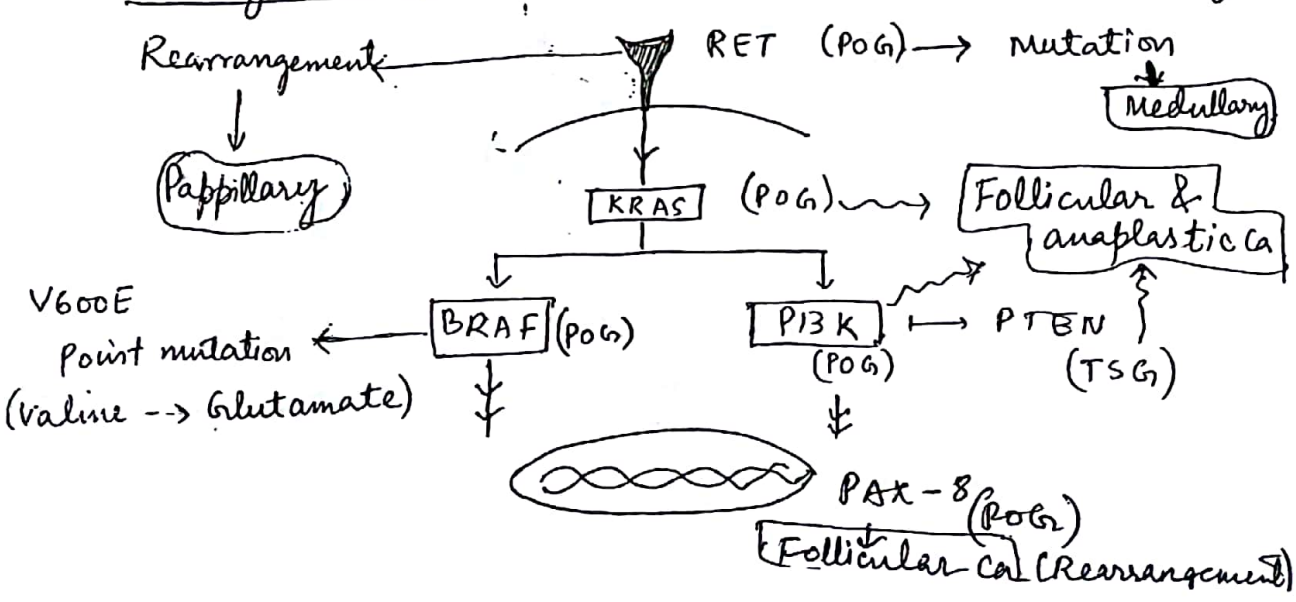
Least common subtype

Most aggressive (rapid onset)

Worst prognosis.

POG → Proto onco gene
TSG → Tumor suppressor gene

Tumor genetics



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Most common genes

Papillary : BRAF

Follicular : KRAS

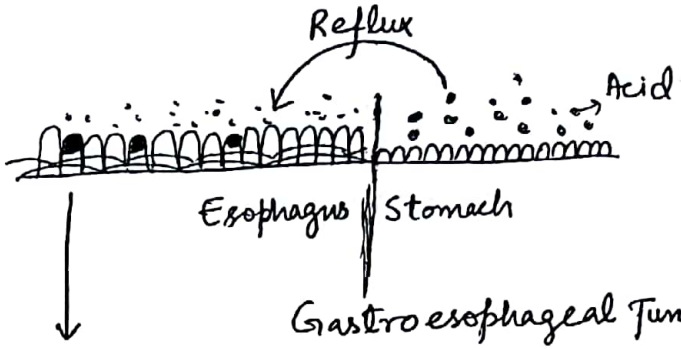
Anaplastic : p53

Medullary : RET

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

GIT

Esophagus



Columnar cells
+
Groblet cells ⟶ Acid mucin]→ Alcian blue Stain (+)

↓

Intestinal metaplasia ⟶ BARRETS Esophagus

Gross → Red velvety patches in esophagus.

Metaplasia ⟶ Dysplasia ⟶ Anaplasia (Irreversible)

↓

[Some serotypes of H pylori are associated ↓ decreased risk of esophageal adeno.ca. because they cause gastric atrophy → ↓ acid → ↓ Barrett's esophagus] [Adeno-Carcinoma]

Gastro Intestinal Stromal Tumor (GIST)

Origin: Interstitial cells of cajal
(Pacemaker cells in Muscularis propria)

Gross: Nodular or Capsulated tumor
Arising from the wall
Mass effects
Cut section → Fleshy Tumor (Grey Tan) with hemorrhage & necrosis

Stroma ↓ Vimentin – Mesenchymal marker

Microscopy → [Spindle cell (most common)
Epithelioid
Mixed]

Genetics

85% c kit mutation → AML, Seminoma, Mastocytosis

c kit → Receptor Tyrosine kinase (RTK)

Imatinib → Inhibitor →

↳ 8% PDGFRA mutations

[c kit & PDGFRA mutations are mutually exclusive]

In a small proportion of non c kit & non-PDGFRA mutated GIST → SDH mutation*

↓

SDH Deficient (Succinate Dehydrogenase)

*Exclusively seen in

↳ Gastric In Location

↳ Indolent Course (slow growing)

↳ Younger Population

↳ Imatinib Resistant

↳ Part of Carney Stratakis Syndrome [Paragangliomas]

Carcinary Triad → GIST, Pulmonary Condroma (Hamartoma), Paraganglioma.

IHC → CD117 (c kit) : +ve (most sensitive)

DOG 1 : +ve (most specific)

Myxomas, Skin Lesions, Multiple endocrine involvement

*Prognosis → Location (stomach : better)

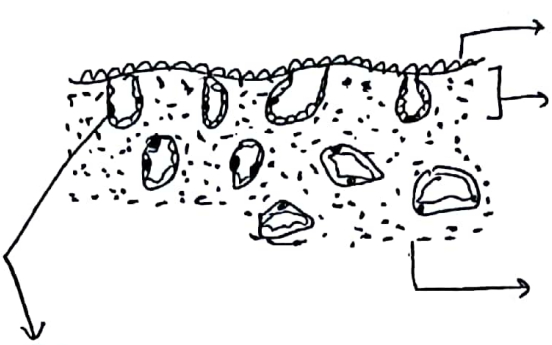
Size (< 5 cm : better)

Mitotic count (counted per 50 HPF)

Different cut offs for different sizes at different locations.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Celiac Disease



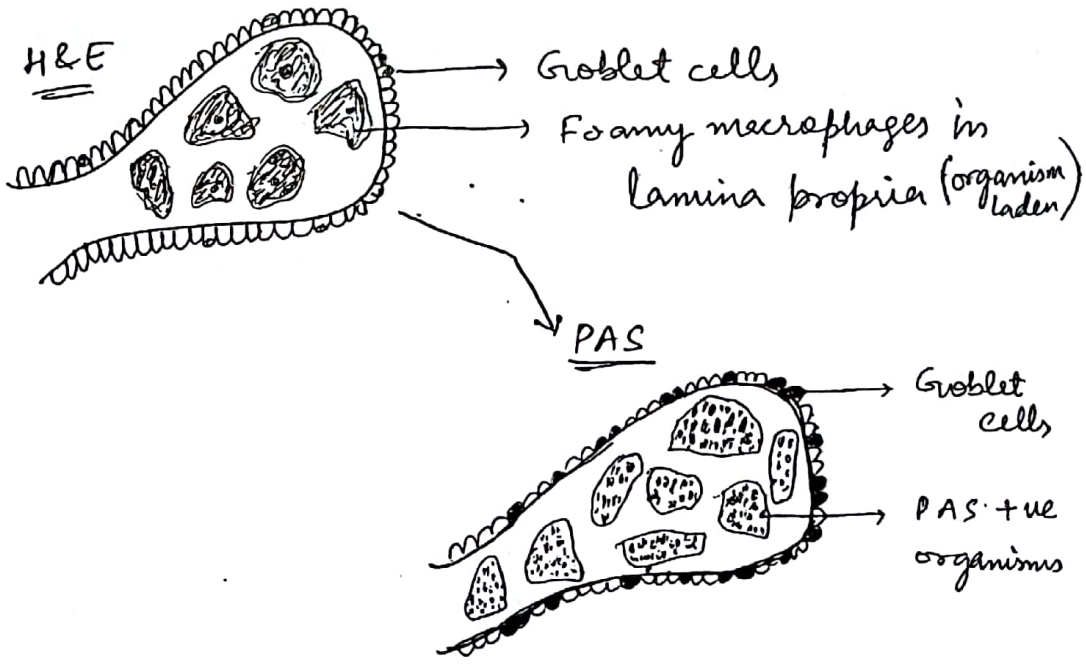
Risk of enteropathy associated T cell lymphoma is high (EATL)

- Adenocarcinoma Risk also increased because of crypt Hyperplasia
- Associated ⊂ HLA DQ2 > DQ8

- IgA Nephropathy
- Dermitiis Herpetiformis

Whipple's Disease

(Malabsorptive syndrome)



Intestinal polyps

Non Neoplastic

- Hyperplastic
- Inflammatory (MC)
- Hamartometous ⇒ Indigenous to that organ ± Disorganised mass
  ↳ Now considered Neoplastic
  - ① Choristoma → Normal tissue, Abnormal site
  - ② Peutz Jegher Polyp
  - ③ Juvenile Polyp.

Neoplastic polyps

Adenomatous / Adenomas

DYSPLASIA

Christmas Tree appearance

Multiple PJPs + Mucocutaneous melanosis

⇓

Peutz Jegher Polyp

(STK 11 gene)

aka – LKB1

Solitary → No risk of cancer

Multiple → Juvenile polyposis

↓ Syndrome

Slight risk of Cancer

BMPR 1A – (Primary Pulmonary hypertension)

SMAD 4 – (Pancreatic Cancer)

Lymphoma – MC primary → MALToma (extranodal Marginal zone Ly

↳ H Pylori associated

CD5–, CD10–

CD23–, CD43+

Adenomas / Adenomatous polyps

[Tubular] (mc)

(Villous)

(Tubulovillous)

Familial Adenomatous Polyposis (FAP)

- APC gene mutation
- Most commonly: Tubular Adenomas
- Diagnosis > 100 polyps
- Attenuated FAP < 100 polyps. (variant)

FAP + Skull osteomas
+ Epidermoid cysts
+ Desmoid Tumor (fibromatosis)

→ GARDNER SYNDROME

FAP + Medulloblastoma (& More common) & Glioblastoma] Turcot syndrome &

Colo Rectal Ca

Adenoma - Carcinoma Sequence.

Normal colonic epithelium → (loss of APC & [gate keeper of colonic neoplasia]) → Hyper proliferation → (epigenetic changes) → Early adenoma → (KRAS & NRAS mutations) → Late adenomas → (Loss of P53.) → Adenocarcinoma

Others: EGFR, BRAF &

Right sided colon

Diameter is more → space for tumor to grow → Cauliflower/fungating/Polypoid

↓

Loose consistency stools → easily pass through

↓

Causes erosion of tumor → Bleeding ← (Fecal occult blood test)

↓

Iron deficiency Anemia

Left sided Colon

Diameter is less → No space to grow → Constriction (Napkin Ring constriction)

Bulky stool → Cannot pass easily

↓

features of Intestinal obstruction

Hereditary Non Polyposis colon Cancer (HNPCC)
or LYNCH SYNDROME

Defect in DNA mismatch Repair gene
(MSH2, MLH1)

↓

DNA mistakes accumulate → genomic Instability

[Especially microsattelites (Tandem sequences)] ← MSI

[Microsatellite Instability]

Colon Cancers	Extracolonic Cancers
- Mean age ~ 40yrs	Endometrial (MC)
- Proximal to splenic flexure	Gastric
- Mucinous / signet ring cell morphology	Ovarian
- ↑sed lymphocytes in tumor	Transitional
- Better prognosis	Small intestinal

Pancreatic Carcinoma

MC subtype → Ductal Adenocarcinoma

Very aggressive

Procoagulant Tumor mucin + cellular debris

↳ DIC risk is increased

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

→ Non bacterial Thrombotic endocarditis

→ Migratory thrombophlebitis
↓
(TROSSEAU SYNDROME) → also seen in Breast Ca, Gastric Ca, Lung Ca

Normal Pancreatic epithelium

KRAS ~90% (Oncogene)

CDKN2A/P16 ~95% (TSG) → (Protein)

Pancreatic epithelial Neoplasia (PanIN)

SMAD4, BRCA2, P53 } TSG

Adenocarcinoma

Most common gene Mutated – CDKN2A

Most common Protooncogene mutated – KRAS.

Most common TSG mutated → CDKN2A/P16

[KRAS changes occur earlier in the Progression]

Chromosome locations (Misc)

BRCA1 – 17q

P53 – 17p

APC – 5q

HFE – 6p

SERPINA1 – 14q

13q – BRCA2, Rb, ATP7B.

MET (Hepatocyte Growth Factor Receptor) – 7 Chr. ↦ Papillary RCC

Mallory Dank Bodies

Mallory Dank Bodies / Mallory Bodies

↓

Remnants of intermediate filaments. Q

following hepatocyte damage.

↓ cytokeratin Q

↓

CK 8/18 Q

→ Eosinophilic Inclusions.

Prognostic Markers for tumors

Stage

Esophagus
Stomach
Gall bladder
Pancreatic
Prostate
Testis

→ T. Stage ↓ Depth of invasion.

Lymph Nodes

Breast (Axillary)
Colon
Penile (Inguinal)
Head & neck

Others

Metastatic Breast
- ER/PR status

Renal
- Pathological Stage

Wilm's
- Histology (Anaplasia)

Soft tissue Sarcoma
- Grade

Melanoma
- ~~Depth~~

Barrett's Oesophagus → AdenoCa

Early genetic Changes

P53 (TSG)
CDKN2A/p16 (TSG)

Late genetic Changes

EGFR (erbb1)
Her 2 Neu (erbb1)
MET
cyclin D1

→ Proto oncogenes [POG]

Cardiac Pathology

Myocardial infarction

Coronary Artery Spasm → Hypoxia damage → Myocardial response (Ischemic Injury) ↓ ATP

- In 30 minutes Reversible (20-40 min)
- Beyond - Irreversible

Infaretion

TTC (Triphenyl Tetrazolium chloride)

- +LDH → BRICK RED : Normal viable myocardium
- −LDH → PALE YELLOW : Recent infarct

Features	Onset
Onset of ATP Depletion	Seconds
Loss of Contractility	< 2 mins
ATP Reduced to 50% of Normal	10 min
to 10% of Normal	40 min
Irreversible injury	20-40 min
Microvascular injury	> 1 hr.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Valvular H.D.

	Morphologically	Special points
Mitral value Prolapse	Gross Ballooning of value Myxomatous degeneration	a/w Marfan's syndrome Mid systolic click
Rheumatic H.D	Verrucous vegetations along lines of closure [MAC callum Plaques]	Pathognomic Aschoff nodule
IE (Infective Endocarditis)	Friable vegetations along lines of closure, invading Chordae Tendinae	Risk of Septic embolisation
NBTE (Non Bacterial Thrombotic endocarditis)	Large Fibrin clots along lines of closure ; No Invasion	Seen in Cancer Malnourished (Marantic Endocarditis)
LSE (Libmann Sack Endocarditis)	Vegetations on both sides of Cusp	SLE

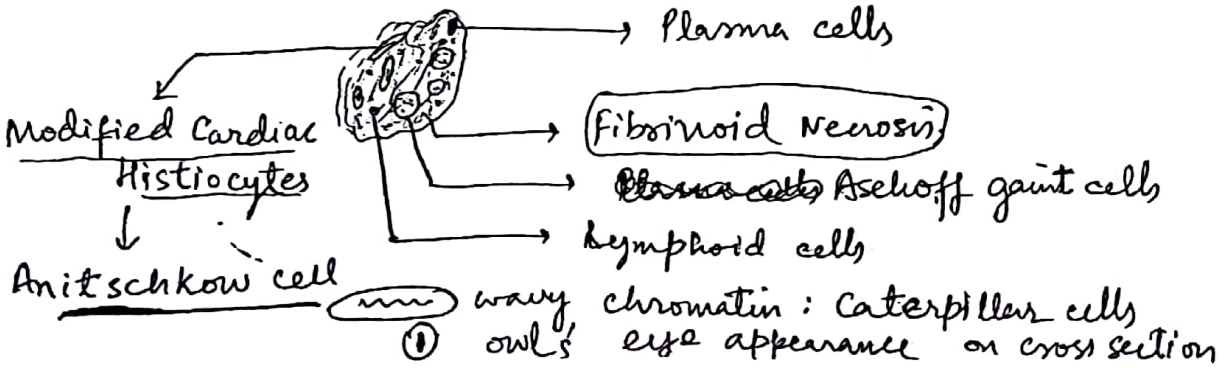
Rheumatic Heart Disease

≡ Molecular Mimicry

Acute = Pancarditis ← Myo, Endo, Peri

↓

Pathognomic feature is Aschoff Nodule which [can be seen in myo, endo, pericardium] Q



Endocarditis

Verrucous vegetations along the lines of closure

↓ warty

↓

Fibrinoid Necrosis

Inflammatory cells, Immune complex

↓

Damage the valves → Regurgitation

↓ Regurgitation jets into Left Atrium

Overtime can cause (Plaque) formation especially in posterior wall of (L) atrium (when mitral value involved)

↓

(Mac Callum Plaques)

Chronic RHD

Due to inflammation

↳ Stenosis of valves

Due to fibrosis of cusps & narrowing of orifice

Fish mouth / Button hole appearance

↓

Most commonly: Mitral > Aortic

Finding in eye →

Superiotemporal dislocation of lens

↓

MARFAN'S Synd

⇒ Owl's eye → CMV inclusions
→ R.H.D
→ Lymphoma

Fish mouth appearance

Floppy Mitral value

↓

MVP

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

CNS & PNS Pathology

Schwanoma

Benign peripheral nerve sheath tumor

↓

Most commonly – Cerebellopontine Angle ✿

NF_2 associated

Variably cellular tumor

↓

- Hypercellular compact areas → Antoni-A
- Hypocellular loose areas → Antoni-B

→ Tumor nuclei are arranged in parallel to each other ⇒ TRUE PALISADING ✿

✿ VERROCAY BODY

CNS TUMORS

1 Glioma (M.C 1° tumor)
- Astrocytoma (MC) glioma
- Oligodendroglioma
- Ependymoma

2. Meningiomas (2nd m.c 1° tumor)

3. Embryonal Tumors
- Medulloblastoma (M.C 1° CNS malignancy in children)
- Atypical Teratoid/ Rhabdoid Tumor (ATRT)

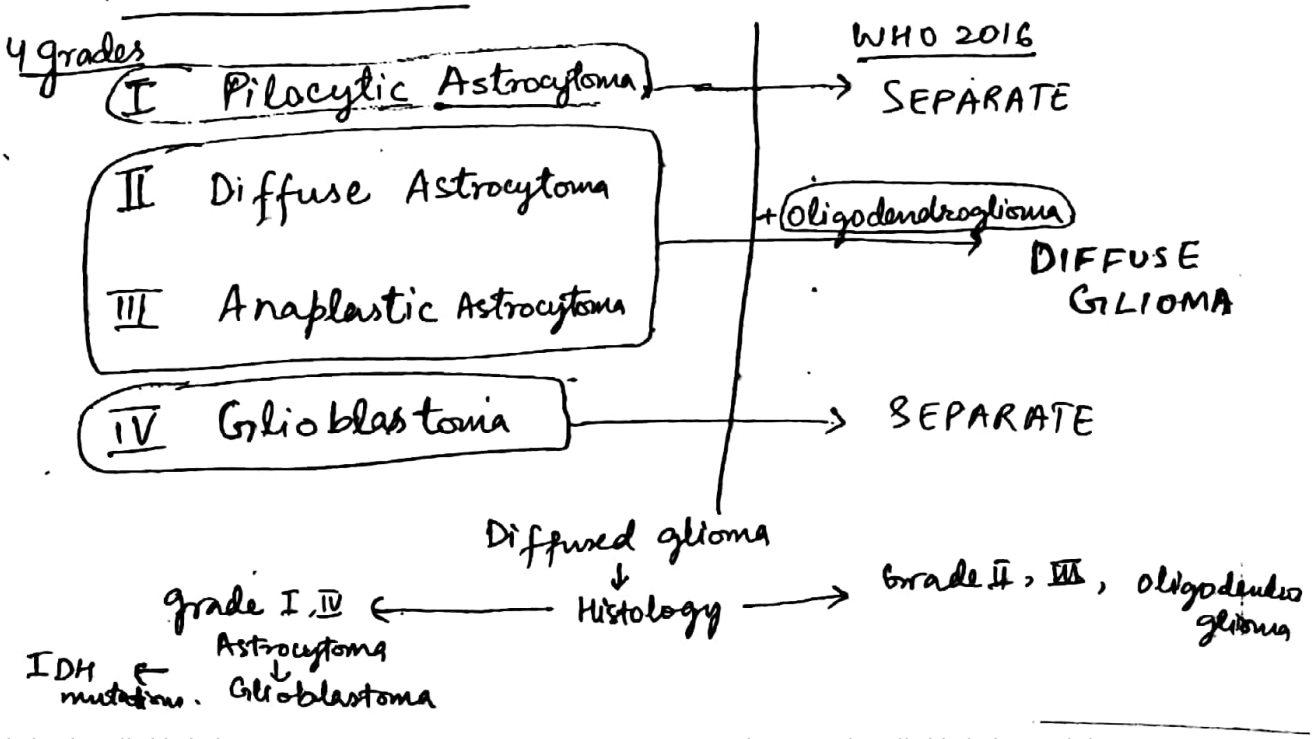
PNET is not included under this anymore WHO 2016

4. Neuronal Tumors (neurofilament +ve)

5. Lymphomas

6. Secondary Tumors (M.C CNS Tumors)
↳ (1° is Lung Ca MC)

ASTROCYTOMAS



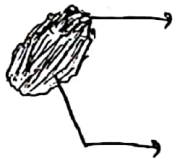
Pilocytic Astrocytoma

Most common 1° CNS Tumor in Children

Seen in
Cerebellum

BRAF ← Mutated (V600E)
Rearranged

Gross



→ Mural Nodule
→ cystic lesion

↓
(Hemangioblastoma)

Micro

→ Pilo (Hair like processes)
→ Tumor Nuclei
→ Eosinophilic crystalline & ROSENTHAL FIBRES
↳ Made of GFAP Proteins & other Proteins
(Non neoplastic reactive change)

Glioblastoma

Most common 1° CNS malignant in Adults

Seen in
Frontal & Parietal Lobes

EGFR
P53
CDKN2A / P16
PDGFRA

Gross
- Tumor infiltrating normal brain
↓
crosses midline (Butterfly glioma)
- Areas of Hge & necrosis

Micro

Leaky vessels → Contrast enhancement
↳ Areas of necrosis (Pink)
bordered by viable Tumor cells (blue dots)
↓
PSEUDOPALISADING NECROSIS

OLIGODENDROGLIOMA

Monotonus uniform tumor cells with Perinuclear Halo
[Fried egg appearance
(also in Hairy cell Leukemia
- Mycoplasma)

Delicate anastamosing vasculature
[chicken wire vasculature]

Chicken wire
↳ Fibrosis – Alcoholic liver disease
↳ Calcification – Chondroblastoma

Microcalcification : Imaging
↳(Basophilic on H&E)

Genetics
- IDH1, IDH2 mutation
- 1p/19q codeleted
  - Favourable Prognosis

MEDULLOBLASTOMA [grade IV]

Mc site – cerebellum (Posterior fossa)
CSF dissemination → Drop metastasis

Small round blue cell tumor
→ Neurophil (cytoplasmic feature)

HOMER WRIGHT ROSETTE
↳(PseudoRosette
[True Rossete has Nucleus]
↳ Ependymal Rosette

MENINGIOMA (I - III)

Arises from Araehinoid cap cells / Meningothelial cells

Dura based tumor (DURAL TAIL)

Easily Detachable

⇒ Causes reactive hyperostotic change in overlying bone.

↓

X'Ray

Express PR ⇒ ↑ses in size during pregnancy.

Associated ε NF_2

Most common Histology is - Meningothelial

WHO 2016 → genetic incorporation into histology

Glioblastoma ⟶ IDH mutations
(Isocitrate Dehydrogenase)

- Present → Glioblastoma, IDH mutant (Better prognosis)
- Absent → wild type glioblastoma

Diffused gliomas

↓

IDH Mutation Status

- IDH Mutant → Depending on histology
  - looks like Astro → ATRX, P53 (IHC) → Diffuse Astrocytoma, IDH Mutant, Intermediate prognosis
  - looks like oligo → 1p/19q codeletion (FISH) → Oligodendroglioma, 1p/19q codeletion & IDH mutant, Excellent Prognosis
- IDH wild → depending on histology → Diffused Astrocytoma, NOS; Oligodendroglioma, NOS (Poor prognosis)

Schwanoma

Neoplastic Schwanoma cell

Cerebellopontine angle = Most Commonly

S100 +ve

NF_2 associated.

Variable cellular areas

- Antoni A
- Antoni B

Neurofibroma

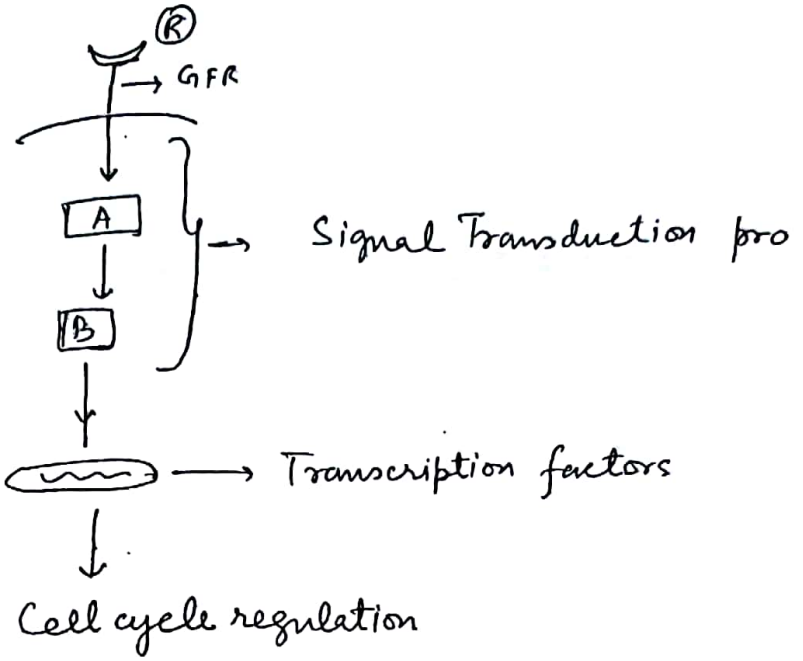
Neoplastic Schwann cells + Fibroblasts + Perineural like cells + Fibroblasts + Spindle cells (CD34 +ve) + Mast cells

S100 +ve

Heterogenous ~ a

NF1 associated ⁰

Wavy collagen & wavy buckled nuclei.



GFR

EGFR (erbb1) — Her2neu

PDGFRA

RET

MET

STDPs

KRAS

BRAF

PI3K

Tyrosine kinase — Receptor TK

ALK

Ckit

Transcription f

PAX 8

myc

Cell cycle inhibitors CDK N2A/P16

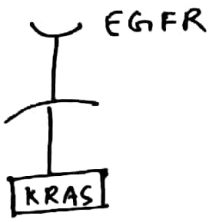
Repair genes : BRCA 1 & 2

p53

Rb

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

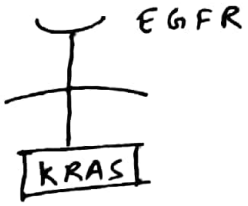
Lung



⇓

Mutually exclusive

Colon



KRAS/NRAS mutation analysis is mandatory now before starting anti EGFR Therapy.

Q Mutation analysis of which of the following genes will not help in progrostication of colon cancer?

(A) EGFR

(B) KRAS

(C) P53

(D) MSH2

↓ DNA mismatch

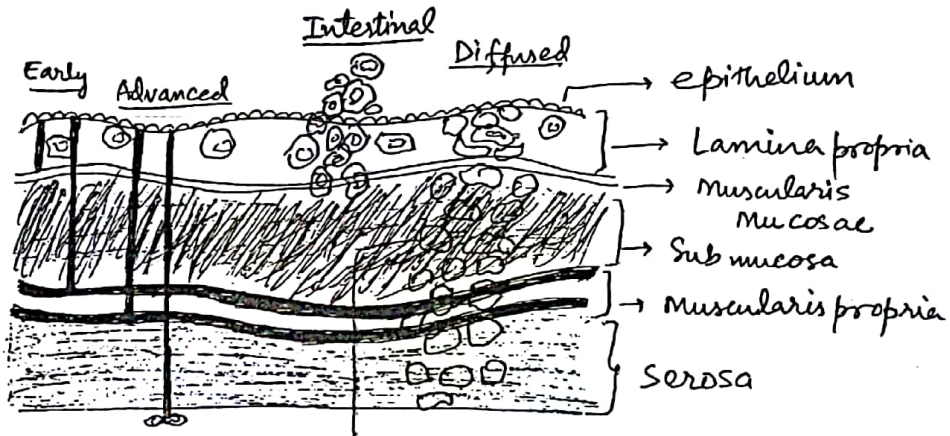
↓

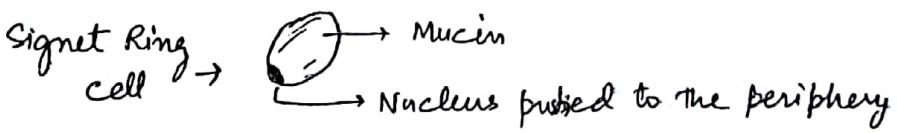
Ly Syndrome

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Gastric Adenocarcinoma

- Depth of Invasion
  - Early
  - Advanced
- Histology
  - Diffuse
  - Intestinal





- No mucosal mass
- Loss of Rugal folds
- Transmural thickening – Infiltration → wall thickening ↓ Leather bottel appearance ← LINITIS PLASTICA

Disease	Efect on			
	Intraluminal digestion	Terminal digestion	Transepithelial Transport	Lymphatic Transport
Celiac disease		⊕	⊕	
Lactase		⊕		⊕
whipples				⊕
Abeta			⊕	
Chronic Pancreatitis	⊕			

Hematology 23/04/18

Hematooncology

Hematopoietic Stem cells

- Common Myeloid progenitor
  - DIFFERENTIATION
    - Erythroblasts → RBC
    - Myeloblast → Granulocytes
      - Neutrophils
      - Eosinophils
      - Basophils
    - Monoblast → Monocytes
    - Megakaryoblast → Platelets
- Common Lymphoid progenitor
  - Lymphoblasts (B/T/NK)
  - Lymphocytes (B/T/NK)

IMATURATION

BEN

Myeloblast → **Promyelocyte** → **Myelocyte** → **Metamyelocyte** → **Band form** → **Neutrophil**

- Myeloblast: Prominent nucleoli
- Promyelocyte: Azurophilic primary granules
- Myelocyte: While maturation
  - Increased segmentation
  - Increased functional granules
  - Decreased size
- Band form:
  - Segmented Nucleus
  - Increased no. of granules

Right Shift ⇒ (Immature cells) (Infection)

Left Shift (Hypoplastic marrow) ⇒ ARNETH Index or ARNETH COUNT

(↑ Immature cells) (Few lobes of Neutrophils Nucleus)

Leukemia ⟷ Lymphoma

White in blood.

Liquid tumor

Origin - Bone Marrow

Malignant

Inv - Flowcytometry of peripheral blood or B. M. aspirate

Lymphocytes → Tumor

Solid tumor

Origin - Lymphoid organs → L.N, thymus, spleen, tonsils. any where in body.

Benign/Malignant.

Inv. Immunohisto chemistry on Histopath sample. (IHC)

Gene Rearrangement

Change in location

karyotyping / FISH

- Translocation
- Inversion

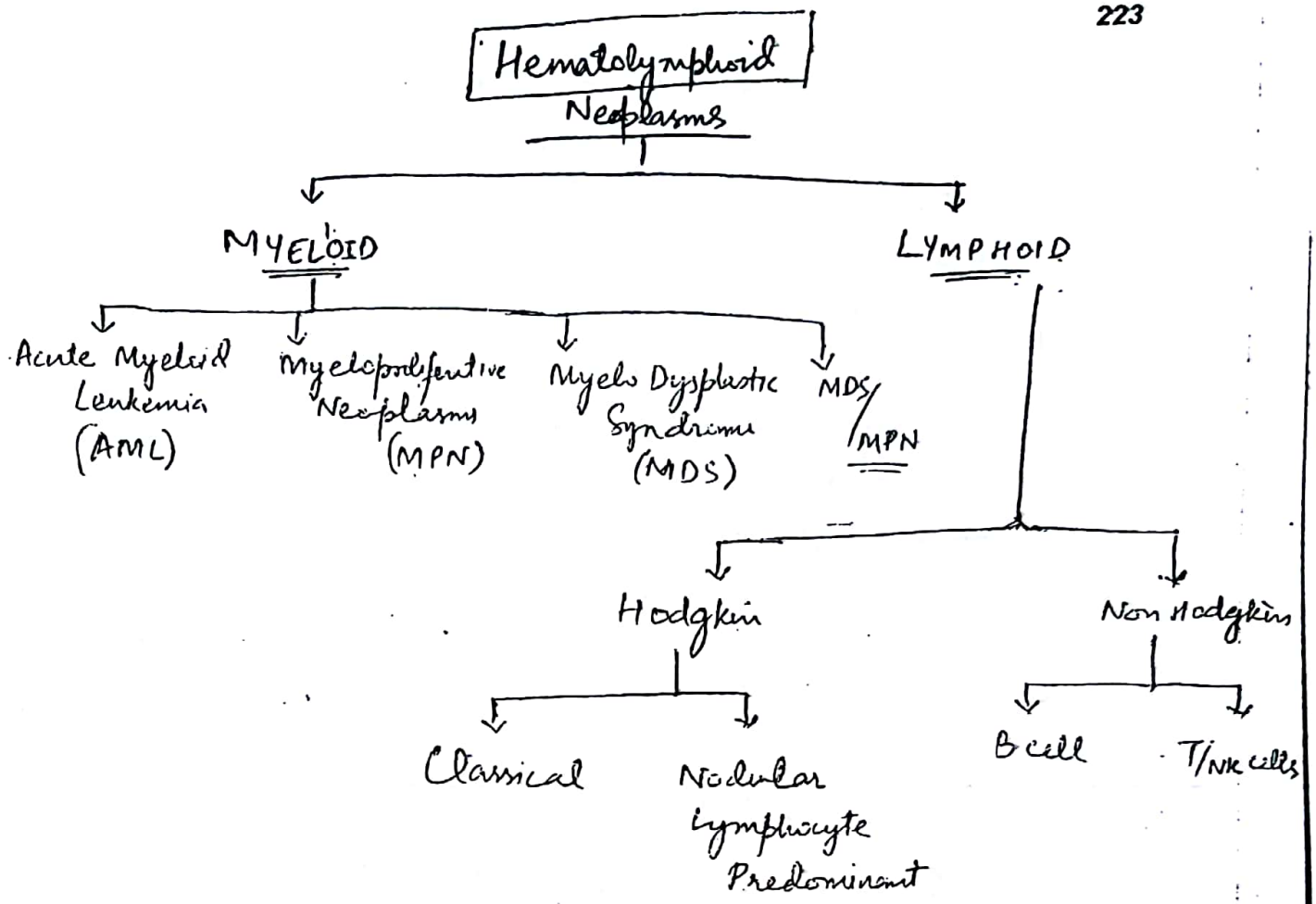
F. In Situ Hyb.

- gene 1 + gene 2 → mRNA (Now fused) [FUSION TRANSCRIPT] — Inv. RT. PCR.
  - → New protein (oncoprotein) — IHC / Flow cytometry
    - → Cancer. (↑ Leukemias)
- gene 1 → gene 2
  - → ↑ sed copies (Amplification → FISH)
    - → Increased protein → (IHC) [Overexpression]
      - → Increased unregulated proliferation
        - → Cancer. (↑ Lymphomas)

Mutation

- Change in sequence (PCR + Screening)
  - → Commonly seen in Solid tumors.
  - → Increased expression or Decreased expression → New protein (IHC)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp



Acute Myeloid Leukemia (AML)

⇒ Rise in Immature cells in marrow.

Origin :- Haematopoietic stem cells/progenitor

Marrow is taken over by bad cells → Thus no place for good cells

- Anemia
- Thrombocytopenia
- Recurrent Infection

HSCs go to the extramedullary sites

↓

Extramedullary Hematopoiesis

↓ Causing

Spleenomegaly or Hepatomegaly

⇒ Combination of Maturation arrest + Clonal proliferation

↓

Increased Immature cells

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

FAB classification

AML - with minimal differentiation (M0)
AML - without maturation (M1)
AML - with maturation. (M2)
AML - with promyelocytic maturation (M3)
AML - with myelomonocytic differentiation. (M4)
AML - with monocytic differentiation (M5)
AML - with erythrocytic differentiation (M6)
AML - with megakaryotic differentiation. (M7)
↳ (↑ risk of myelofibrosis)

Indented nucleus ⇒ Monocyte

2017 WHO AML Classification.

≥20% Blastcells in Marrow. (<20% - MDS)

1. AML with Recurrent genetic abnormalities.

Do not require 20% Blast count for diagnosis (exceptions)

- AML with t(8;21)
- AML with t(15;17) M3
- AML with t(16;16) or inv(16)

} Favourable Prognosis

- AML with t(6;9)
- AML with 11q23 rearrangements (MLL gene)

} Unfavourable Prognosis

AML with t(9;22) (WHO 2017) — Phil. Chromosome. 22nd chr. formed after Translocation

AML with minimal karyotype.
- (i) Biallelic CEBPA mutation
- (ii) NPM mutation

(2017) } Favourable prognosis

8;21
15;17
16;16
6;9
11q23
9;22

2. AML, therapy related.

Alkylating Agents
Epipodophyllotoxins

3. AML, with dysplasia related changes.
   With prior MDS
   Without prior MDS

4. AML, Not otherwise Specified (NOS)
   Previous FAB M0 - M2, M4 - M7. (30-40%) More common in adults.

AML with t(8;21)

RUNX1T1 | RUNX1 → Important for myeloid & lymphoid differentiations & maturation.

→ Fine chromatin
→ Auer rods
→ Prominent Nucleoli

Fused azurophilic granules (MPO +ve granules)

- with M2 Morphology.

AML with t(15;17)

PML (Promyelocytic Leukemia) | RARA (Retinoic acid receptor α)

PML-RARA Fusion

Myeloblast → Promyelocyte ✗→ Myelocyte

PML-RARA fusion blocks the maturation

Thus ↑ Promyelocyte

→ Granules MPO+ve
→ Stacks of Auer rods

Atypical promyelocyte + Stacks of Auer rods ⇒ FAGGOT cells

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

↑ Granules → Procoagulate in nature

↓

[Widespread thrombosis

↓

[Consumption of all platelets & coagulation factors.

↓

Bleeding

↙

[Disseminated Intra Vascular Coagulation]

DIC

↓

Consumption Coagulopathy.

All Trans Retinoic Acid (ATRA) Remove the block!

Arsenic

[AML ≡ DIC = M3

[AML ≡ best prognosis = M3

AML with t(16;16) or Inv(16)

Gene - Core binding factor β (CBFβ)

Usually shows [M4] & [M5] morphology.

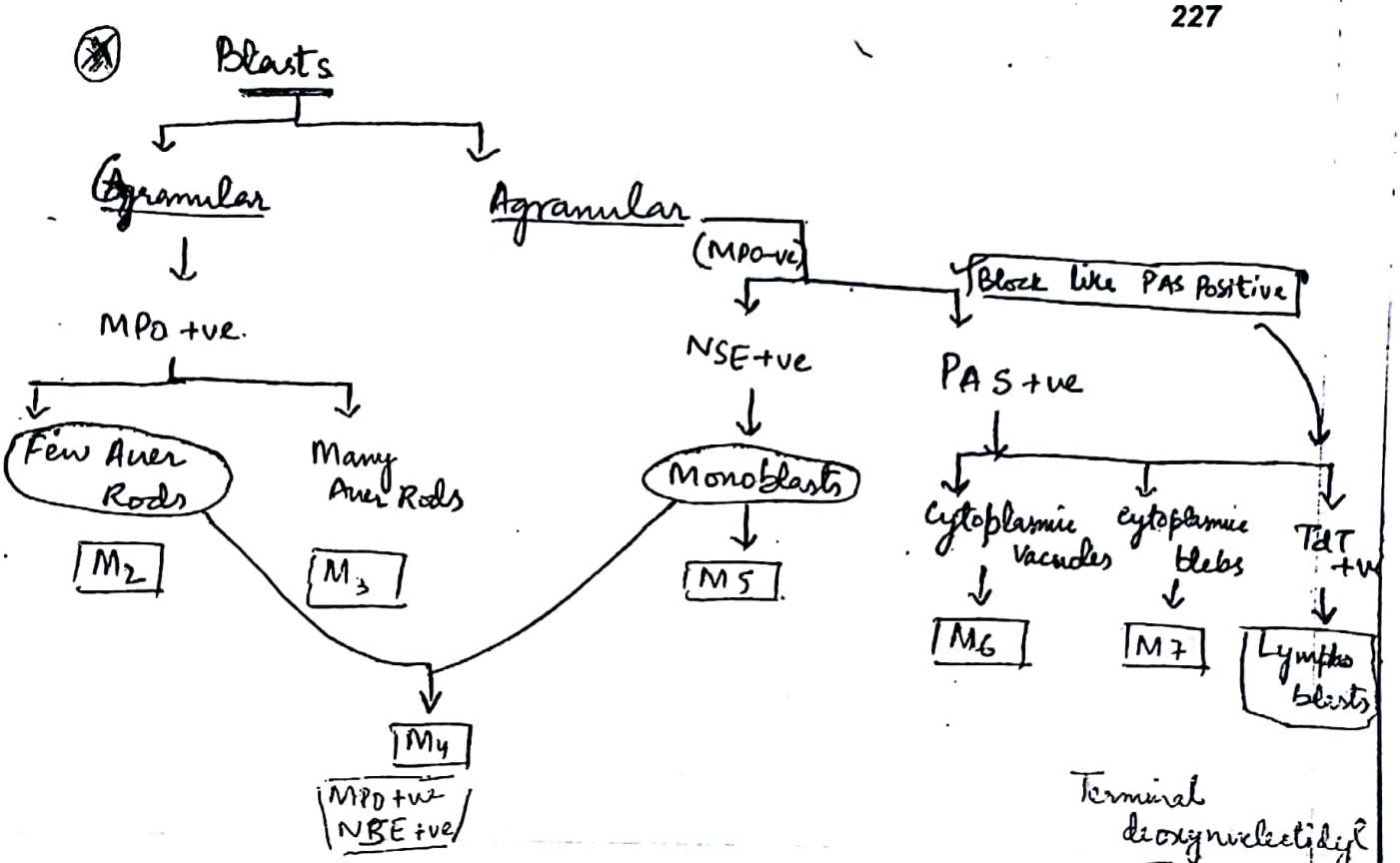
→ Nuclear creases/folds/Indentation.

Monoblast (NSE +ve)

✓ M4 = MPO + NSE +ve.

✓ M5 = NSE +ve

Myeloblast → Auer Rods



MYELOPROLIFERATIVE NEOPLASMS (MPNs)

Origin - Hematopoietic cells (stem cells)/Progenitor cells

PANMYELOSIS
- ALL
- Myeloid cells

with ⇒ GRANULOCYTE DOMINANCE

⇓

Chronic Myeloid Leukemia (CML)

t (9; 22) = fusion of BCR - ABL 1 on Chr 22 ⇓ Philadelphia Chr.

(Tyrosine kinase)

⇒ Variable excess of BCR may fuse with a fixed sequence of ABL1

(i) Major BCR (M-BCR) + ABL 1 = 210 KD = P210 ✓CML

(ii) Minor BCR (m-BCR) + ABL1 = 190 KD = P190 ✓ALL

⇓

Unregulated Tyrosine Kinase ⇓ Using TYROSINE KINASE

(#) AML can have both (P210 & P190) WHO 2017

In CML Chronic phase

TLC ↑ → Differential C. ⇒ Marrow preferable over blood

- Myelocyte peak
- Neutrophil peak
- Blasts < 2%
- Basophilia
- Eosinophilia +/−

→ Garden Party Appearance

→ College Girl Appearance

Additional cytogenetic changes

⇓

Progression to Accelerated Phase

↑ TLC → Differential C.

Blasts 10–19% (marrow > blood)

Basophilia > 20% (blood)

Thrombocytosis / Thrombocytopenia

↑↑ig Splenomegaly.

Unresponsiveness to Tyrosine Kinase Inhibitors (WHO 2017)

⇓

Additional Genetic changes.

⇓

Blast Crisis

Blasts ≥ 20% (marrow > Blood) OR Extra medullary Blast Proliferation (Skin, CNS)

75% (Myeloid) Blasts

25% (Lymphoid) Blasts

RT PCR → To monitor response to treatment & to followup

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

⇒ Neutrophil Alkaline Phosphatase (NAP)
(Leukocyte ALP)

NAP → Number – ↑ses (Leukemoid reaction)
→ Function – ↓ses (CML)

2. Erythrocyte Dominance :- Polycythemia vera

[redacted]

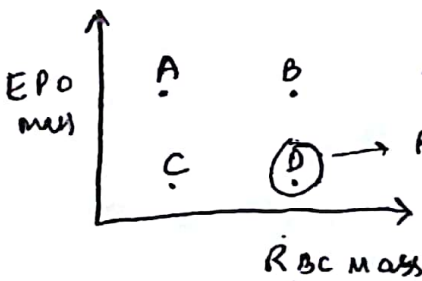
Epo (erythropoietin)
↓
EPO receptor
↓
JAK2 (JANUS KINASE) (Non receptor kinase Tyrosin kinase)
↓
Nucleus
↓
Erythrocyte formation & proliferation.

Unrequired & Unregulated Erythropoiesis
↓
- RBC mass ↑
- Hb > 16.5 g/dl (M)
  > 16.0 g/dl (F)
- Hematocrit
  > 49 % (M)
  > 48 % (F)

Polycythemia vera → JAK 2 → Activating Point Mutation
Essential thr.
Myelofibrosis
↓↓
Proto oncogene
↓
Oncogene
↓↓
Unrequired & Unregulated Erythropoiesis
↓
POLYCYTHEMIA VERA

Biopsy - Erythroid hyperplasia
-EPO Level = Normal/Subnormal

[redacted]
↓↓
At 617th position
Valine → Phenylalanine



↑ Risk of thrombosis ⇒ Budd Chiari Syndrome
Platelet function defects may be present → Bleeding manifestation

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

③ Essential Thrombocytosis / Thrombocythemia
(Megakaryocyte dominance)

Platelet count > 450 x 10^9/L

Biopsy ⇒ Mature enlarged Megakaryocytes

Genes – JAK2 (40%)
MPL } (WHO 2017)
CALR }

↑ Thrombosis (+)

Thrombopoietin
Thrombopoietin Receptor
JAK2
Activating point mutation (JAK2 V617F) 40%
Thrombopoietin
Bone Marrow Aspirate & Biopsy indicated
Essential Thrombocytosis.

④ Primary Myelofibrosis

De novo Marrow Collagen deposition

Panmyelosis ⟶ Atypical Megakaryocytes
(JAK2, MPL, CALR)

↓
TGF β, PDGF ⇒ Fibrosis

– Tear Drop cells / Dacrocytes (distorted RBCs)

↓ cellularity in marrow

⇒ Extra Medullary Hematopoiesis (EMH)

– Precursors of RBCs & Granulocytes.

Erythroblasts, Leucoblasts } Leuco Erythro Blastic Reaction (LEBR) ⇒ Myelofibrosis

Biopsy is diagnostic
↳ Aspirate is Dry tap

Demonstrate fibrosis (Retics)
↳ Reticulin Stain (Silver → Black)

AML ⇄ Myelofibrosis

Biopsy indicated

Visualize Reticulate fibers
(Fibrosis of liver)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Myelofibrosis secondary to some inciting events

↓

Myelophthisic Anemia.

→ Metastatic Carcinoma
→ Storage disorders
→ Granulomatous Inflammation
→ Radiotherapy/Chemotherapy.

MYELODYSPLASTIC SYNDROME

Disordered growth in marrow ⟶ Cytopenia in blood.

At least 10% of the cells of a series should have dysplasia to call it significant.

MDS can occur in a single lineage ⇒ Single Lineage Dysplasia (MDS-SL)

or Multi lineage ⇒ (MDS-ML)

[MDS with ring sideroblasts
MDS with excess blasts.]

	Blood cytopenia	Bone marrow dysplasia	Ringed Sideroblasts	Blasts in marrow.
MDS-SL	Uni/Bi cytopenia	One cell line	<15%	<5% (No Auer Rod cells)
MDS-ML	Uni to Pancytopenia	More than one cell line	<15%	<5% (No A.R. cells)
MDS-(RS) Ring Sideroblasts SL	Uni cytopenia	One or two cell lines	>15%	<5% (No A.R. cells)
MDS-(RS) MLD	Uni to Pancytopenia	More than one cell line	>15%	<5% (No A.R. cells)
MDS-EB1 Excess blasts	Uni to Pancytopenia	One to three cells lines	None or any	5-9% (No A.R. cells)
MDS-EB2	Uni to Pancytopenia	One to three cell lines	None or any	10-19% Auer Rods

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Erythroid Dysplasia

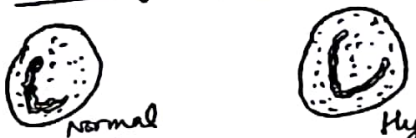
Perlie Stain

→ Prussian blue deposits (Iron laddon Mitochondria around the nucleus)

↓

Ring Sideroblasts

Granulocyte Dysplasia



Pelger Huet Anomaly :-

- Inherited condition
- Neutrophils are morphologically abnormal but functionally normal.

↓

Psedo Pelger Huet anomaly

Megakaryocyte Dysplasia

Large cell → Dysplastic Small cell
Single nucleus → Multinucleated
Multilobed → Hyper/Hypolobulated

⇒ Most significant Dysplasia for diagnosis of MDS.

- small megakaryocytes & multinucleation & Hypolobation

✓ Most common cytogenetic abnormality in MDS

In Adults
In Children
Overall
⇒ **Monosomy 7** (who 2017)

MDS/MPN

$>1 \times 10^9/L$ ± monocytosis ≥10% of all Leucocytes

- Chronic Myelomonocytic Leukemia (CMML) ⇒ Dysplasia ⇒ Proliferation
- Juvenile Myelomonocytic Leukemia (JMML)
- Atypical Chronic Myeloid Leukemia (ACML) (Philadelphia Chr. –ve)

New confirmed addition by WHO.
↳ MDS/MPN with ring sideroblasts and thrombocytosis

Lymphoid Neoplasms

HODGKIN LYMPHOMA

- Involves contiguous group of lymph nodes. (Contiguous → sharing common border)
- Almost always Nodal (Axial L.N.)
- Bimodal age distribution (young adults & old)
- Neoplastic cells <<< Non neoplastic cells (1:10 – 1:100)

HL ⇒ Classical R-S cells, Lacunar cells, Mononuclear cells, L&H cell.

NON HODGKIN LYMPHOMA

- Non Contiguous group of lymph Nodes
- Can be Nodal / Extranodal (Waldeyer's Ring, Mesenteric LN) commonly affected
- No specific age group.
- Almost all cells are neoplastic.

NHL

- B cell (more common)
  - Precursor → B-acute Lymphoblastic Leukemia/lymphoma
  - Peripheral/mature
- T/NK Cell
  - Precursor → T/NK-Acute Lymphoblastic Leukemia/lymphoma
  - Peripheral/Mature

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Acute lymphoblastic Leukemia/lymphoma

Most common Cancer in children

B-ALL

- Children
- Leukemia (↑ Tendency)

T-ALL

- Adults
- Lymphoma (↑ tendency)
- Thymic mass → SVC obstruction

Also seen with
- small cell CA.
- Hodgkin Lymphoma

Lymphoblast

Large cell
↑ N:C ratio
Less/no prominent Nucleoli
Scanty cytoplasm
Agranular
Block like PAS +vity

Prognosis of ALL

Unfavourable

<1yr, >10yrs
CNS involvement
Testicular involvement
Male
T. phenotype
t (9;22) (P190)
11q23 MLL gene
Hypoploidy (<45 chr)

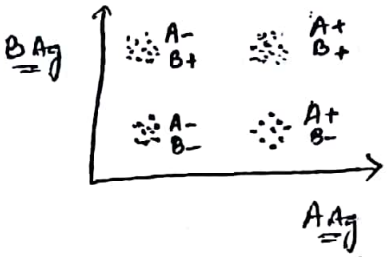
Favourable

2-9 years
Absent
Female
B phenotype
t 12;21
RUNX1
Hyperploidy (>47 chr.)

Priority for ALL prognosis

1. – Response to treatment (steroids)
2. – Cytogenetics – Polidy
   – Translocations
3. – Clinical features.

Flowcytometry :→



Myeloid Markers :-

Myeloperoxidase (MPO) :- Lineage Specific marker for granulocyte

- CD 13, CD 33] :→ Seen in granulocytes + Monocytes (Myeloid Lineage marker)
- CD 11c, CD 14, CD 64] :→ Monocytic markers.
- CD 71, CD 235] :→ Erythrocytic markers
- CD 41, CD 61] :→ Megakaryocytic markers.

Lymphoid Markers :-

T cell

- CD 1a → Thymocytes, Langerhan cells
- CD 2 → Almost all T cells
- CD 3 → Part of T receptor (more diagnostic)
- CD 4 → Helper T cell.
- [illegible] T, B1 + Subset of B cells

Pan T cells: 2, 3, 7

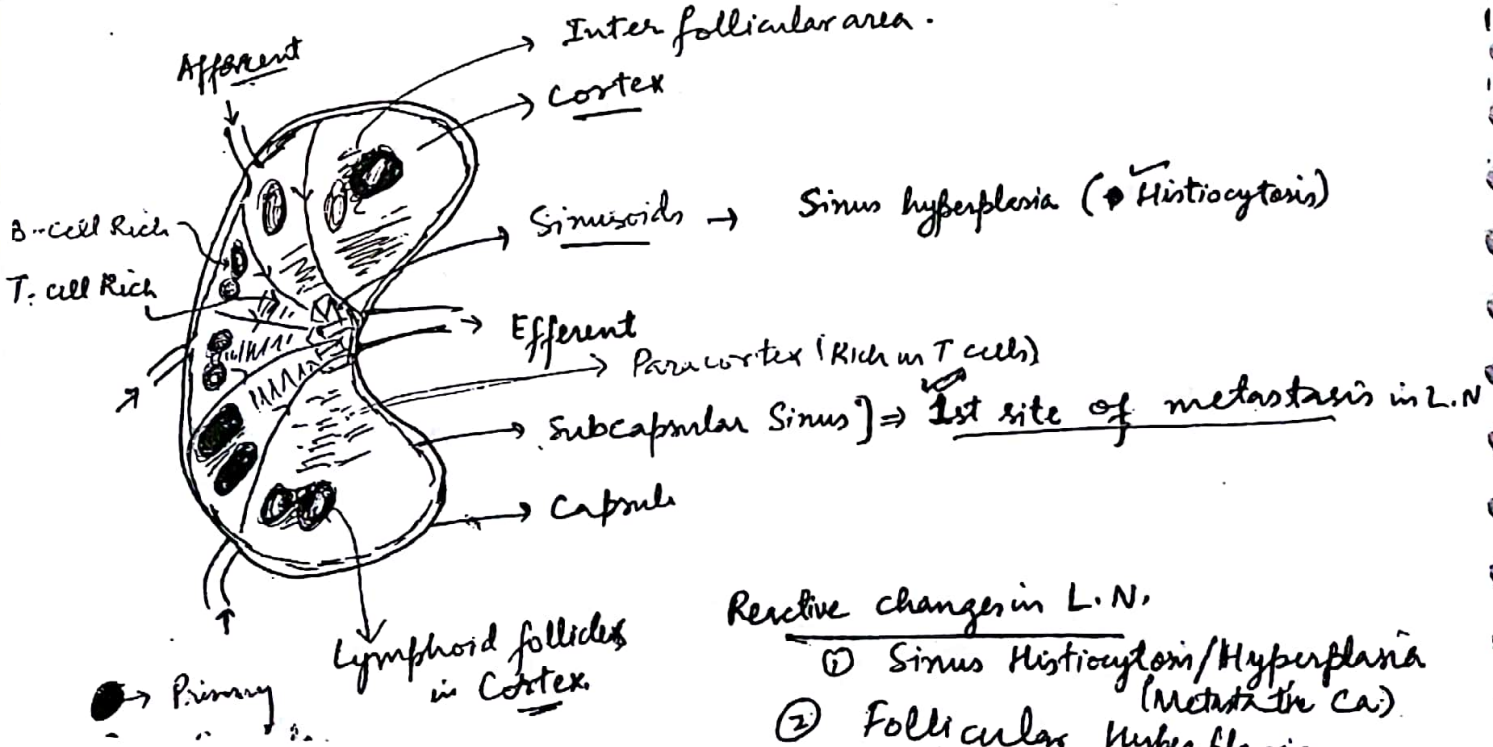
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

B. cell markers

- ✓ CD19 → Lineage specific and consistently expressed.
- CD20 → Marker of choice for B cell lymphomas (Mature)
- ✓ CD21 → EBV receptor
- CD23 → Activated B cells
- CD79a → Almost all B cells
- ✓ PAX 5 → B cell trancription factor. (PAIR)
  (New marker)
  [♡ → First love of B cell: PAX 5]

Miscellaneous markers

- CD34 :- Hematopoietic stem cells + Progenitors
- HLA DR : Blasts (immaturity)
- CD10 : Precursor B cell + T cells
  ⟸ Germinal centre - B cells
- CD15 - Mature granulocytes



Reactive changes in L.N.

1. Sinus Histiocytosis/Hyperplasia (Metastatic Ca.)
2. Follicular Hyperplasia

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Follicular hyperplasia – Humoral immunity requirement ↑↑

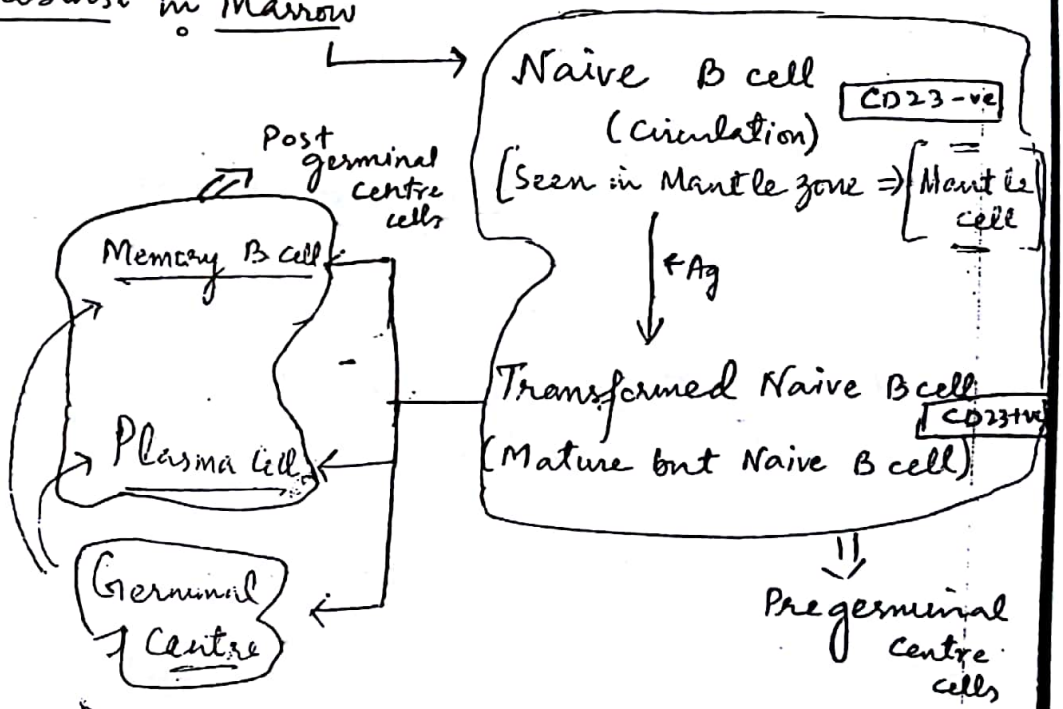
Paracortical hyperplasia – ↑ T cell mediated immunity
↳ Infected B cells but increases T cells.

⇒ Plasmal cells and Histiocytes are formed in Medulla.

Primary Follicle

Secondary Follicle

B Lymphoblast in Marrow



Pre Germinal centre	Germinal centre	Post Germinal centre
Mantle cell lymphoma (CD23-ve)	Burkitt lymphoma	Marginal zone lymphoma
Chronic lymphocytic lymphoma/Leukemia (CD23+ve)	Follicular lymphoma	Plasma cell neoplasm
	Diffused Large B cell lymphoma (DLBCL)	Lymphoplasmacytic Lymphomas (LPL)
		CLL
		DLBCL
CD5+ve, CD10-ve	CD10+ve, CD5-ve	CD5-ve, CD10-ve

(1) Mantle cell lymphoma

Elderly

Nodal & Extranodal

↓

GIT - Polyploidal appearance.

May be high grade - (small cells & cleaved Nucleus)

t(11;14)

→ IgH (Heavy chain Ig) (Promoter)

→ Cyclin D1 (cell cycle regulator which pushes the cell cycle forward)

↓

Overexpressed (IHC)

New marker for cyclin D1 Negative MCL

→ [redacted] May AHMS17

SOX 11

IHC

- CD20 +ve
- CD79a +ve
- CD5 +ve
- CD23 -ve
- CD10 -ve
- Cyclin D1 +ve

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

(2) Chronic Lymphocytic Leukemia
Small Lymphocytic Lymphoma (CLL/SLL)

Small cell — Resembling small lymphocyte
Non cleaved
Low grade

→ Coarse clumped Chromatin
→ Scanty cytoplasm.

"Soccer ball appearance"

- CLL is most common Leukemia in adults
- Almost exclusively in the elderly

Peripheral Blood :- Uniform monotonous population
[Convent School Girl appearance]

Tumor cells have very less **Vimentin**
(Intermediate filament of cytoplasm)
↓
Become fragile
↓
Making a smear disrupt easily.
↓

→ Smudge cells / Basket cells

Lymph Node Histology

Diffused effacement of LN architecture (No demarcation between cortex & medulla seen) Most common Pattern

Pro lymphocyte (another type of tumor cell)

(Rapidly multiplying cell)
↳ enough cytoplasm.
Thus lighter staining.

→ Proliferation centres (Pseudo follicular pattern)
Most Pathognomonic pattern of CLL
⇒ More the proliferation centres Poor the prognosis (Pleomorphic)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Most common cytogenetic Change

50% – Deletion 13q

20% – Trisomy 12 (47 XX +12)

New marker for CLL – LEF1

	MCL	CLL
Nuclear	+	+
CD5	+	+
CD23	–	+
CD20	+	+
cyclin	+	–

Best marker to differentiate b/w MCL & CLL → CD23

(3) Follicular Lymphoma

Nodal >> Extranodal

Most common NHL in western hemisphere

Dual population.

Multiple peripheral Nucleoli

Centroblast

Cleaved Nuclei

Centrocyte

WHO grading of FL = No. of centroblasts per high power field.

gr I < 5

gr II 6-15

gr III >15

t (14 ; 18)
↓ ↳ BCL2 (anti apoptotic)
IgH ⇓
(Promotor) over expression (1yc)

⇒ Back to back closely packed follicles with very little interfollicular space.

To differentiate from follicular hyperplasia
↳ BCL2 is the marker of choice
⇓
+ve in germinal centres of follicular lymphoma & -ve in germinal centre of follicular hyperplasia

BCL2 is normally expressed in mantle zone.

IHC
CD 20 +
CD 79a +
CD5 -
CD10 +
BCL6 (germinal center) +
BCL2 +

(4) Burkitt Lymphoma
↳ Extranodal >>> Nodal
↳ EBV +ve

Types
- Endemic (African continent) — most common site is Jaw
- Sporadic — most common site Ileocecum
- Immunodeficiency associated (HIV) — most common site - CNS, GIT

↳ 8 = B
↓
Chr. No 8.
"C myc" Transcription factor
⇒ t(8;14)
↳ IgH ⇒ Kappa (κ) Chr 2 t(2;8)
Lambda (L) Chr 22 (t(8;22))

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

To assess proliferation of tumor cells – marker used is

Ki-67 (Mib-1)
(% of cells expressed)

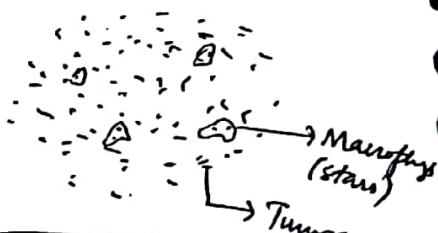
Lymphomas
- <40% – low grade
- >40% – Highgrade

[different cut offs for different tumors]

Ki 67 in Burkitt lymphoma ≃ 100%

i.e; rapidly proliferating & rapidly dying cells

High Mitotic Index ⟹



Starry sky appearance

IHC
- CD 20 – +ve
- CD 79a +ve
- CD 5 – -ve
- CD 10 +ve
- BCL6 +ve
- BCL2 – -ve
- ~~Translocation~~ Cmyc +ve

Also seen in
- ALL
- BLBCL
- Variants of MCL
- Reactive lymph nodes.

New marker is [redacted] who 2017

(6) DLBCL (Diffused Large B Cell Lymphoma)

- Diffused effacement of architecture
- Nuclei of tumor cell is 3x – 5x that of normal lymphocyte nucleus

Most common NHL worldwide

↳ Molecularly heterogenous.

* Most common Ca arising in HIV patients

	Frequency
BCL6 rearrangent	
BCL2 rearrangent	
Cmyc rearrangent	

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

DLBCL is high grade lymphoma.

Large cell

Histological variants — Centroblastic
Immunoblastic
Plasmoblastic → Most common in Immunodeficiency.

IHC

CD20 +ve
CD79a +ve
CD5 −ve
CD10 +ve
CmyC +/−
BCL2 +/−
BCL6 +ve.

Ki 67 > 40% (not as high as Burkitt)

Low grade Small cell Lymphoma → (can transform) → High grade Large cell Lymphoma

⇓

Richter transformation

(6) Marginal Zone Lymphoma

⇒ Diagnosis of exclusion
(CD5−, CD10−) (CD43 +ve)

⇓

NODAL & Extranodal ⇒ MALToma

⇓

Chronic inflammatory states
- Sjogren's Syndrome
- Hashimoto thyroiditis
- H. Pylori Gastritis
(regression of MALToma on treating H.Pylori)

New marker for Marginal zone lymphoma

⇓

IRTA 1
MNDA.

MALT (Mucosal-associated lymphatic tissue)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

(7) Lymphoplasmacytic Lymphomas

Commonly associated with Hepc.

- Lymphocytes
- Plasmacells

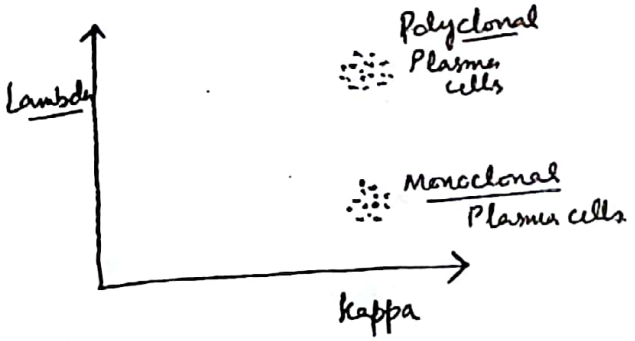
LPL in CNS ⊆ WM
⇓
Bing Neel Syndrome

IgM ⟶ forming pentamers
↑ Viscosity in blood
⇓
Waldenstorm's Macroglobulinemia (WM)
⇓
Hyperviscosity

JIPMER 247

(8) Plasma Cell Neoplasms

Clonal plasma cells ⟶ Abnormal Immunoglobulins + Excess of Light chains
⇓
Monoclonal Proteins (M-Proteins)



Deletion 13q

Monoclonal Gammopathy of Uncertain Significance (MGUS)

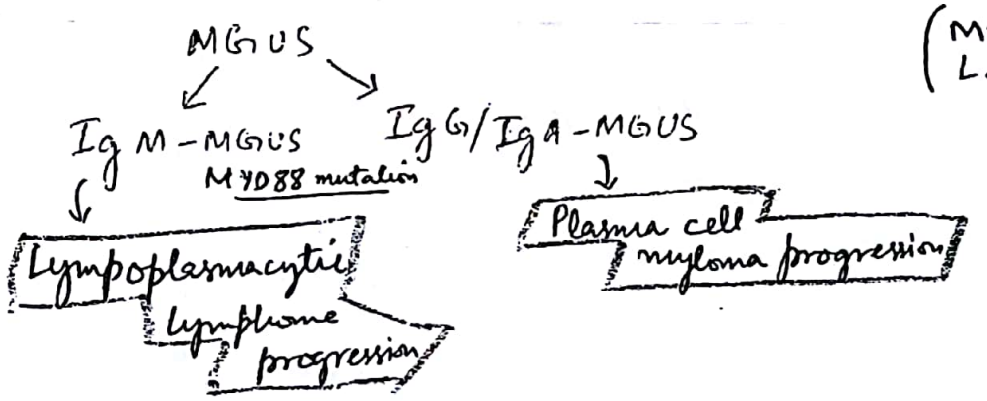
Heavy chain disease
↓
Rare monoclonal gammopathy
Occurs in malnourished population
A/K/A ↳ Mediterranean Lymphoma.

Smoldering Myeloma

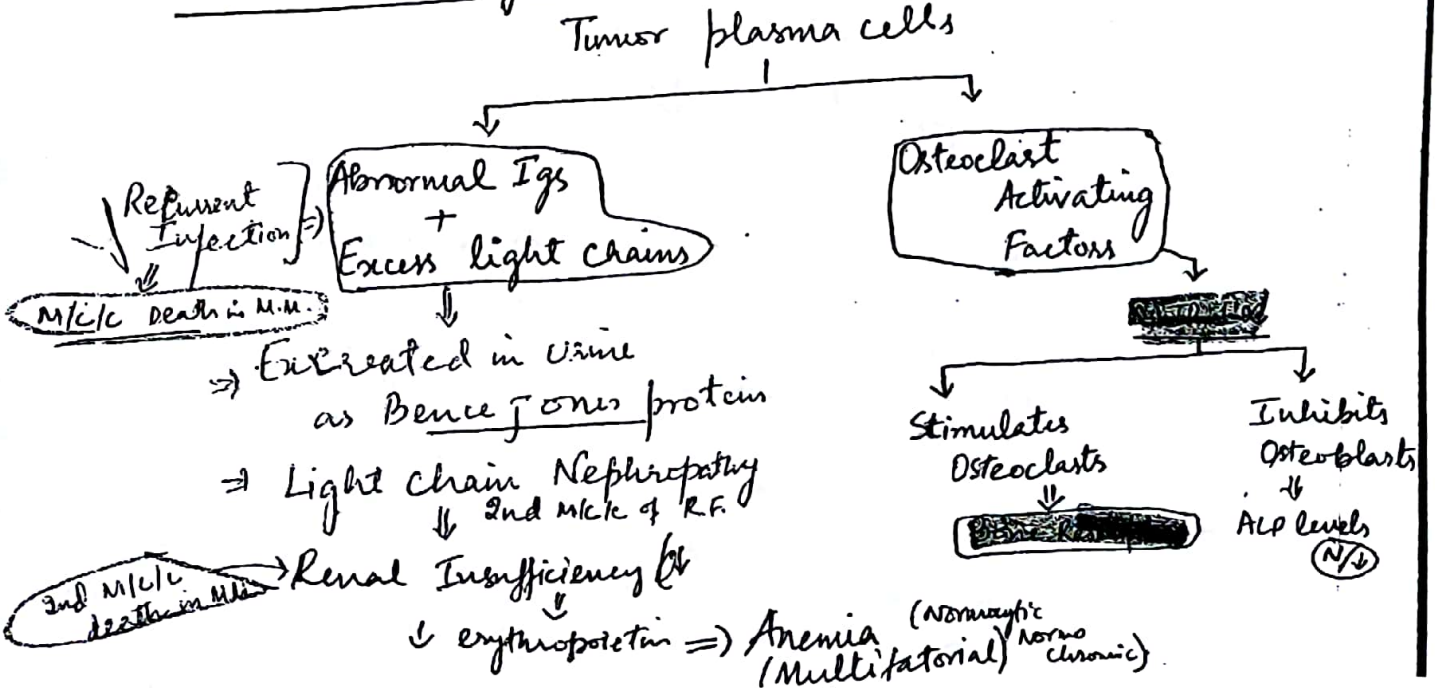
Plasma cell Myeloma

	Monoclonal Gammopathy of Uncertain Significance (MGUS)	Smoldering Myeloma	Plasma cell Myeloma
M-protein (g/dl)	< 3	≥ 3	≥ 3
Bone marrow clonal plasma cell (%)	< 10%	≥ 10%	≥ 10%
Symptoms	Absent	Absent	Present

MGUS → Premalignant condition.



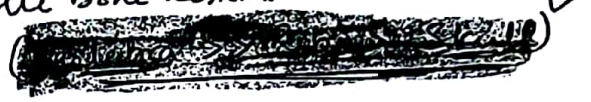
Plasma cell Myeloma



Bone resorption

Hypercalcemia → Most common Cause of Renal failure in Multiple Myeloma.

Blanched out Lytic bone lesion



CRAB Symptoms of M.M.
- Hypercalcemia
- Renal insufficiency
- Anemia
- Bone Resorption/lesion

Tumor plasma cells → IL-6 → Survival, proliferation & level correlate with disease activity.

Symptoms of P.C. Myeloma

> 20% of Plasma cells in peripheral blood

⇓

Plasma cell leukemia

How to Diagnose Multiple Myeloma As Per 2014 — IMWG Criteria

1st → Look for >10% clonal plasma cells in bone marrow or biopsy proven plasmocytoma (either bony or extramedullary)

2nd → Any of the myeloma defining events.

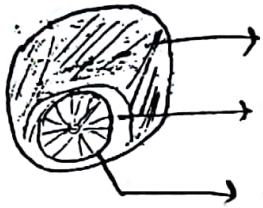
End Organ Damage (CRAB)
- Hypercalcemia
- Renal Insufficiency
- Anemia
- Bone lesions

Any one or more of malignancy biomarkers
1) >60% of plasma cells in Bone marrow.
2) Involved/uninvolved Serum free light chain ratio ≥100
3) >1 focal lesion on MRI (>5 mm)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

In Multiple Myeloma order of frequency of Ig secreated

⇒ Ig G (50%).
Ig A (20%)
Ig D
Ig E
Ig M



Globular inclusions
⇓
Mott cell/Grape cell

Intra Nuclear inclusion
⇓
Dutcher Body

Intra cytoplasmic
⇓
Russell Body

common

Malignant plasma cells are ⇒ Binucleate/ Multinucleate
⇒ Have Inclusions

Most common cytogentic abnormality associated is
Rearrangements of 14q (IgH)

Most common gene involved is cyclin D1

Drugs used ⇒ Ibrutinib
Rituximab.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

(9) Mature T cell lymphomas

1. Mycoses Fungoides (Most common cutaneous T cell Lymphoma)

↓

Leukemia when developed is called [redacted]

CD4+

→ Cerebriform Nuclei

(Tumefaction of skin Lesions)

SEZARY LUTZNER Cell → Invade epidermis & form [redacted]

(10) Adult T cell Lymphoma/Leukemia

Caused by HTLV-1

→ Flower shaped/cloverleaf shaped Nuclei

(11) Anaplastic Large cell Lymphoma

ALK positive

↳ Anaplastic Lymphoma Kinase (Receptor tyrosine kinase)

T cell lymphoma

Rearranged in

- ALCL
- Lung Adenocarcinoma
- Inflammatory Myofibroblastic tumor ~~AIIMS~~ AIIMS

Mutated in

- Neuroblastoma
- Hereditary hemorrhagic telengiectasia II (JIPMER)

6 "Hallmark cells"

Embryoid Nuclei

Horseshoe Shaped Nuclei

R.S like cells

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

HODGKIN Lymphoma

- Involves Contiguous group of LN.
- Almost always Nodal —— Most common is cervical group. (Axial)
- Bimodal age
- Neoplastic cells LL Non neoplastic cells

ASSOCIATED WITH EBV

RS cells + Mixed infl. cells

Classical (CHL) [EBV+ve]

Nodular Lymphocyte Predominant HL (NLPHL) [EBV-ve] → Best prognosis of all HL

Nodular sclerosis	Mixed cellularity	Lymphocyte depleted	Lymphocyte Rich
M = F	M > F	M > F	
Mediastinal Lymphnodes		Strongest Association b/w EBV & HIV	
Most common subtype overall	Most common Subtype in India	Worst Prognosis	
Least associated b/w EBV (5-10%)	Most common in HIV		
Best prognosis in classical HL	Most common in EBV HL		

CD15, CD30 — Classical markers for HL.

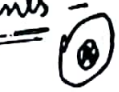
→ Large/giant cell
Binucleate
Prominent macronucleoli

Owl's eye appearance

origin - germinal centre B cells

Size - 45 μm

Variants – Mononuclear cell/ Hodgkin cell.



- Lacunar cell → Nodular Sclerosis

- Popcorn cell / LP cell / L & H cell

NLPHL

	RS cell	LP cell
CD45 (Leucocyte common Ag)	–	+
CD20	–	+
CD10	–	+
BCL6	–	+
CD30	+ 100%	–
CD15	+ 75-85%	–
PAX 5	Weakly +ve 95%	Strongly +ve

Hairy cell Leukemia

- Tumor cells resemble the features of memory B cells.
- Mutation has been identified in the hematopoietic stem cells.

→ Signal transduction protein

→ Both position Val → Glutamate

Also seen in - Langerhan cell histiocytosis
- Pilocytic Astrocytoma
- Papillary Carcinoma Thyroid
- Malignant Melanoma

BRAF inhibitor
↳ VEMURAFINIB

Hairy cells (frayed borders)

Im marrow → Individual cell fibrosis

→ Fried egg appearance → also seen in Oligodendroma Mycoplasma c.

Aspirate - Dry Tap

Biopsy - Diagnostic

- Also infiltrates Spleen → Splenomegaly (involves Red pulp)
- Pancytopenia
- Tumor cells stain positive for acid phosphatase
  ↓
  wash them with tartarate
  ↓
  Stain is retained.

Tartarate Resistant Acid Phosphatase (TRAP) +ve ⇐

Associations
- Monocytopenia ⇒ Used Risk of Infection with atypical Mycobacterium
- Erythema nodosum
- Polyarthritis Nodosa

IHC ✓ Annexin A1 most specific marker

CD 11c
CD 103
CD 25

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Langerhan Cell Histiocytosis

- Tumor of Immature Dendritic cells (Langerhan's cells)
- [redacted] mutation
- Clinically

Unisystem

Unifocal
- Eosinophilic granuloma

Multifocal
- Calvarial bone defects
- Exophthalmos
- Diabetes Insipidus

→ Hand Schuller Christian Trad

Multisystem
- Cutaneous
- Hepatic
- Splenic
- Pulmonary

→ Letterer Siwe Disease

Histology

Coffee Bean Nuclei (Longitudinal groove)

- Langerhan cells
- Eosinophil.

Also found in
- Granulosa cell tumor
- Brenner tumor
- Papillary Ca. Thyroid
- Chondroblastoma

Electron Microscopy

Pentalaminar Crystalline Structures with fusiform dilatation (Tennis Racquet appearance)

⇒ Most specific marker ⇒ LANGERIN (CD 207)

⇒ Birbeck Granules

Pulmonary LCH

- Neoplastic → BRAF V600E
- Reactive → Smoking → Cessation of smoking causes regression of disease

IH

CD 1a

S-100 → Neuroectodermal marker

HLA-DR

- Malignant Melanoma
- Schwannoma
- Lipoma / Liposarcoma
- Sustentacular cells of pheochromocytoma.

RBC Disorders

Anemia

Means Absence → Blood

↓ sed O_2 Carrying Capacity

Reflected on red Hb

- Too little production → Aplastic anemia; Nutritional deficiency
- Too much Destruction → Hemolytic anemia
- Blood loss. → Acute; Chronic

Hemolytic Anemia

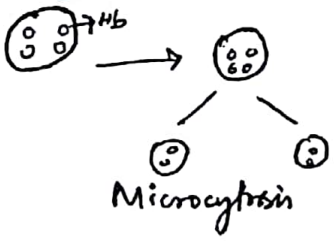
Protoporphyrin → Heme → Hemoglobin

- Protoporphyrin: Sideroblastic anemia
- Fe: -Iron deficiency -Anemia of Chronic disease
- Globin: -Thalassemia

Microcytic anemia

⇓

Defective in formation of Hb.



Reticulocyte :- Immature RBC with retained RNA due to improper enucleation & maturation

→ Polychromatophilic cell seen as routine peripheral smear

→ Purplish due to bluish staining of RNA.

On Supravital Stain → Reticulocytes meshwork/ reticulum of blue deposits of RNA

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Routine - Polychromatophilic

Supravital : Reticulocyte
- → New methylene blue
- → Brilliant cresyl blue
- → Crystal violet

Reticulocytosis → Marrow is normally functioning
→ Marrow is in hurry.

Normal Retic count = 0.5 - 1.5%

Hemolytic Anemia

↑sed RBC destruction

~~Extrinsic~~

Intrinsically wrong ~ RBC
↓
or There is Intracorpuscular defect.
⇓
Extravascular Hemolysis
↳ Spleenomegaly.

Extrinsically wrong ~ RBC
↓
or There is Extracorpuscular defect.
⇓
Intravascular Hemolysis

Lab findings

Signs of ↑sed defect/destruction
- Hemoglobinemia / uria
- ↑sed Indirect Bilirubin
- ↑sed LDH
- → ↓sed Haptoglobulin

Signs of compensatory production
- Reticulocytosis
- Bone marrow hyperplasia

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Hereditary Spherocytosis

Defect in membrane proteins

- **Integral**
  - Glycophorin (CD235) — Almost never involved in H.S
  - Band 3 (most abundant Integral glycoprotein)
- **Peripheral**
  - ⇒ Ankyrin – Most common def.
  - ⇒ Spectrin – most severe def. — Responsible for biconcave shape of RBC
  - ⇒ Protein 4.1
  - ⇒ Protein 4.2 (Palladin)

Most common inheritence is Autosomal Dominant.

Loss of Surface area → Spherical Shape → Splenic macrophagic destruction of RBC formed

↓ Mean corpuscular Hb Conc. (MCHC)

Less deformable

⇒ Osmotically ~~fragile~~ more fragile.

⇒ RBCs without any central pallor
↳ Characteristic feature of Spherocytes

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Paroxysmal Nocturnal Hemoglobinuria (PNH)

- Episodic
- Intravascular hemolysis

Decreased pH in body during night activates complement.

⇓

Acquired genetic defect

PIGA gene

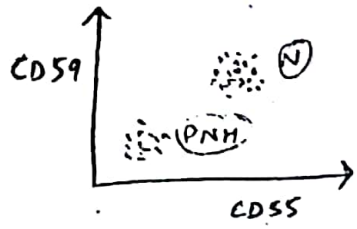
GPI anchored proteins

⇓

(Protect cells from complement mediated damage)

GPI anchored Proteins

- Membrane Inhibitor of Reactive lysis (MIRL) (CD59) — Most common & important
- Reactive Decay Accelerating Factor (DAF) (CD55)
- C8 binding protein



Triad of:

- Hemolytic anemia
- # Pancytopenia
- # Thrombosis (50%) – common cause of Death. (Multifactorial)

5-10% ⇒ Progress to AML/MDS

Stem cell Transplant ⇓ Treated

Diagnosis
- Ham's test
- Sucrose lysis test
- Flowcytometry ⇒ Best technique

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

G-6 PD Deficiency

HMP Shunt ⟶ Detoxify H_2O_2

In G6PD deficiency → when there is oxidative damage
↓
H_2O_2 is not detoxified
↓
Free radical damage to Sulfhydryl groups of Hb.
↓
Denaturation of Hb
↓
HEINZ Body
↓
Can be visualized on (Supravital Stain)

→ Denatured Hb doesn't take other stains.
← When stained Routinely

Heinz body → capable of damaging the membrane
↓
EV Hemolysis
without membrane damage - IV Hemolysis

G6PD deficiency → X linked recessive
Males full expression
Females - Carriers.

Oxident damage

Infections
Drugs
(Fava beans)

- Antimalarials
- Dapsone
- Co-trimoxazole
- Nitrofurantoin

(cDNA)

Adult Hb

HbA	$\alpha_2\beta_2$	96%
HbA_2	$\alpha_2\delta_2$	3%
Hb F	$\alpha_2\gamma_2$	1%

⇒ α is coded by a pair of genes on chr. 16 ✓
⇒ β is coded by a single gene on chr. 11. ✓

Sickle cell Anemia

Glutamate changes to valine at 6th position of β globin chain
↓
Hb becomes sticky.

In reduced state → the stickiness of Hb causes polymerization
↓
HbS polymers distort the shape of RBC

O → Sickle cell Drepanocyte

↓ Fragile
↓
Hemolysis

↓ Can cause microvascular occlusion
↓
Hypoxia → Ischemia
↓
Tissue damage.

If there is repeated occlusion in splenic tissue,
↓
Repeated cycles of damage & fibrosis
↓
Autosplenectomy → ↑ risk of infection by encapsulated organism

Autosomal Recessive

$\frac{\beta\beta}{N}$

$\beta^S\beta \rightarrow \alpha_2\beta_2 =$ HbA → Interferes ∵ polymerization of HbS.
↖ $\alpha_2\beta^S$ ↗ Heterozygous
↓
Sickle cell trait

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

$\beta^S\beta^S \Rightarrow \alpha_2\beta^S_2$ – HbS Homozygous condition

Diagnosis

Hb Electrophoresis]– Qualitative

High performance liquid chromatography [HPLC]

↳ Quantitative & Qualitative

Sickling test

Na Meta bisulphite is used.

or Na dithionate

THALASSEMIA

α or β thalasemia (α↓ or β↓)

↓ globin production → Microcytic cells

If α ↓ ⇒ β↑, δ↑, γ↑

β ↓ ⇒ α↑

Thus getting Excess unpaired chains

↓

form tetramers

↓

Precipitate ⇒ Hemolysis

β↑ ⇒ β_4 – HbH (Golf ball Inclusions)

γ↑ ⇒ γ_4 – Hb Bart's

α thalasemia

Most common Genetic Change ⇒ Deletions

αα | αα → (N)

αα | α– → ¼ deletion | silent carriers

αα | –– → | 2/4 deletion α thal. trait

or

α– | α–

α– | –– → ¾ HbH disease

–– | –– → 4/4 deletion ⇒ Hydrops fetalis

β thalasemia

Clinically → Major, Intermedia, Minor

β - Genetic Changes

β - (N)

β^+ - Reduced production of β] ⇒ Splicing mutations

β^0 - Absent production of β] ⇒ Chain Termination mutation

When both alleles are mutated → Homozygous (Major)

When only one allele is mutated → Heterozygous (Minor)

Major	Minor
- Severe anemia	- Mild to moderate anemia
- Dependence on blood transfusion.	- No history of blood transfusion
Target cell +ve Microcytic cell	- Target cell +ve Microcytic cell
⇒ Considerable amount of anisocytosis & reticulocytosis	⇒ Uniformly microcytic so no anisocytosis

Target cell OR CODOCYTE

Microcytic cell

Anisocytosis ⇒ Variation of Size

↓ Absence

Poikilocytosis ⇒ Variation of Shape

RDW - Red cell Distribution width

Range over which RBCs are distributed.

→ Anisocytosis confirmation by RDW.

β thal. Minor

At least on allele is functional (β)

Mild reduction in β

↓

Mild excess of (α) → binds ε ζ

β thal major

Both alleles are affected

Severe reduction in β

Severe excess of (α) → binds more ε ζ → HbF ↑

& ζ also → HbA2 ↑

HPLC – Quick Interaction

	HbA	HbA2	HbF	Additional.
Normal	~96%	< 3.5%	< 1%	–
β thal. Trait	< 96%	3.5-9%	Normal or ↑sed	←
β thal Major	~ 3%	Variable	> 85%	–
Sickle Cell Trait	40-60%	~ 3.5%	Normal or Slightly ↑sed	HbS - 30-40%
Sickle cell Homozygous	Markedly Reduced	Slightly ↑ or Normal	5-25%	HbS - 70-90%

Autoimmune Hemolytic Anemia (AIHA)

↓

Auto antibodies targetted against RBC Ags

Warm Antibody type (IgG Antibodies Active at 37°C)

Primary (No clumping in PB Smear)

Secondary

- Autoimmune disorder ⇒ SLE
- Drugs
- Lymphoid Neoplasms ⇒ CLL

Cobid Agglutinin Type (IgM antibodies active below 37°C)

Acute (mycoplasmal Infection)(Infectious mononucleosis)

Chronic (Clumping is found in PBS)

Idiopathic

Lymphoid neoplasms.

Cold Hemolysin Type (IgG antibody active below 37°C)

→ Donath Landsteiner Ab.

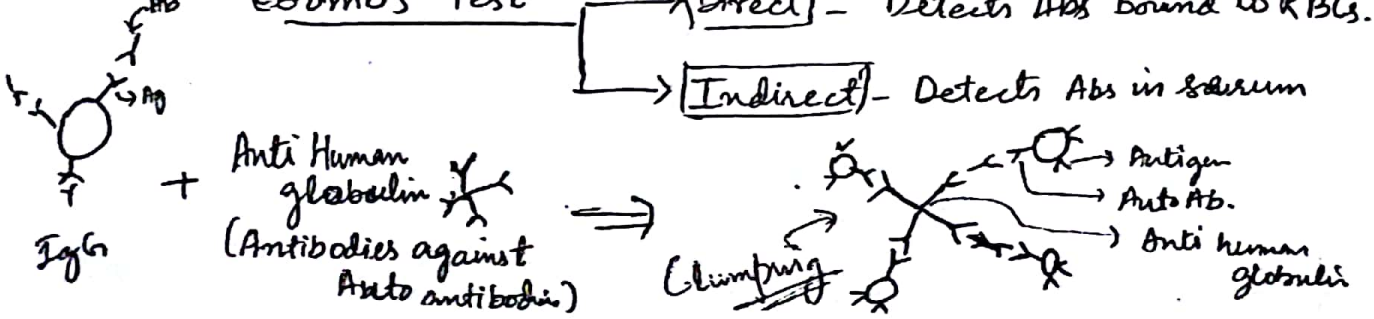
Rare; Occurs mainly in children following viral inf.

As RBC is covered with antibodies

- Compliment mediated membrane damage → IVH
  - ↓ Spherocytes
  - ↓ Most common cause is AIHA
- Splenic macrophages destroy them → ↓ EVH

Coomb's Test

- Direct – Detects Abs bound to RBCs.
- Indirect – Detects Abs in serum



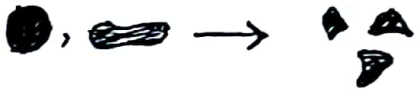
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Microangiopathic Hemolytic Anemia (MAHA)

↓ Small Vessel pathology

- In Vasculitis (SLE)
- DIC
- TTP/HUS

| Thrombi formation



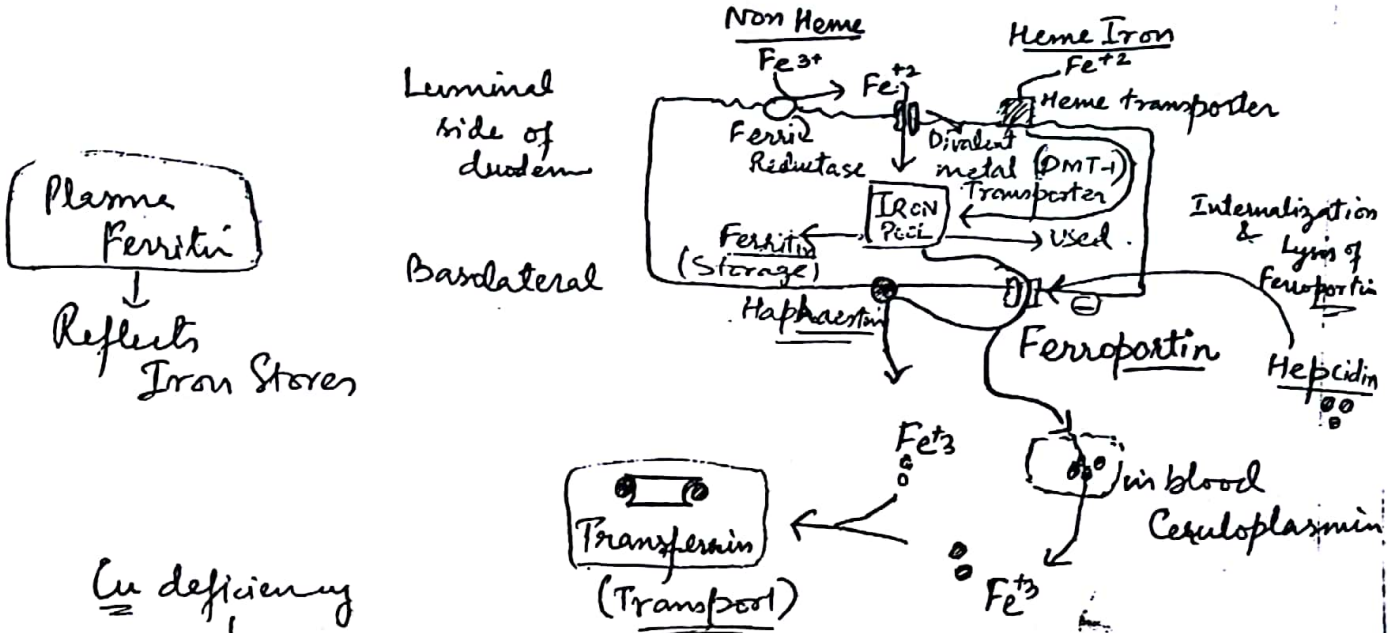
- Schistocytes
or
Schizocytes
or
Fragmented RBCs
or
Helmet Shaped

Macroangiopathic Hemolytic Anemia

⇓

Prosthetic valves
Coarctation of Aorta

Iron Absorption



Cu deficiency
↓
can also lead to
Iron deficiency
As Haphaestin is ⇒

Hepcidin
↳ ↓ing the exit of Iron from cell to blood.

TIBC ⇒ Reflection of Transferrin Production in body.

Transferrin % Saturation

Iron deficiency Anemia

- Earliest smear finding is: **Anisocytosis (RDWT)**
- After treatment first response: **Improvement of Mood**
  Sign is Reticulocytosis
  (↑se in Reticulocyte Hb)
- Pencil Shape cells +ve ↳ characteristic of Iron def. anemia

Megaloblastic Anemia :-

- It is a macrocytic anemia, but every macrocytic anemia is not a megaloblastic anemia

- Macrocytic anemia ⇒ MCV > 100

Folic acid / Vit B_{12} ↓ ⟶ Retarded DNA Synthesis

↓

Immature Nuclei + Mature cytoplasm + Big cells

Megaloblasts in marrow

↓

Macro ovalocytes in blood

↓

Earliest finding

Other cells are also affected

↓

Giant metamyelocytes + Hypersegmented Neutrophils

↓

Most characteristic

Ineffective erythropoiesis ⟶ Improperly formed cells

↓

Destroyed in marrow itself

↓

Hemolytic phase

↓

Jaundice

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Platelets

Injury to vessel
↓
Vasoconstriction
↓
Primary Platelet Plug (unstable)

Fibrin clot
↑
Coagulation Cascade.

Primary Hemostasis

- Disorders will present ∵ Superficial haemorrhages
- Not associated with family history

Secondary Hemostasis

Deep haemorrhages

Family history +ve

Thrombocytopenia
Immune Thrombocytopenic Purpura (ITP)
Thrombotic Thrombocytopenic Purpura (TTP)

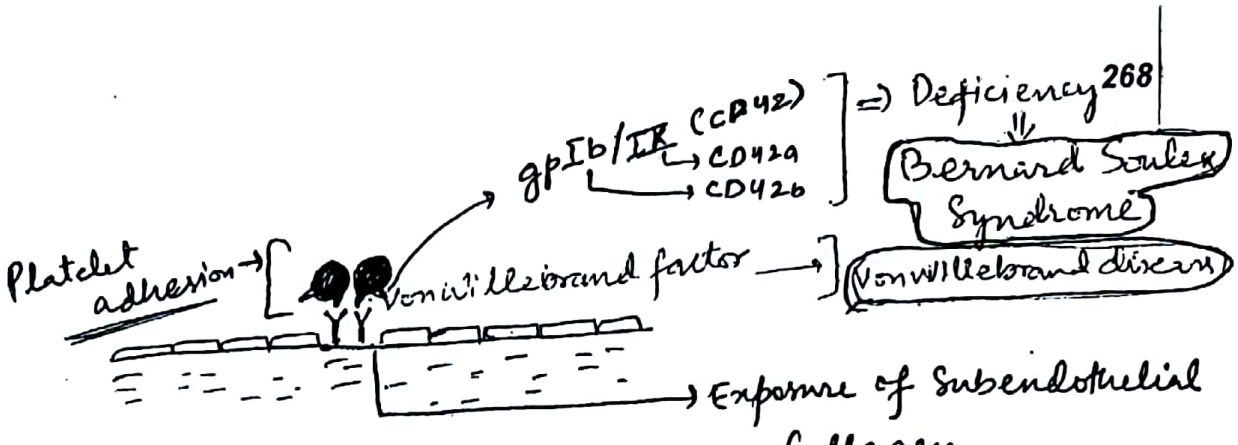
Hemophilia (A/B/C)
Clotting factor inhibitors

Von Willebrand Disease

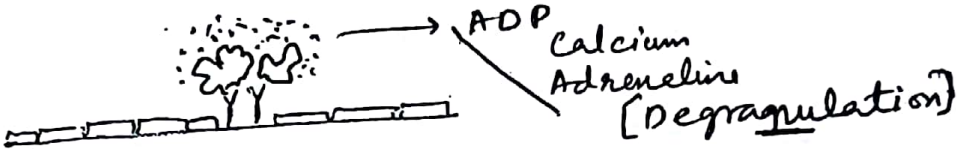
Disseminated Intra Vascular Coagulation.

Platelets release ① granules
α
δ — Serotonin, ADP, Ca+
② Thromboxin A_2

Fibrinogen
Coagulation
→ Fibrin (on the surface of primary platelet plug)



↓ Platelet activation



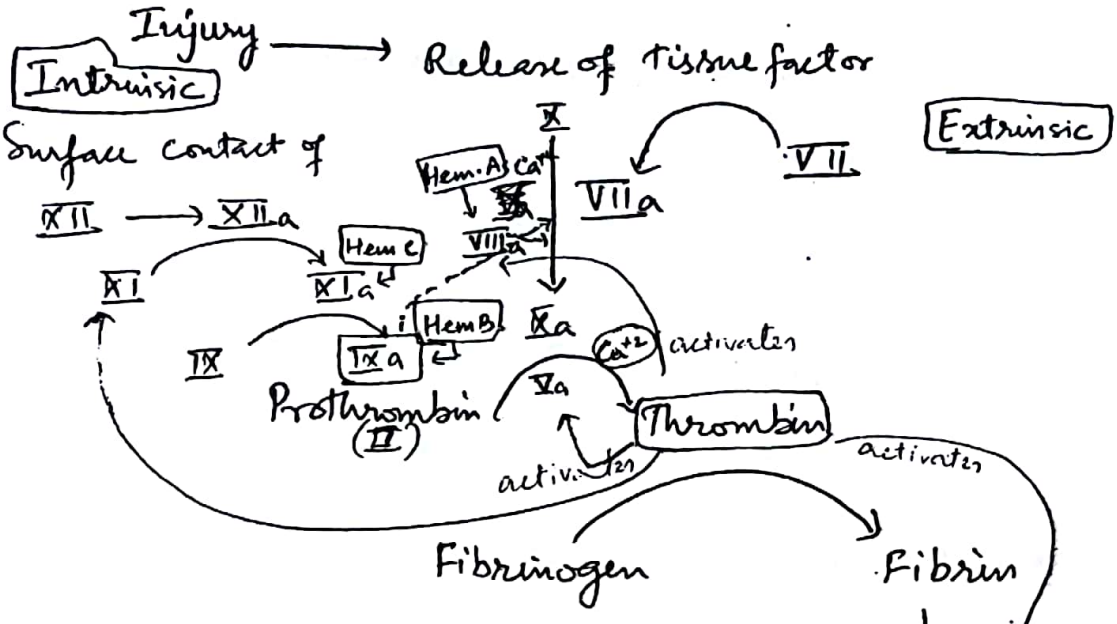
Platelet function Aggregometry (PFA)

Umbilical Stump bleeding

Agonists are given to stimulate Primary ~~Plug~~ Plug formation

- Ristocetin → Plt. ~~aggreg~~ adhesion
  - → If no curve/flat curve
    - ↓
    - vWF or gpIb/IX ↓↓
    - ↓
    - vWD or gpIb/IX def.
    - ↓
    - BSS

Injury to vessel
↓
Release of Tissue factor



XII def → Asymptomatic

Polymerises & Stablises the CLOT.

Intrinsic Pathway

Measured by

APTT (Activated Partial Thromboplastin Time)

[25 - 40 sec (N)]

Extrinsic Pathway

Measured by PT.

[11 - 14 sec (N)]

Factor VII - K dependent factor

Prothrombin time is measured as

Platelet Poor Plasm + Tissue factor [Thromboplastin]

↓

Phospholipids (platelets are missing)

↓

Calcium (Monitor stopwatch)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

APTT

Platelet poor plasma + Surface Activator (glass, silica, kaolin)

↓

Phospholipids (Platelets are missing)

↓

Calcium → (Start stopwatch)

Immune Thrombocytopenic Purpura

Auto antibodies against Plt. Ags.

Most common – gp IIb/IIIa

Destruction of plts. by splenic macrophages

[TOC – Splectomy]

Children (Acute) – Following Infection

Adults (chronic) – NO H/o Infection

Auto immune disorders.

Marrow → Megakaryocytic Hyperplasia (not required of Dx) as it is non specific

VWF (von Willebrand Factor)

Produced as large multimers —ADAM TS 13 enzyme→ broken in small molecules

↓

Act as carrier for factor VIIIa

Deficiency of ADAM TS 13 enzyme

↓

Large multimers of VWF will cause widespread platelet ~~aggre~~ adhesion followed by aggregation.

↓↓

Thrombotic Thrombocytopenic Purpura

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

If VWF is deficient ⟶ No primary plug formation
↓
Bleeding

If Severe
↳ APTT ↑

Functional deficiency of VIII
will lead to ↑ APTT in VWD.

DIC

↳ [Procoagulant molecules (cancers, Autoimmune)
Extensive endothelial injury
↓
Wide spread thrombosis → PT ↑, APTT ↑] due to Coagulation factor consumption.
Bleeding

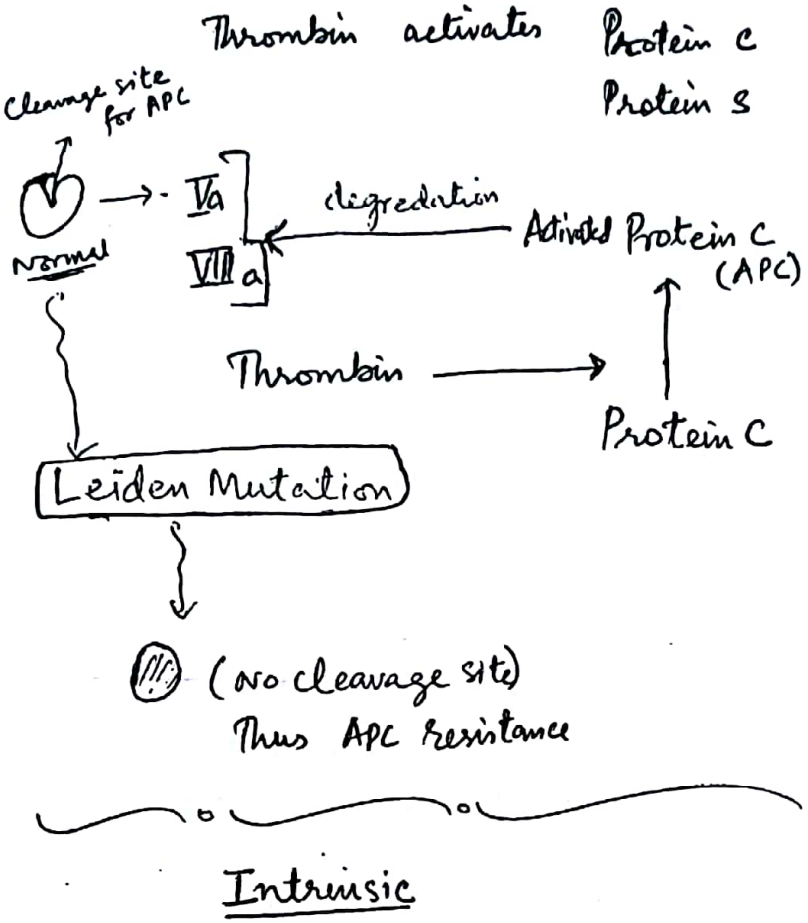
Also called as Thrombohaemmorhagic Disorder.

Bleeding Pt. with APTT ↑
↓
Mixing Studies ⇒ Pt plasma + Normal pooled plasma
50:50
↓
Repeat APTT

APTT Normalize
Confirms Coagulation factor deficiency
↓
Factor Assay.

APTT is Still ↑ed
↓
Confirms presence of Clotting factor Inhibitors
↓
Lupus Anticoagulant ← Dilute Russel Viper venom Test

Inherited Thrombophilia



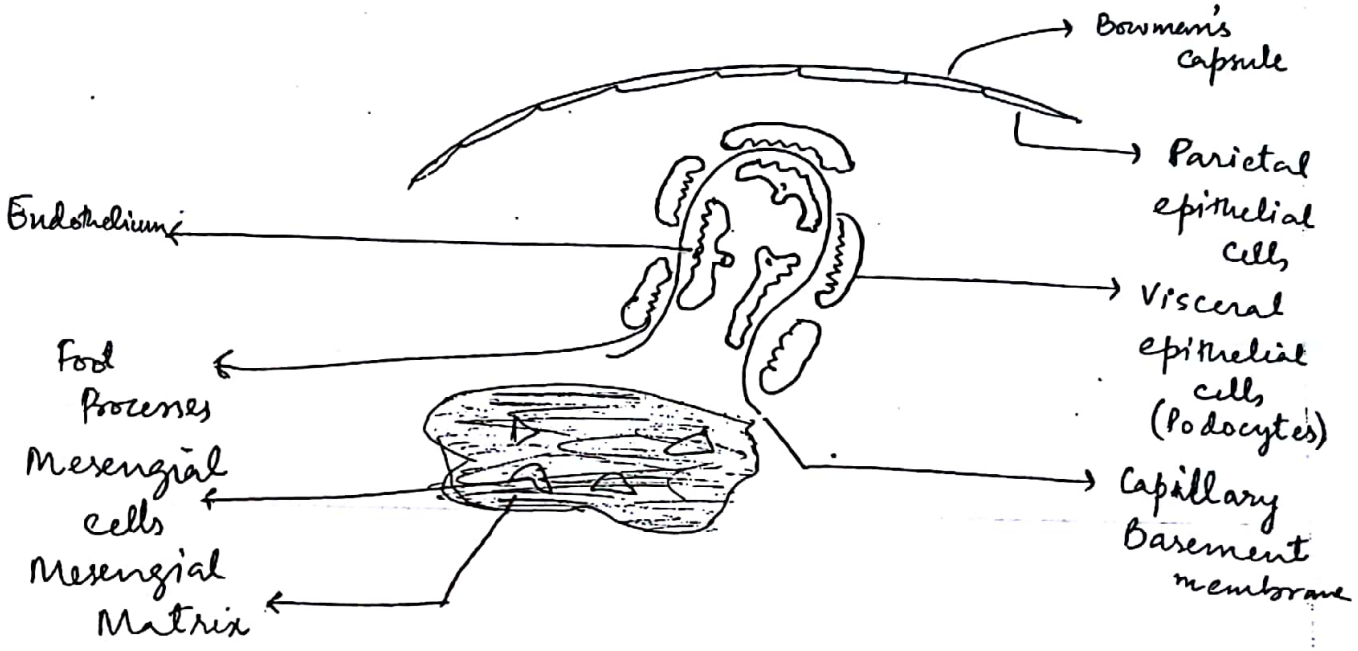
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

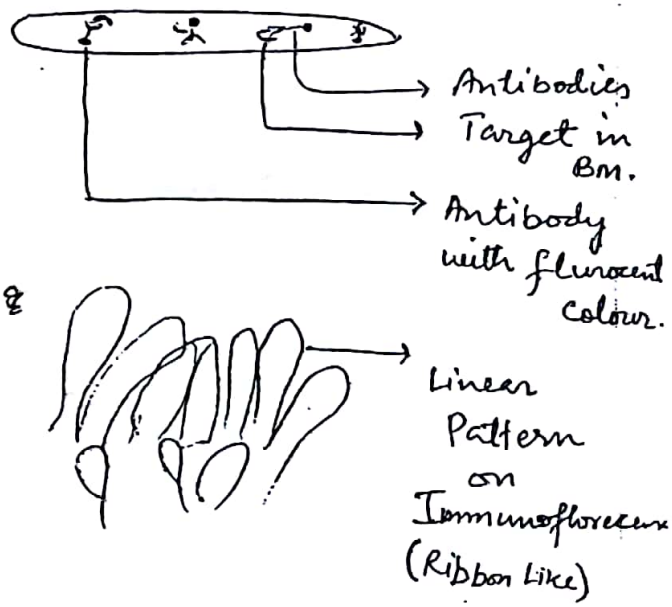
Renal Pathology

Ultrastructure of Glomerulus



Mechanisms of Glomerular Injury

① Antibodies to components of Basement membrane.

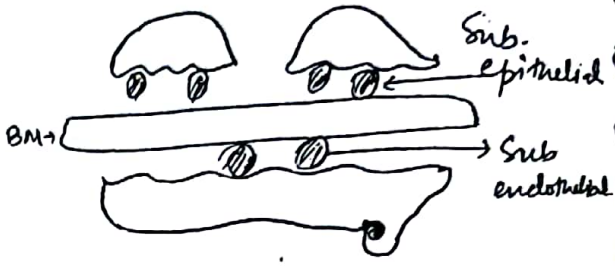


Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

2) Immune Complex deposition

↓ Circulating

↓ Insitu



⇓

→ Granular Pattern (Coarse, Irregular texture).

3) ANCA mediated.

(Anti Neutrophil cytoplasmic Antibody)

⇓

(No pattern on immunofloresense.)

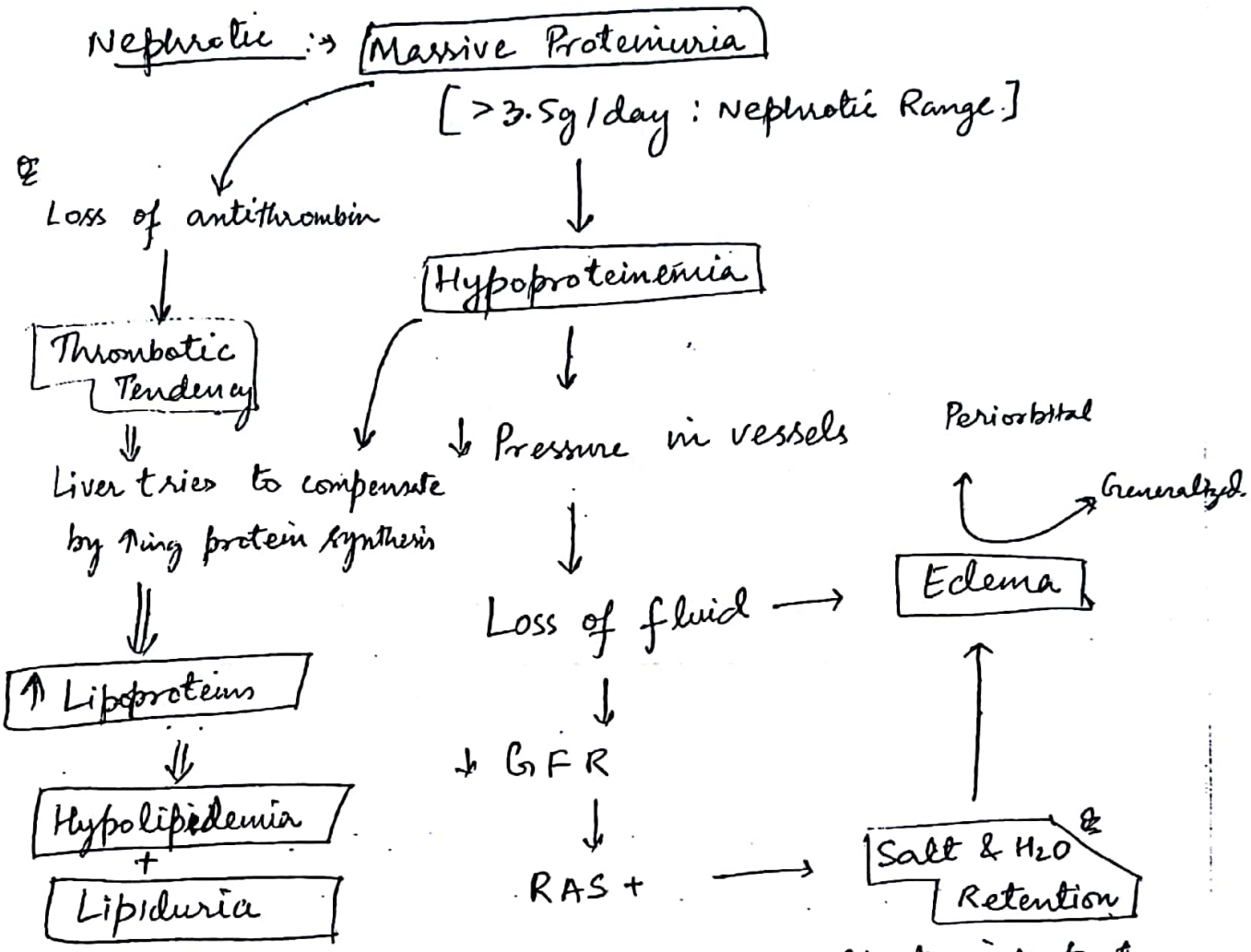
Clinically

Hematuria - Damage to glomerular basement membrane (most often due to inflammation)

↓ Nephritic

Proteinuria - Derangement of capillary wall + Podocytes.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp



Proteinuria
Lipiduria
Hypolipidemia
Hypoproteinemia

Clinicopathological features

1. Minimal change disease (Nephrotic)
2. Focal segmental glomerulosclerosis (Nephrotic +/- Nephritic)
3. Membranous Nephropathy (Nephrotic)
4. Membroproleferative glomerulonephritis (Nephrotic + Nephritic)
5. IgA Nephropathy (Nephritic)
   - ↳ (BERGER's Disease)
   - (BUERGER ✗ → Thrombangitis Obliterans)
6. Post infectious glomerulonephritis (Nephritic)
7. Rapidly progressive glomerulonephritis (RPGN) (Nephritic)

Pathological Assessments

(1) Light Microscopy
- H & E
- Special Stains → PAS (Magenta)
  → Jone's Methanamine Silver (Black)

(2) Immunofluoresence → No pattern.
→ Linear
→ Granular
→ Any other

(3) Electron microscopy → Site of deposition
→ Associated changes

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Minimal Change Disease

(NIL LESION or LIPID NEPHROSIS)

? Cytokine mediated podocyte Injury.

↳ Dramatic Response to steroids.

↳ This condition is associated with Hodgkin lymphoma & Tcell lymphomas

LM ⇒ None

IF ⇒ None

EM ⇒

→ Effacement/Loss of foot processes

Focal Segmental glomerulosclerosis

- Only some of the glomeruli are involved
- Only a part of glomerulus is involved
- Thickening/Hardening → Hyaline deposition

Eosinophilic Amorphous Acellular Homogenous glassy.

[Intracellular/Extracellular]

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Tiny Tiny damage to BM → Tiny Tiny leakage of plasma proteins

↓

Podocyte damage → Dying Podocyte → Debris → Deposited outside the capillary wall (Hyalinosis)

↓

Loss of foot processes.

+

Lipid Deposition.

Obliteration of Capillaries and sclerosis of glomerulus

⇒ Idiopathic (Primary)

⇒ Secondary focal segmental glomerulosclerosis
- → Virus : HIV / HepB / Parvovirus
- → Hypersensitivity Nephropathy

⇒ Reflux Nephropathy.

Cholesterol emboli

⇒ Drugs: Heroin / analgesic / Pamidronate.

⇒ Oligomeganephronia

⇒ Renal dysgenesis

⇒ Alport's syndrome

⇒ Sickle cell disease

⇒ Lymphoma

⇒ Radiation nephritis

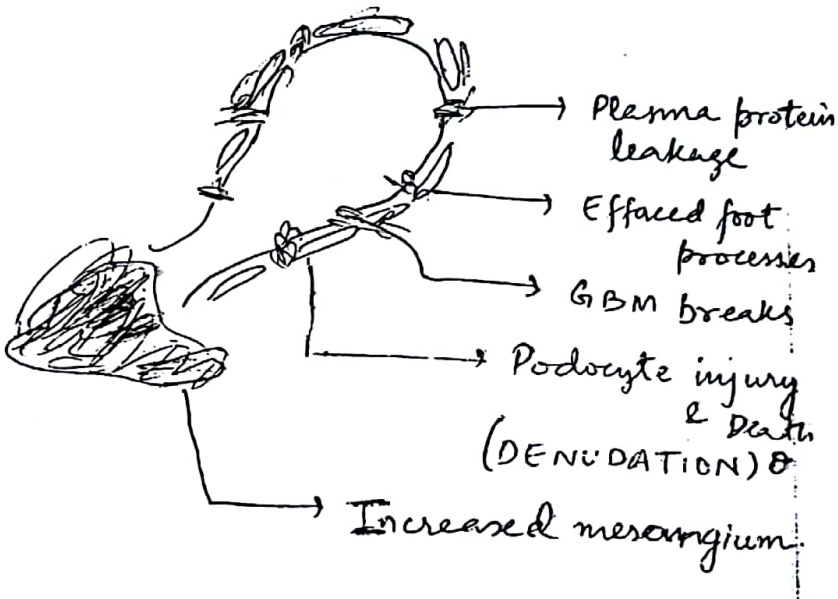
⇒ Familial podocytopathies

	Gene	Protein
→	NPHS 1	mutation/nephrin
→	NPHS 2	mutation/podocin

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

LM: Mesangial widening by sclerosis
↓
Obliterate capillaries
↳ Hyaline nodules.

IF: Usually no pattern > Granular.

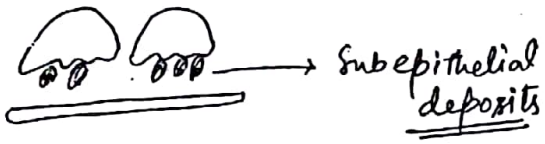


Membranous Glomerulopathy

Primary

Antibodies against

Phospholipase A_2 Receptors on podocytes



Secondary

① Drugs – Gold
NSAIDs
Penicillamine

② Infections – Hep B
– Hep C
– HIV
– Leprosy; Syphilis

③ Cancers – Lung
– Colon
– Melanoma

④ Autoimmune
Hashimoto & SLE

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

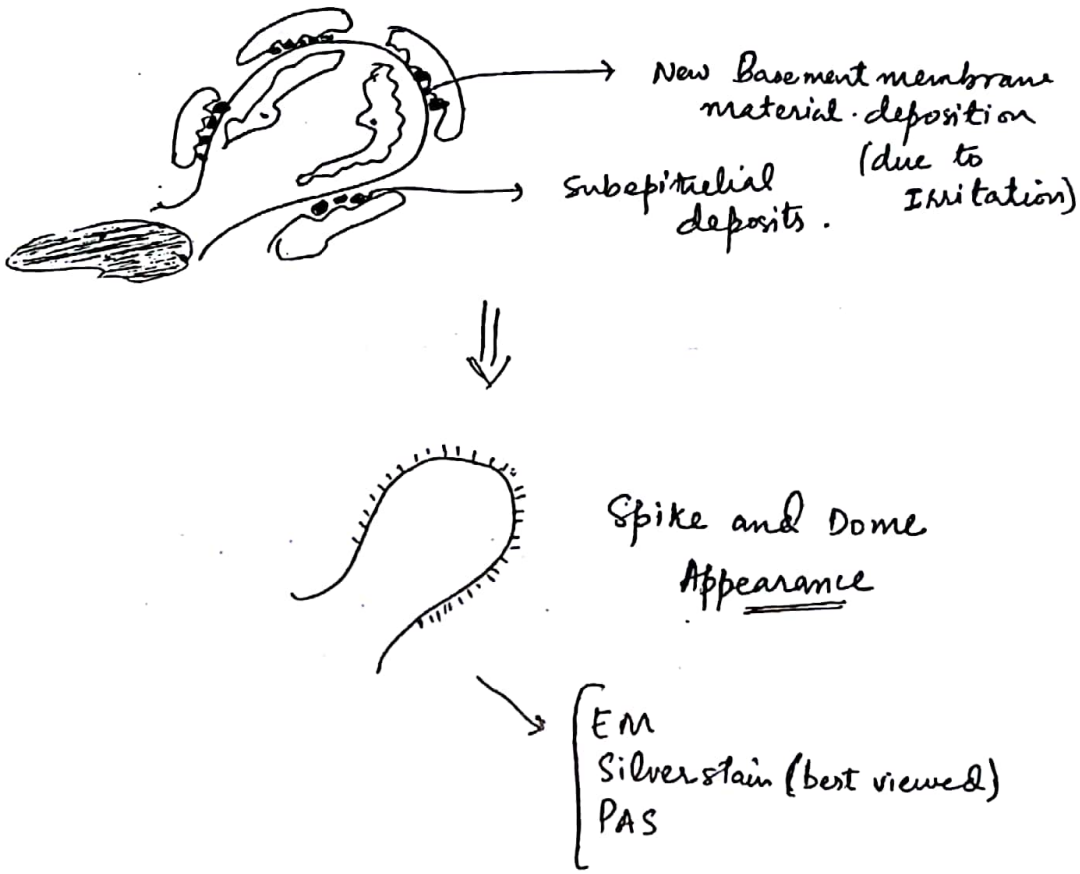
LM :-

- Thickened basement membrane H & E

IF

Granular IF.

EM



Membrano proliferative Glomerulonephritis

- Thickened BM → ⊖ Subendothelial Deposits
- ↑sed cellularity (↑ cells) → ⊖ Mesangial & Endothelial (Reactive)
- Inflammation → ⊖ GBM damage & Podocyte Damage.

Type I	Type II	Type III
(Most common)	(Dense deposit disease)	(Now removed)

Type I

Subacute bacterial endocarditis
Systemic Lupus erythematous
Hepatitis C ± cryoglobselinemia
Mixed cryoglobulinemia
Hepatitis B
Cancer: Lung, breast & Ovary (germinal)

Type II

C_3 Nephritic factor - associated

Type III

Complement Receptor deficiency

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

LM

Hypercellular glomerulus.

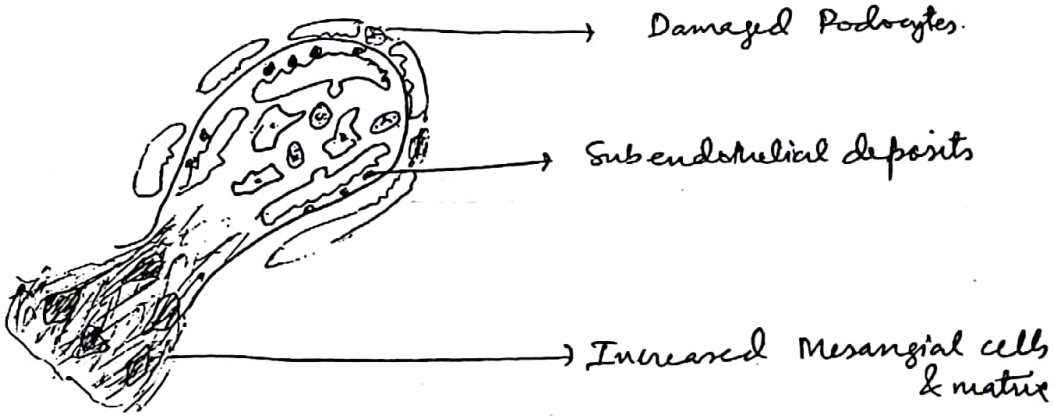
- Mesangial cells ↑ed (more) } AKA Mesangio Capillary Glomerulonephritis
- Endothelial cells ↑ed

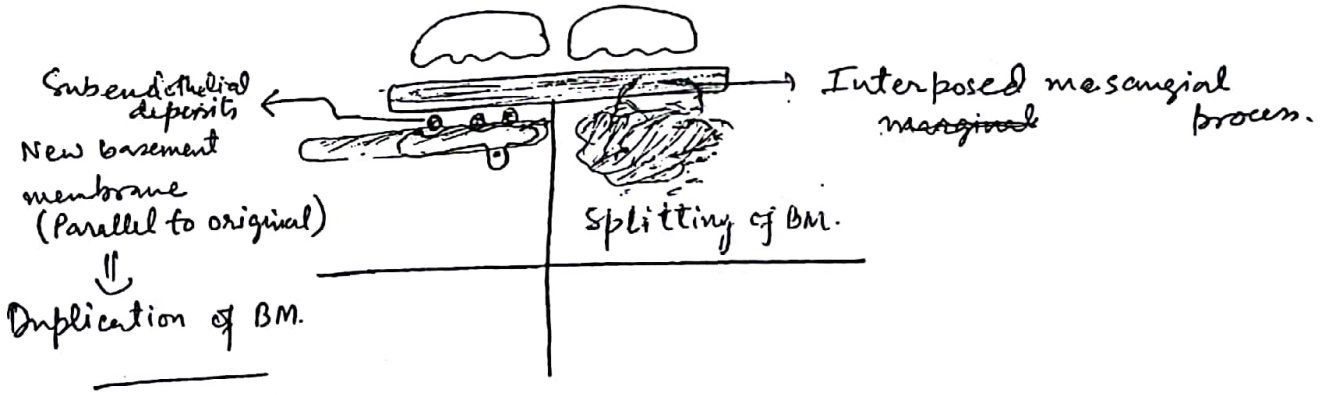
Inflammatory cells ⊕

Silver

IF - Granular.

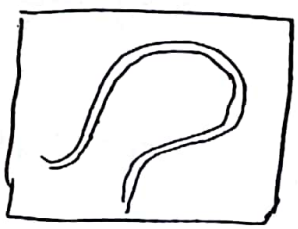
EM





⇓

TRAM TRACK APPEARANCE
or
DOUBLE CONTOURING



IgA Nephropathy (BERGER'S Disease)

↑sed IgA: Following Respiratory/GIT infections.
< 1 week ⊕.

↓sed IgA clearance: Liver diseases
(↓ed hepatobillary clearance)

Abnormal IgA: Celiac disease ⊕

Also attacks anchoring filaments in hemidesmosomes of Dermal papillae thus leading to
⇓
Dermatitis herpetiformis.

LM

Mesangial widening.
(even on PAS)

IF: Mesangial pattern.

EM:

→ Mesangial deposits

↳ ↑ mesangial matrix & cells.
⇓
Mesangio proliferative
(Mesangial widening)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

PSGN

POST INFECTIOUS

After 1-3 wks of throat infection or 3-5 weeks of skin Infection

POST INFECTIVE → Streptococcal, Staphylococcal, Viruses, Parasitis

or

Acute Proliferative Glomerulonephritis

Onset is quick: Transient. Rarely leads to chronic renal failure.

Increase in number of cells. → Hypercellular glomeruli.

Inflamation → Damages GBM

LM:-

Hypericellular glomerulus

increased Endothelial cells — More ↑ (Max seen)

Mesangial cells

Inflammatory cells

IF : Granular

EM

→ Subepithelial deposits (MC & characteristic)

→ Endothelial ↑

→ Subendothelial (early)

→ Mesangial cells ↑

Most common cause of Nephrotic Syndrome.

In adults – Focal segmental Glomerulosclerosis

In Children – Minimal change Disease

In Elderly – Membranous nephropathy.

Most common cause of Glomerulonephritis.

Primary GN in world : IgA Nephropathy

Primary GN in India : Post Streptococcal glomerulonephritis

Secondary GN : Diabetes Mellitus.

Most common type of Glomerular Disorder in.

⇒ Leprosy:- MPGN

⇒ Syphilis : Membranous Nephropathy.

⇒ Malaria : Mesangioproliferative.

⇒ Hepatitis C : Cryoglobulinemic glomerulonephritis > membranous glomerulopathy > type 1 MPGN.

⇒ Hepatitis B : Membranous Nephropathy (Component of Hep B virus Responsible - HBsAg).

⇒ SLE – Diffuse glomerulonephritis (class IV) Lupus Nephritis

⇒ Colon cancer / lung cancer – Membranous glomerulopathy.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Rapidly Progressive GlomeruloNephritis

Onset — Has progressed from something.

Type I

Anti GBM antibody

- Renal Limited
- Good Pasture's Syndrome

Type II

Immune Complex mediated

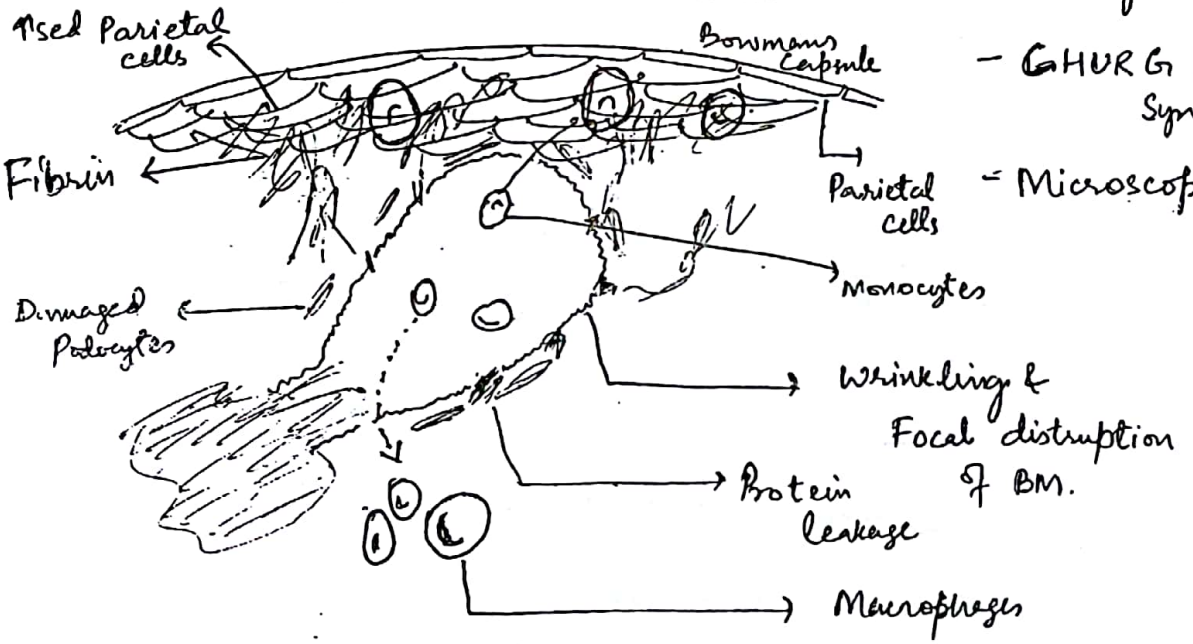
- IgA Nephropathy
- PSGN
- SLE

Type III

ANCA mediated.

(Pauci Immune)

- Wegener's granulomatosis
- CHURG STRAUSS Syndrome
- Microscopic Polyangitis



⇒ CRECENT ⇒
- ↑ Parietal cells
- Fibrin
- Macrophages

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Subepithelial
Deposits on EM
+
GRANULAR IF

- Nephrotic → Membranous Nephropathy
- Nephritic → PSGN

Hypercellular
Glomerulus
+
GRANULAR IF

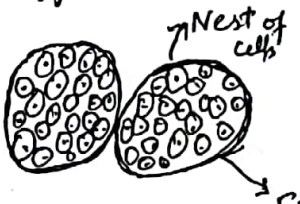
- Subepithelial → Nephritic → PSGN
- Subendothelial. → Nephritic + Nephrotic → MPGN

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

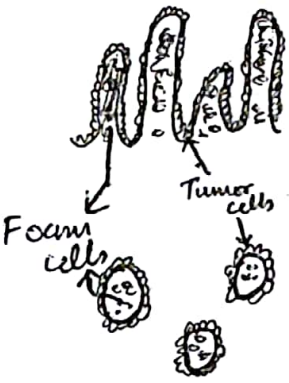
Renal cell Carcinoma

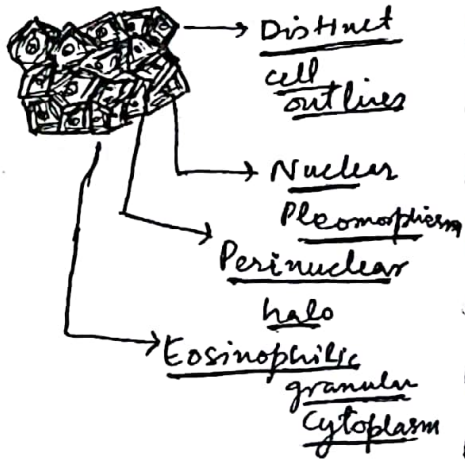
	Clear cell	Papillary	Chromophobe
ORIGIN	← Proximal tubule →		Intercalated cells of CD.
Genetics	3p deletions → VHL gene	Trisomy (7) 17 Loss of Y ↓ Met-proto-oncogene	Extreme Hypoploidy.

Histology



Pleomorphism with Clear cytoplasm (because of glycogen/lipid)





- CK7 +ve
- Hem's colloidal iron +ve

Psammoma Bodies (Dystrophic Calcification) [ARISE FROM THE INFARCT and CALCIFICATION OF PAPILLAE TIPS.]

P - Papillary Ca thyroid
P - Prolactinoma
S - Serous CAO
Sa - Somatostatinoma
M - Meningioma
Mo - Mesothelioma

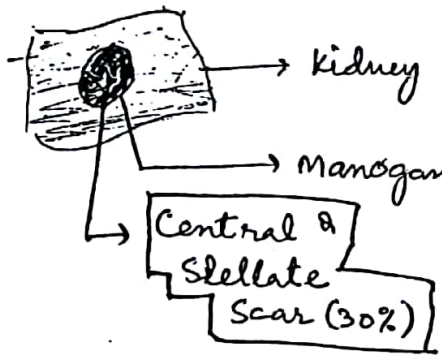
IFI
- Papillary Ca thyroid
- Serous cystadenocarcinoma ovary
- Meningioma
- Mesothelioma

Intercalated cells of collecting duct

↓ gives Rise to

Benign Tumor

Oncocytoma



Angiomyolipoma
Picoma

Pancreas
↓
Central scar

Histology

Same as chromophobe except

- No perinuclear halo
- No nuclear pleomorphism

(cells are eosinophilic & granular because of increased number of mitochondria)

Renal cell carcinoma

- Most common subtype: Clear cell carcinoma
- Most common subtype in sickle cell anemia: Medullary Ca
- Most favourable prognosis: Chromophobe
- Least favourable prognosis: Sarcomatoid > Medullary > Collecting duct > Clear cell

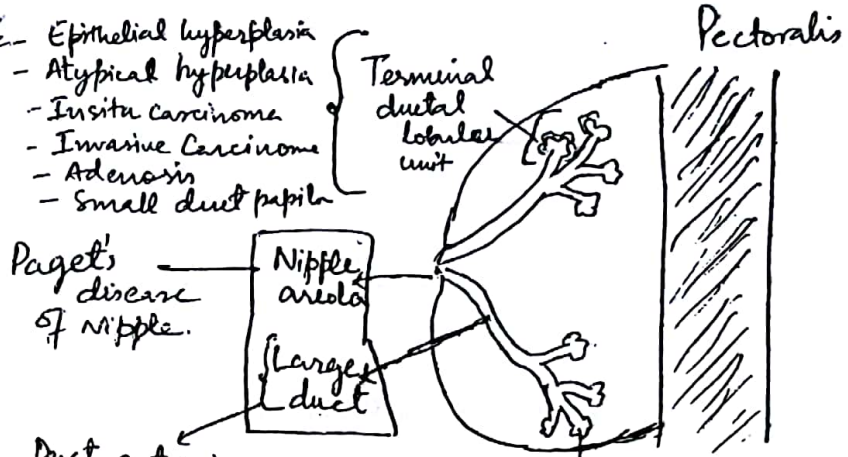
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

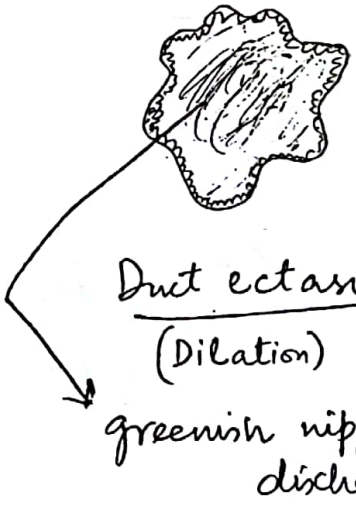
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

BREAST PATHOLOGY

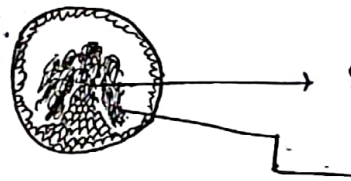
- Epithelial hyperplasia
- Atypical hyperplasia
- In situ carcinoma
- Invasive Carcinoma
- Adenosis
- Small duct papilla

} Terminal ductal lobular unit

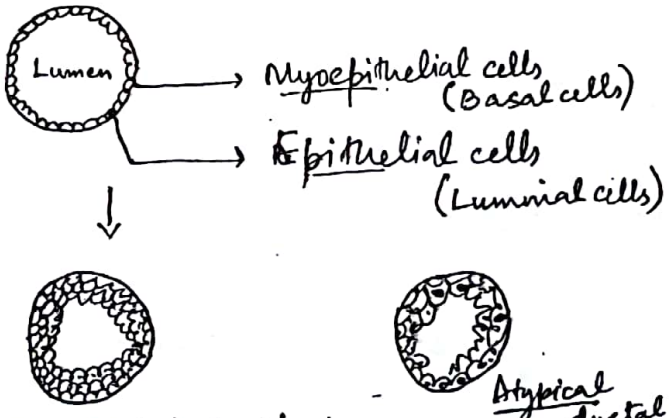


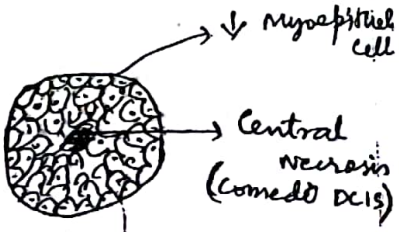


Duct ectasia
(Dilation)
greenish nipple discharge



Duct papilloma
(Benign papillary tumor of lining Epithelium)

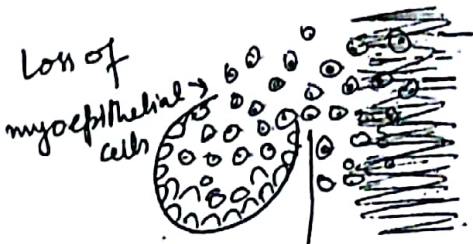




Epithelial hyperplasia
(NO pleomorphism of Nuclei)

Atypical ductal Hyperplasia

Ductal carcinoma in situ (DCIS)



→ Desmoplastic Stroma (invaded) Q
- Stroma reacts with fibrosis

Invasive Carcinoma

→ Invasion of basement membrane.

Benign epithelial Lesions

Non Proliferative Q
(No relative Risk)

→ Duct ectasia
Fibrocystic change
Apocrine Metaplasia

Proliferative Q

Without Atypia (Slight Risk)

Duct Papilloma
Epithelial Hyperplasia
Sclerosing Adenosis

With Atypia (Moderate Risk)

Atypical ductal hyperplasia
Atypical lobular hyperplasia

Higher Risk
- DCIS
- LCIS

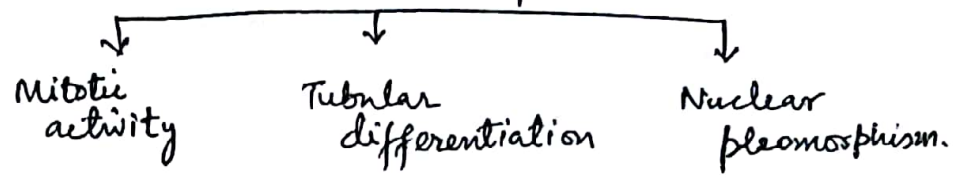
Histological Subtypes of Invasive Carcinoma

(1) Invasive Ductal Carcinoma, Not otherwise specified (IDC, NOS)

Q- Most common histological subtype
- Firm, grey white, Irregular

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

- Grading based on **NOTTINGHAM CRITERIA**

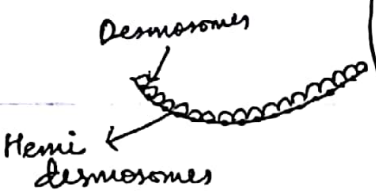


② Invasive Lobular Carcinoma. (ILC)

CDH 1 gene mutation (Loss of function for making protein E-Cadherin)

↓

E Cadherin loss



Cells become dyscohesive (lose their cohesion)

Become wild & free!

Single File / Indian File Pattern

⇒ Fail to elicit a desmoplastic response

[difficult to detect as a well defined mass on imaging]

⇒ Involve contralateral side commonly.

⇓

Metastasize to
- Leptomeningis (arach. + Pia)
- Peritoneum
- Ovaries

(3). Medullary Carcinoma

Sheets of tumor cells interspersed with lymphocytes.

↓

Poorly differentiated tumor

↓

Improves treatment response

↓

Thus better prognosis as compared to other poorly differentiated tumors.

Usually associated with

BRCA 1 gene mutation.

- Triple Negative
(ER−, PR−, Her2 Neu−)

(4) Tubular Carcinoma

Best prognosis

(5) Inflammatory Carcinoma

Dermal lymphatics are involved by tumor cells

↓

Peau de orange appearance.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Tumor genetics

Sporadic (more common)[Q]

Most common: p53

Familial

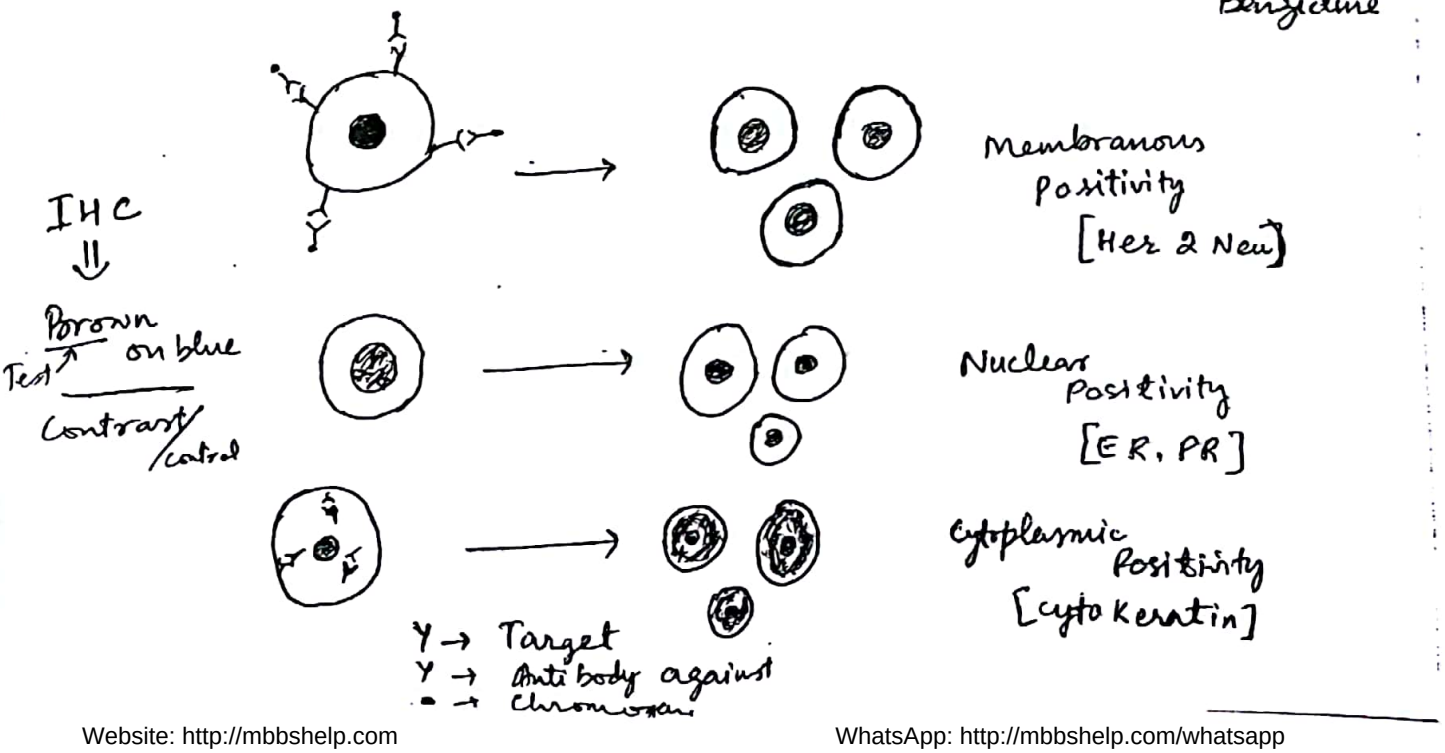
- BRCA1 (most common)[Q] → Ovarian Cancer
- BRCA2 → Male breast Cancer, Pancreatic Cancer, Prostate Cancer
- p53 → Li Fraumeni Syndrome

- Triple Negative (ER-, PR-, Her2Neu-)
- ER+ (Her 2 Neu -ve)
  - ~~Her 2 Neu +ve~~
  - ~~Her 2 Neu +ve~~
- Her 2 Neu +ve
  - ER+
  - ER-

IHC

Chromogen: Di Amino Benzidine (DAB)

BROWN



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

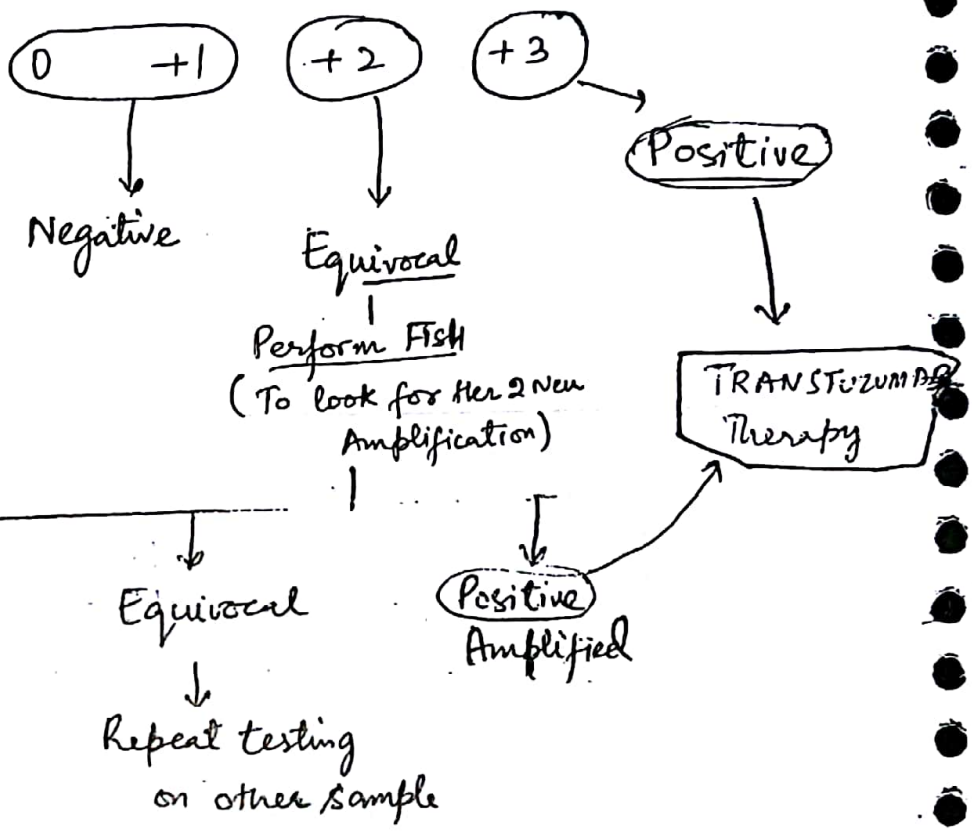
IHC in Breast Cancer

① ER/PR: Allred Score = [0-8]

Intensity + % of positive cells.

② Her-2-Neu

% of cells positive & intensity.



Breast Carcinoma

Most common histological subtype – IDC, NOS

Most common molecular subtype – Luminal A

Histological subtype with Best prognosis – Tubular > Mucinous

Molecular subtype with Best prognosis – Luminal A

Most common genetic mutation – p53.

Most common familial genetic mutation – BRCA 1.

Highest susceptibility seen with which mutation – BRCA 2

Association of male breast cancer, prostate cancer, pancreatic Ca, melanoma and gastric cancer – BRCA 2

Association of ovarian cancer (serous) – BRCA1 > BRCA2

Most common molecular group associated with BRCA1 – BASAL

Most common molecular group associated with BRCA2 – Luminal B

Most important prognostic marker – Lymph node status.

Most important marker (prognostic) for metastatic Cancer – ER/PR status

Least desmoplastic tumor – Lobular Carcinoma.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

PHYSIOLOGY

Handwritten Notes

MBBS Help

http://mbbshelp.com

http://www.youtube.com/mbbshelp

http://www.facebook.com/mbbshelp.com

Name: _____

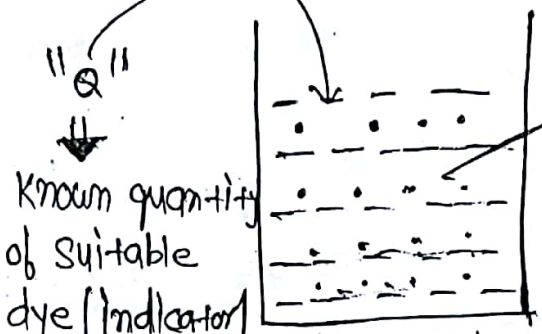
Subject: **Physiology**

All 2018 Handwritten notes by **MBBS Help**

http://mbbshelp.com ← More information → WhatsApp: +1 (402) 235-1397

MBBSHELP.COM

Physiology



$$V = \frac{Q - e}{C}$$

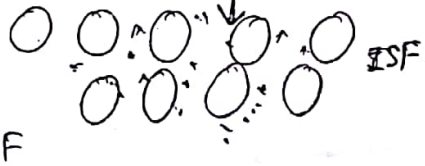
- Q → Amount of dye Metabolized or excreted during Procedure
- V → Volume of body compartment to be Measured
- C → Concn of dye after Mixing.

* Q → ⇒ only Measure Plasma

Dye will Not cross Capillary Membrane

Dye ⇒ Evan's blue; (T1824)
Radioactive Labelled Iodine;
Albumin.

* Q → ⇒ crossed the capillary Membrane but Not the cell Memb.

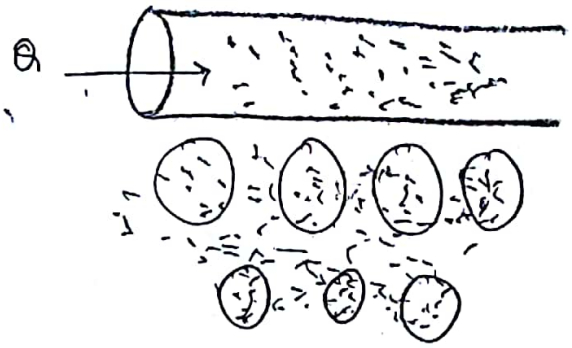


- It will Measure ECF (Plasma + ISF)

Most accurate

Dye ⇒ Inulin
Mannitol
Sucrose;
Radioactive Sodium (Na²⁴)

①



Cross Capillary Memb & Cell Memb..

⇓

Measures TBW.*

⇓

dye ⇒ D_2O

Most frequently used.

Tritium oxide ;
Amino Pyrine ;
Anti-pyrine .

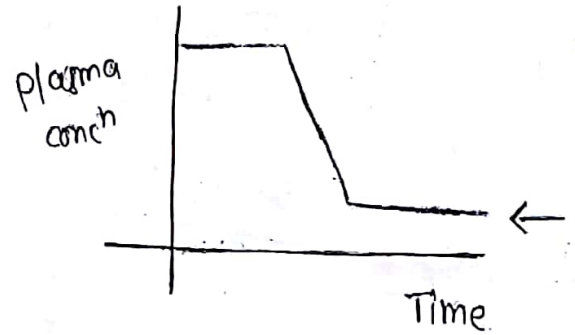
* ♀ ECF Measurement ⇒ TWB − ECF
(D_2O − Inulin)

♀ ISF Measurement ⇒ ECF − plasma
(Inulin Evan's blue)

→ Indirect estimation

Q. AIIMS'15

We want to determine ECF volume. We take 10gms of Inulin ; After equilibrium ; pl. Insulin 50mg/100ml ; during the procedure 10% excreted ; ECF volume=?



10gm = 10,000mg

$$V = \frac{10,000 - 1000}{500} \simeq 18 \text{ Litre}$$

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Qq "XYZ" dye → Plasma volume Measure

⇓

"ABC" dye ⇒ Diffuses out of tissue capillary

Pl. volume Measurement ∵ dye "ABC".

a) Same as ∵ "XYZ"

~~b)~~ Falsely high

c) Falsely Low

$V = \frac{Q - e}{C}$

$\uparrow_{es} V = \frac{Q}{C \downarrow_{es}}$

* Measurement of solute Conc^n

MOLE ⇒ Gram Molecular wt.

32 gm of O_2 = 1 mole of O_2.

58.5 gm of NaCl = 1 mole of NaCl.

67,000 gm of Albumin = 1 mole of albumin.

1 mole = 6.023×10^{23} Molecules

↳ Avogadro No.

Millimole = $\frac{1}{1000}$ th of Mole

OSMOLE ⇒ $1\ Osmol = \frac{1\ Mole}{No.\ of\ Freely\ Moving\ Particles\ Liberated\ in\ solution}$

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* 1 Osmol of NaCl = $\frac{1 \text{ mole of NaCl}}{2}$

1 mole of NaCl	=	2 osm
1 mole of KCl	=	3 osm
1 mole of $CaCl_2$	=	3 osm
1 mole of Na_2SO_4	=	3 osm
1 mole of $C_6H_{12}O_6$	=	1 osm.
1 mole of Urea	=	1 osm
1 mole of Albumin	=	1 osm

* Milliosmol ⇒ $\frac{1}{1000}$ th of osmol

OSMOLARITY	OSMOLALITY
• No. of osmols of solute per Liter of solution.	• No. of osmols of solute per kg of solvent.
• affected by – Temp.	– Not affected by temp; so, better to use

Q. (N) Plasma osmolality ⇒ 280-290 mosm/Litre

* if there is ↑es Plasma osmolality ⇒ eg ⇒ Sweating (Hypo-tonic)

↳ Stimulates osmoReceptors (Located @ Ant. hypothalamus)

ADH - Thirst Mech^m for Regulation of Plasma osmolality & the Na+ Levels, b/c Max^m contribution 1st ↑es in ADH & Thirst comes Later

↳ Supraoptic (↑es Plasmolality by 5 mosm) (↑ADH)

↳ Lateral hypothalamus (↑es Plasmolality 1 mosm)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Q. Maxm contribution to plasma osmolality ⇒

a) Sodium & its associated anions ⇒ 270 mosmol

b) Glucose ⇒ 5 mosmol

c) Urea ⇒ 5 mosmol

d) Pl. proteins ⇒ 2 mosmol *

↳ Least contribution

e) Remaining ions ⇒ 8 mosmol

290 mosmols

* (N) Plasma proteins ⇒ 6-8 gm/dl } Fairly high conc^n.

(N) Albumin proteins ⇒ 3.5-5.0 gm/dl

(35-50 gm/L)

67,000 gm of Albumin = 1 mole of Albumin = 1 mosm of Albumin

50 gm of Albumin = $\frac{1}{67,000}$ × 50 mole of Albumin = 0.00075 moles

= 0.00075 osmoles

*** * No. of Moles or osmoles of protein = $\frac{\text{Conc}^n \text{ in gm/Litre}}{Mw}$

QQ Plasma proteins contributes only 2 mosm to plasma osmolality

b/c ⇒ a) high Molal conc^n; high Mw

b) Low Molal conc^n; Low Mw

c) High Molal conc^n, Low Mw

d) Low Molal conc^n; high Mw.

Q. Plasma proteins contributes only 2 mosm/l to plasma osmolality ; b/c of →

a) high conc ; high Mw.

b) Low conc ; Low Mw.

c) High conc ; Low Mw

d) Low conc ; high Mw

Proteins — High conc (g/L) (gram/litre)

but b/c of high Mw

↓

↓ Molal conc

∴ Contribution to Plasma osmolality also less.

* How to Measure Plasma osmolality

Gn mosm/L ⇒ $2[Na^+ + K^+] + 0.055$ [Glucose] (mmol/L) mg/dl

(↓ $\frac{1}{18}$ Multiply ∈ mg/dl of Glucose)

↓

mmol/L or meq/L

||

$2[Na^+]$ + 0.36 [BUN] (mmol/L) mg/dl.

Q. Na^+ = 140 meq/L

K^+ = 5 meq/L

Glu = 5 mosmol/L

BUN = 5 mosmol/L

Pl. osmolality = ??

$2[140+5] + 5 + 5$

= 300 mosmol/Litre

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Measurement of Plasma osmolality by freezing point depression

∴ ⇒ 1 osmol of solute depress freezing point by 1.86°C

QQ. freezing point of soln ∝ 1 mosmol of solute

⇓

a) 0°C ; b) +1.86°C ; ~~c) −1.86°C~~

* 1 mosmol of solute depresses freezing point by 0.00186°C

QQ freezing point of Plasma ∴⇒

a) 0°C

b) −1.86°C

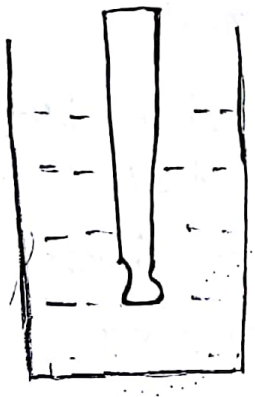
~~c) −0.54°C~~

d) +0.54°C

1 mosmol ↔ −0.00186°C

290 — → 290 × −0.00186°C

= −0.54°C.



***

$$\text{Pl. Osmol (mosml/L)} = \frac{(\text{F.pt.})^{\circ}\text{C}}{0.00186^{\circ}\text{C}}$$

⇒ More accurate to Measure the plasma osmolality.,

↳ b/c we consider all things ⊕ in plasma @ here

* (N) Pl. osm. by freezing point depression is higher than Pl. osmolality by using formula,

* (N) difference b/w two Method is ≤ 10 mosm/L
* if difference b/w two Methods > 10 mosm/L

↓↓

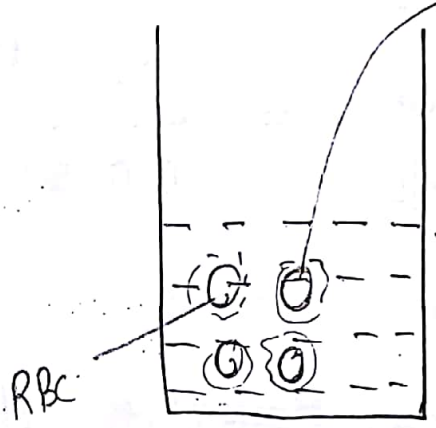
K/as "OSMOLAL GAP"

QQ: Osmolal gap prt. in all of the following except ⇒

a) Mannitol in plasma
b) Methanol in plasma
c) Ethylene glycol in plasma
~~d) Hyperglycemia~~

→ Osmolal gap is seen in the presense of "extraneous Substance" in plasma.

QQ



Into which solution have RBC been placed

~~a) 140 mmol Glucose = 140 mosm Hypotonic~~
b) 280 mmol Glucose = 280 mosm Isotonic
c) 140 mmol NaCl = 280 mosm Isotonic
d) 280 mmol NaCl = 560 mosm Hypertonic

. http://mbbshelp.com WhatsApp: +1 (402) 235-1397

*	ECF	GCF
Osmolality	290 mosm/L	290 mosm/L
Major cation	Na^+	K^+
Major Anion	Cl^-	Misc phosphates > HCO_3^-
Most osmotically active	Na^+	K^+
Major buffer	HCO_3^-	Proteins (∵ pK of proteins is close to intracellular pH)
pH	7.35 – 7.45	7.1
H^+		Yes (as compare to ECF b/c of Metabolism in GCF)

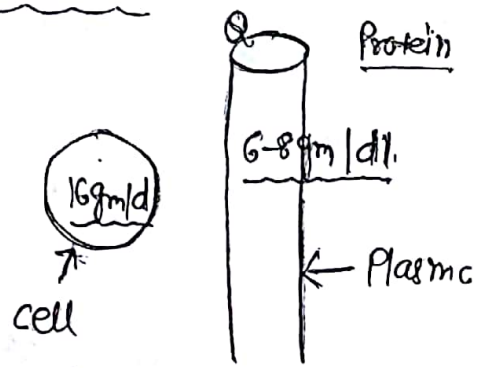
QQ. Which of the following is higher in ECF **

a) Osmolality;

b) proteins

c) Phosphates

~~d) pH~~

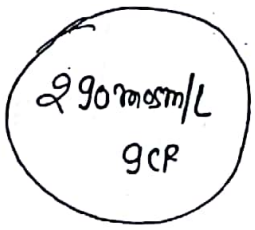


http://mbbshelp.com WhatsApp: +1 (402) 235-1397

OSMOTIC ADAPTATION

In chronic hyperNatremia :⇒ (> 24-48hrs)

ECF
290 mosm/L



Brain cells show osmotic Adaptation.

i> ↑es intracellular Synthesis of osmolytes
- → Betaine (BIG)
- → Inositol
- → Glutamine

ii> Import of sodium

In chronic hypoNatremia :⇒ (> 24-48hrs) brain cells show osmotic adaptation.

i> ↓ intracellular synthesis of osmolytes

ii> Export of K+,

* **Rapid correct of chronic hypoNatremia**

⇓

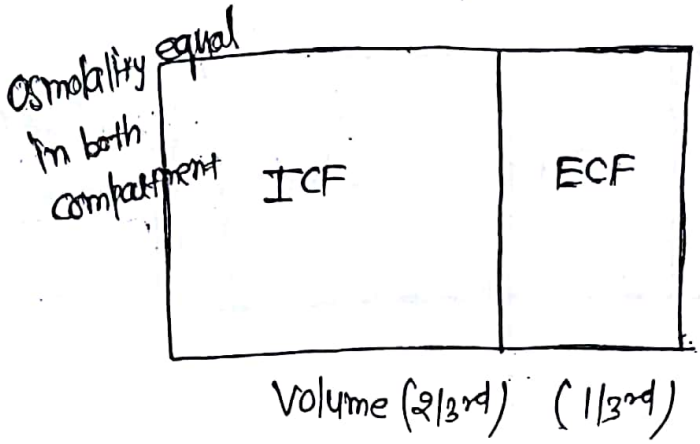
Result in **central Pontine Myelinosis**

↳ **Result in death.**

So; should Not correct Nat Rapidly; do; correction gradually & Not More than 6 mmol/Lit./day. (on 1st day ⇒ 6-8 mmol/Lit. correction done only & Later ↑es Nat gradually).

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* DARROW - YANNET DIAGRAM (D-Y Diagram)

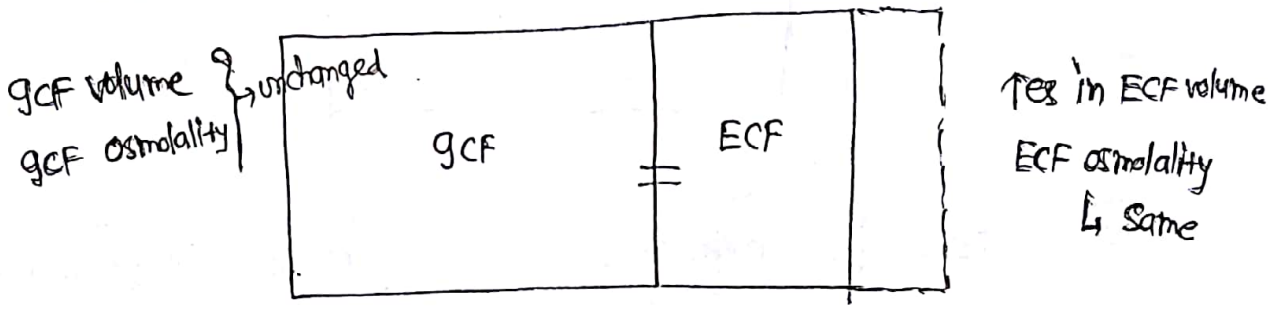


① Addition (Loss of Fluid is from ECF)

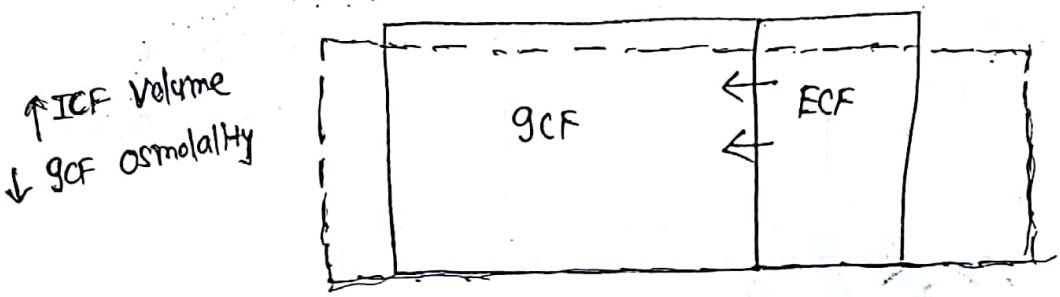
② ECF Osmolality determines shift of fluid;

③ Shift of Fluid will occur till ECF & ICF Osmolality is same

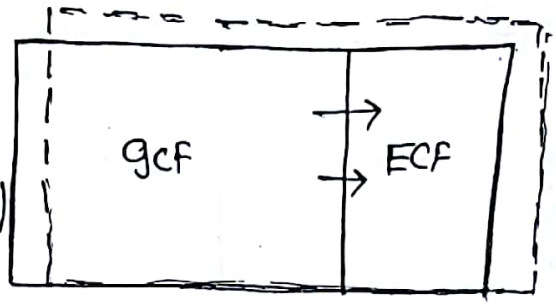
* Addition of Isotonic saline :→



* Addition of Hypotonic saline :→



* Addition of Hypertonic saline :⇒

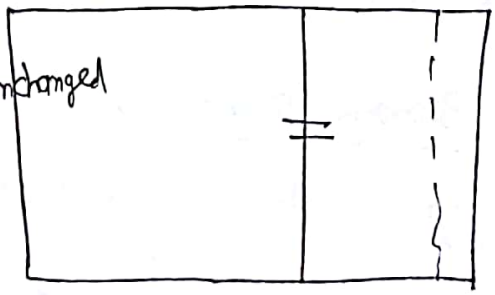


↓gCF volume
↑gCF osmolality
(cellular dehydration)

↑ECF volume
↑ ECF osmolality

* Loss of gso-tonic fluids :⇒ eg ⇒ Hemorrhage ;
Burns ;
Initial stage of diarrhea & vomiting.

↳ gso osmotic dehydration

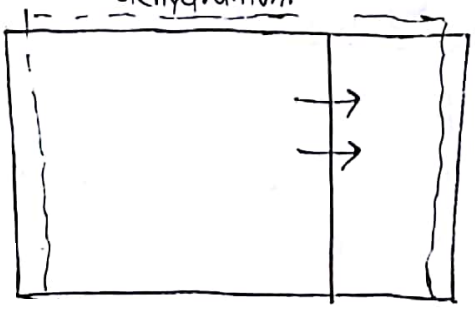


gCF volume } unchanged
gCF osmolality }

↓ ECF volume
ECF osmolality = unchanged

* Loss of hypotonic fluids ⇒ eg ⇒ Excessive sweating
Diabetes insipidus

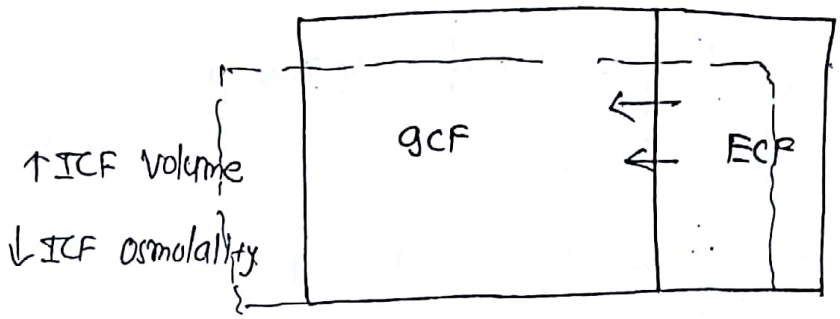
↳ hyperosmotic dehydration.



↓ICF volume
↑ICF osmolality

↓ ECF volume
↑ECF osmolality

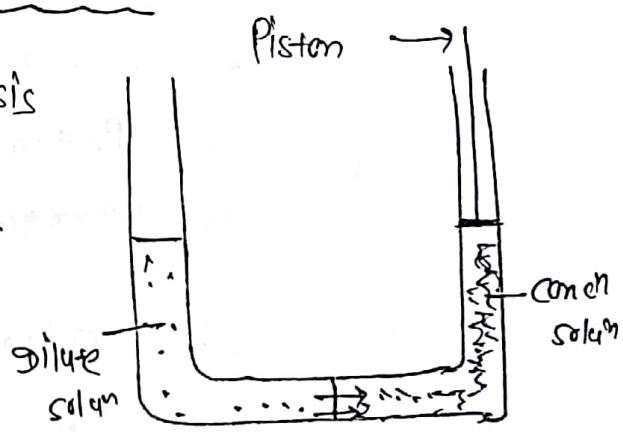
* Loss of hypertonic fluids eg ⇒ Mineralocorticoid deficiency
  ↳ Hypoosmotic dehydration ⇓
  Addison's ds



↓ ECF volume
↓ ECF osmolality

* OSMOTIC PRESSURE

- Pressure applied to stop osmosis
  ⇓
  Also " osmotic-pressure"



* 1 mosml of solute
  ↳ exert Osmotic pressure of 19.3 mm Hg

QQ Osmotic pressure of plasma
⇓
5500 mm of Hg (290 X 19.3 = 5597)
↳ slightly Lower than calculated b/c all solutes Not contributed in osmotic pressure

* Colloid osmotic pressure (oncotic pressure)

→ osmotic pressure exerted by colloids (proteins)

→ 25 – 28 mm of Hg

Osmotic Pressure = No. of mosm of solute × 19.3 × Osmotic coefficient (Reflection coefficient)

= 2 × 19.3 × 0.7

⇒

QQ Which proteins contributes Maxm to colloid os. pressure

a) Albumin

b) Globulin

c) Prothrombin

d) Fibrinogen

QQ Why albumin contribute to colloid osmotic pressure??

a) High conc^n; high Mw

b) Low conc^n; Low Mw

c) High conc^n; Low Mw (compare to other proteins it has less Mw; while its conc^n is high).

d) Low conc^n; High Mw

* Reflection coefficient :⇒ Freely permeable solute : Reflection coefficient (σ) = 0.

Impermeable solute

Reflection coefficient (σ)

↳ 1.0

↳ cell Membrane

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Solute & Reflection coefficient is zero

⇓

don't contribute to osmotic pressure

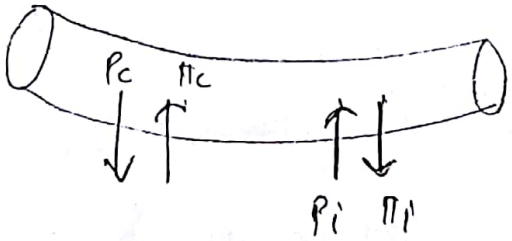
⇓

Kl/a " Ineffective osmoles".

eg ⇒ Alcohol
Glycerol
Urea ⇒ via facilated diffusion.
Glucose

* STARLING'S FORCES IN TISSUE CAPILLARY

PUSH = Hydrostatic Pressure
PULL = colloid osmotic Pressure



P_c ⇒ capillary hydrostatic Pressure.

π_c ⇒ capillary colloid osmotic Pressure

P_i = Interstitial fluid hydrostatic pressure

π_i = Interstitial colloid osmotic Pressure

***

Net force ⇒ $P_c - \pi_c - P_i + \pi_i$

P_c = 35 mm of Hg
π_c = 25 mm of Hg
P_i = −1 mm of Hg (bcz of continuous drainage into Lymphatics)
π_i = 0 mm of Hg

⇒ 35 − 25 − (−1) + 0

⇒ +11 mm of Hg.

QQ
AIIMS'15

Net pressure = 3 mm of Hg ;

P_C = 25 mm of Hg

Π_C = ??

P_i = 2 mm of Hg

Π_i = 7 mm of Hg

Net pressure = $P_C - \Pi_C - P_i + \Pi_i$

$3 = 25 - \Pi_C - 2 + 7$

$\boxed{\Pi_C = 27 \text{ mm of Hg}}$ ***

* Rate of tissue Fluid formation $\propto$ Net pressure

$(P_C - \Pi_C - P_i + \Pi_i)$

$= K_f (P_C - \Pi_C - P_i + \Pi_i)$

③ ④ ⑤ ⑥

$K_f \Rightarrow$ Ultrafiltration constant

= Permeability ✕ Surface area

① ②

all six (in No.) affected tissue fluid formation.

* Gn cirrhosis / Nephrotic syndrome } Hypoalbuminemia ↓ ↓ Π_C ⇓ ↓ Rate of tissue fluid formation ⇓ Result in edema

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

QQ organ ē Maxm P_C
↳ kidney

QQ. organ ē Maxm K_b
↳ kidney

QQ organ ē Maxm capillary permeability
(Most permissible capillary)
↳ Liver

Hepatic capillary — Sinusoidal
Glomerulus capillary — Fenestrated

BLOOD VOLUME

B. volume = 8% of body wt.
Plasma = 5% of body wt.
cells = 3% of body wt.

$$\text{Blood volume} = \frac{100}{100 - \text{Hematocrit value}} \times \text{Pl. volume}$$

Q ⇒ Pl. volume = 3L
Hematocrit = 40
Blood volume = $\frac{100}{100-40} \times 3 = 5$ Lit

CELL MEMBRANE

- Thickness = 7.5 nm
  OR
  75 Å

- Lipid Bilayer (Symmetrical Arrangement)
  +
  Protein ——function as——→
  - Receptors
  - Antigens
  - Transport proteins
  - Channel proteins
  - Structural proteins
  - Enzymes.

  → "Fluid Mosaic Model"

Protein
divided into
- Integral
- Peripheral
  ⇓
  Enzymes

QQ In terms of dry wt. of cell Membrane ; Maxm amount :→
- ⓐ Lipids
- ⓑ Protein ⇒ 52% of dry wt. of cell Membrane

Ration (1:1)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Cell adhesion Molecules (CAMs) :⇒

- Cadherins
- Integrins
- Selectins
- Protein belonging to IgG Superfamily.

* TIGHT JUNCTIONS :→ formed by proteins

⇓

- Occludins
- Claudins
- JAMs (Junctional Adhesion Molecule).

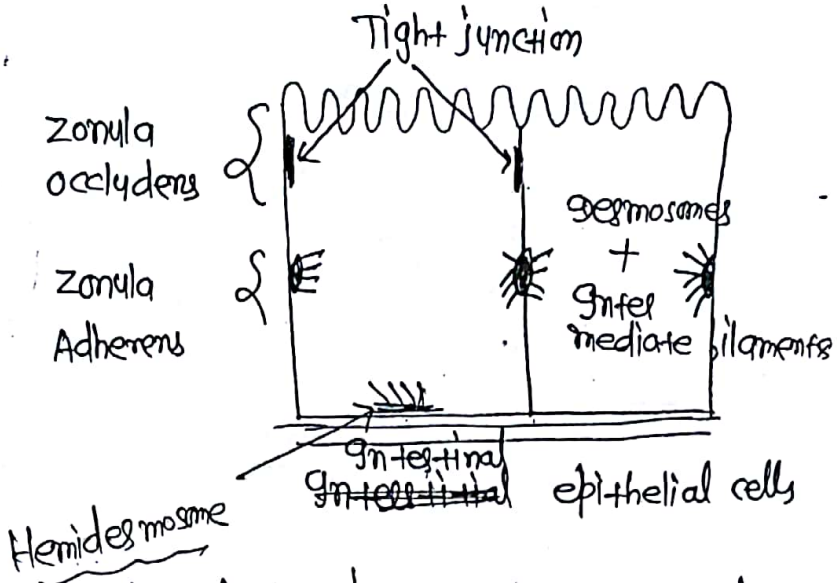
– Tight junctions are seen in ⇒ b/w endothelial cells of cerebral capillaries

↳ BBB ∞

⇓

Astrocyte induce formation of Tight Junction.

- b/w ~~Intestinal~~ Intestinal epithelial cells (Towards Luminal side)
- PCT
- CD

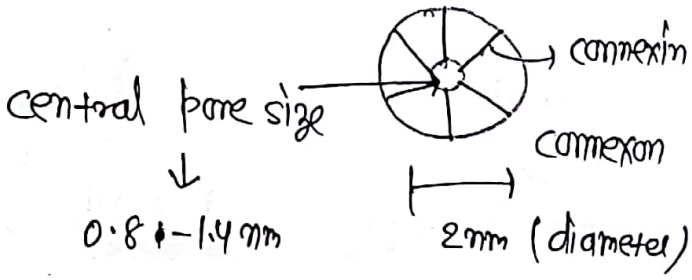


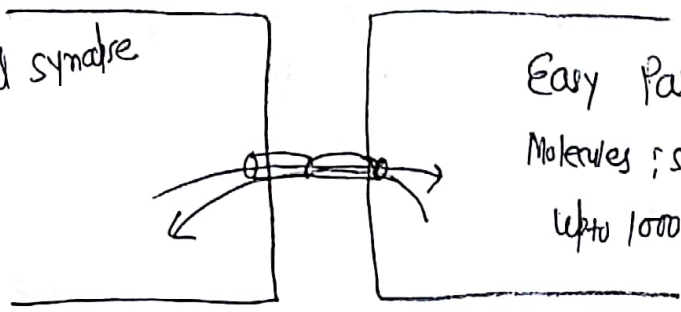
↳ helps in attachment to basement Membrane

GAP JUNCTIONS ⇒ Made of Protein Connexins.

⇓

Each Connexin has 6 subunits Klas "connexins"; which surround central pore





http://mbbshelp.com WhatsApp: +1 (402) 235-1397

- Gap junction ⟶ Yes Inter cellular junction

(N) Gap b/w Inter cellular ⇒ 20nm

by Gap junction Reduce

by 3nm

eg ⇒ Retina

Cardiac Muscle (Heart – Functional Syncytium)

Single unit type of Smooth Muscle

(In wall of hollow viscera

eg ⇒ GI Muscle)

* If connexon Mutation

↳ Charcot Marie tooth disease

(X-Linked disease).

- TRANSPORT ACROSS CELL MEMBRANE

Passive	Active
– "Downhill transport"	– "Uphill" transport
– Along Electrochemical gradient	– Against electrochemical gradient
– No energy Required	– energy Required
eg ⇒ Simple diffusion	– 1° Active
Facilated diffusion	– 2° Active
Non-ionic "	
Osmosis	

Simple diffusion

- all Lipid soluble substance;
- Alcohols; steroids
- Respiratory gases

Fick's Law of diffusion :⇒

$$J = -D \frac{A \Delta c}{\Delta x} \quad **$$

J = Net transport; · D = Diffusion coefficient

A = Surface Area

Δc = conc^n gradient.

Δx = thickness of Membrane

depends on → Lipid solubility. (Most imp.)
→ Molecular size / diameter
→ M_w

Diffusion coefficient ∝ $\frac{\text{Lipid Solubility}}{\text{Molecular diameter} \sqrt{M_w}}$

- if 2 Equal Lipid soluble substance; then Next imp. to determine diffusion coefficient ⇒ Molecular diameter
- $J \propto A$ (surface Area)

In emphysema ⇒

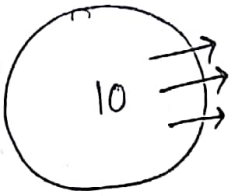
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* gn Pulmonary fibrosis ⇒ ↓ Diffusing capacity.
b/c of ↑ Thickness.

$$J = \frac{D A \Delta C}{\Delta X}$$

Shows direction of transport from higher Conc^n to Lower conc^n.

QQ. Membrane permeant Substance



Intracellular conc^n
Surface area
thickness of Membrane
} X 2

the extracellular conc^n ⇒ Same

Rate of transport ⇒

a) 2X ; ~~b) 3X~~ ; c) $\frac{1}{2}$; d) $\frac{1}{3}$

$$J = - \frac{D A \Delta C}{\Delta X}$$

Initially ⇒ 10-5 ⇒5
after double ⇒ 20-5 ⇒15
} Conc^n gradient

3 times Res

FACILLIATED DIFFUSION

Carrier Mediated

i) Stereospecificity

↳ Carrier protein is specific for a substance or structurally similar substance

Glucose Galactose

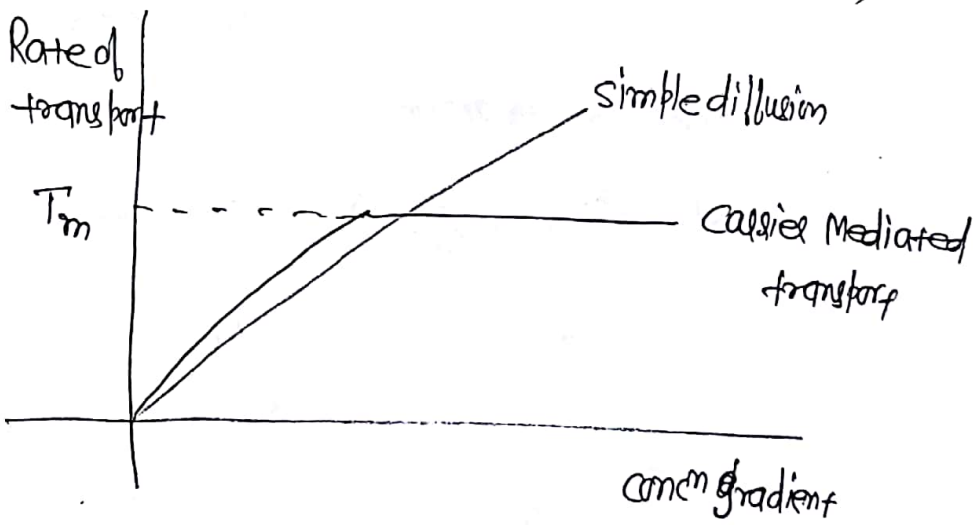
GLUT

So; Galactose ⊕ ves Absorption of Glucose

ii) Saturation Kinetics

Carrier protein – tend to get saturated

– T_m (transport Maxima)



eg :- GLUT ⇒ for Glucose;

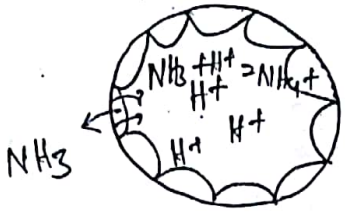
AA transporters

Urea transporters :- In Kidney ⇒ UTA1, UTA2, UTA3; UTA4

RBC, Vasa Recta ⇒ UTB

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

NON IONIC DIFFUSION



Collecting duct

Glutamine $\xrightarrow{\text{Glutaminase}}$ NH_3

* NH_3 Moves from cell to Lumen & form NH_4^+ inside the Lumen.

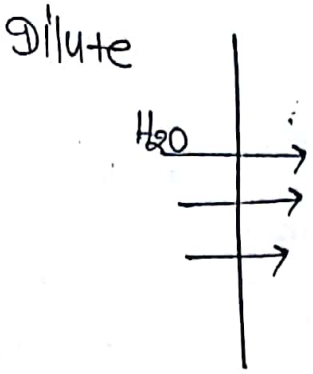
- Secretion of NH_3 → PCT (No H^+ in lumen to bind NH_3)
  → Collecting duct.

- Non-ionic diffusion of NH_3 seen in → Collecting duct.

eg :→ Secretion of NH_3 by collecting duct cells;
Excretion of weak acids & weak bases by the kidney;
Absorption of weak acids (salicylates) in stomach;
Absorption of bile acids in distal ileum.

OSMOSIS

- Movement of water from dilute to conc^{n} solution;



Q. Movement of H_2O is by →

~~a~~ Passive transport

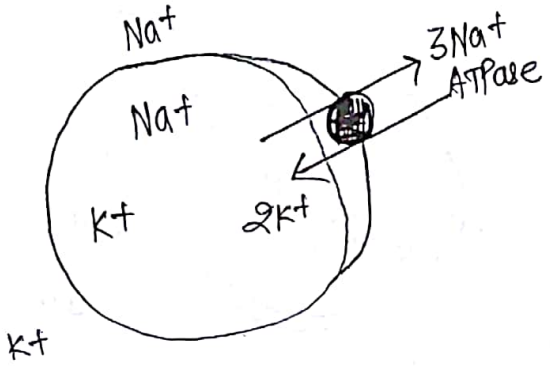
~~b~~ Osmosis

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

ACTIVE TRANSPORT

- Primary
  - Na^+ - K^+ ATPase
  - H^+ - K^+ ATPase
  - SERCA (Sarcoplasmic E.R. Ca^{++} Pump)
    - Seen in Muscle
- Secondary
  - Co-transport (symport)
  - Counter-transport (Antiport)

Na^+ - K^+ ATPase Pump



Coupling Ratio

3 : 2

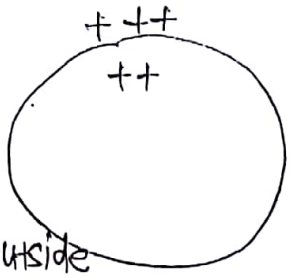
↳ b/c of two-stage process (1st ly Sodium goes & then Potassium go

- Electrogenic Pump

Net loss of one ⊕ve charge

↓

Inside become ⊖ve w.r.t. outside



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

RMP = −90mv;

Contribution of Na+ − K+ ATPase = −4mv;

⇓

No+ sullicient to Make RMP.

Na+- K+ ATPase Pump Utilize 25% of total energy of cell. (In Neurons ⇒ 75% of total energy of cell).

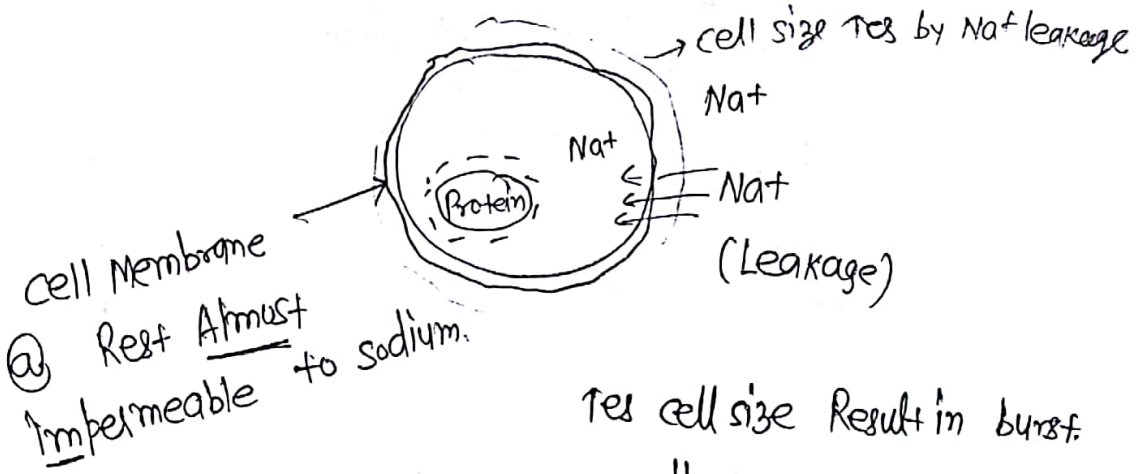
⇓

So; it contribute significantly to BMR

QQ. Most imp. Function of Na+-K+ ATPase Pump

⇓

Cell volume Regulation



Res cell size Result in burst.

⇓

Na+ K+ Pump do net loss of one osmotically active particle

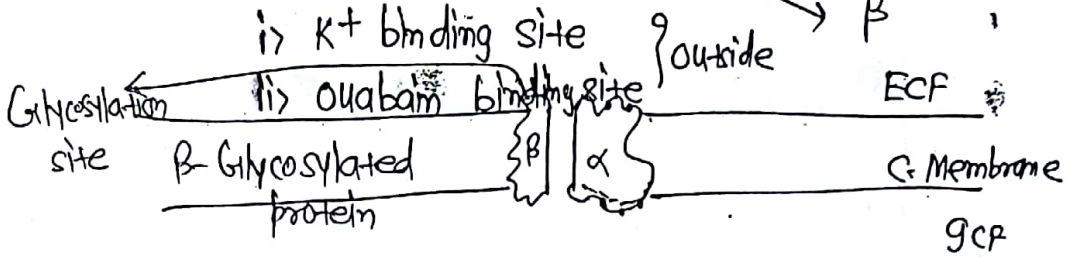
⇓

Maintains cell volume

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Structure of $Na^+ - K^+$ ATPase Pump ⇒

Heterodimer → α ⇒ Larger one (almost double of β = 100 units ↳ 55 units)
→ β



i) Na^+ binding site
ii) ATP binding site
iii) Phosphorylation site.
} Inside

Aspartate 376 ⇐ iii) Phosphorylation site.

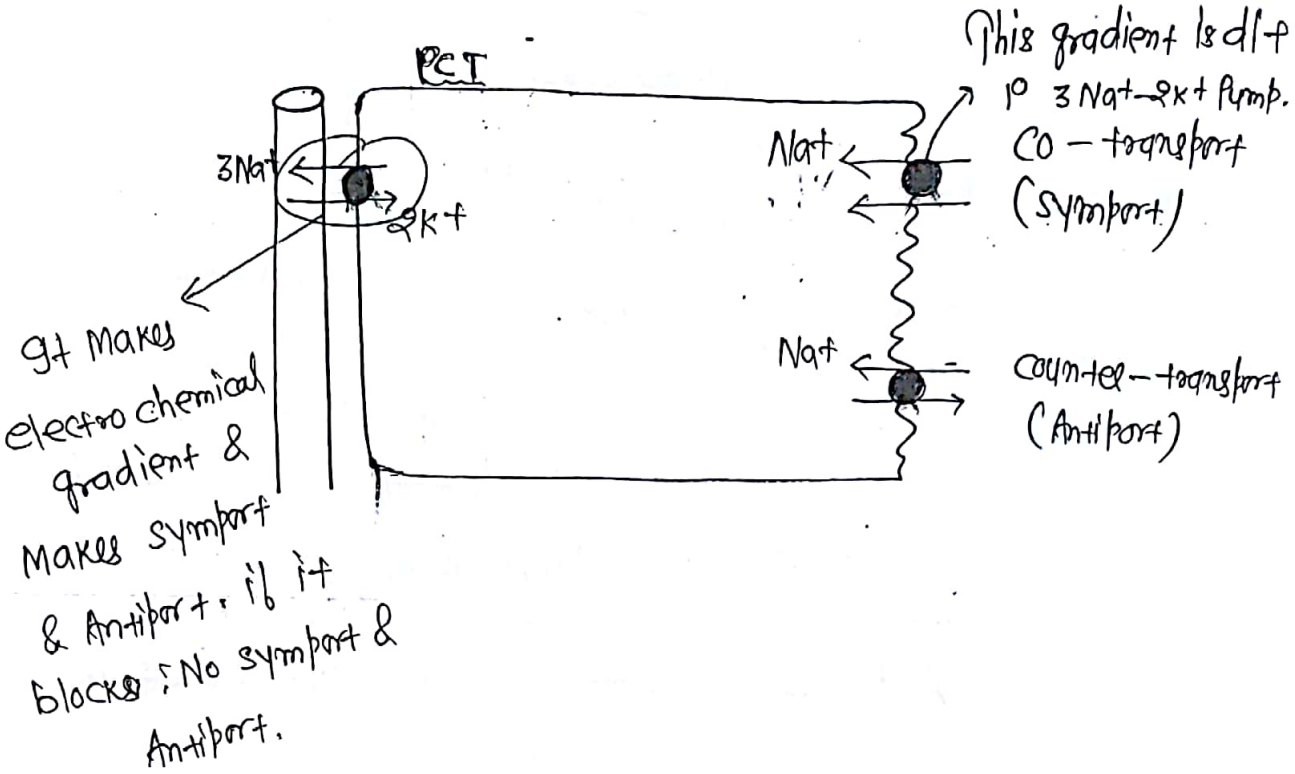
ATP —ATPase→ ADP + (i)P + Energy
(goes here)

* All the binding site is prt. @ α-Unit.

• β-Unit has 3 extracellular Glycosylation sites.

*	Hormones		No. of $Na^+ - K^+$ ATPase Pump	Activity Na^+K^+ ATPase Pump
①	Thyroid	→	↑ es	⊖
②	Aldosterone	→	↑	↑
③	Insulin	→	⊖	↑
④	Dopamine	→	⊖	↓
⑤	ANP	→	⊖	↓

Secondry Active Transport



Co-transport in PCT ⇒ Na+- Glucose
Na+- Amino acid
Na+- Ip (Inorganic phosphate)

Co-transport in Thick ascending Limb (TAL) ⇒ Na+- K+-2Cl⁻ Co-transport

In DCT ⇒ Na+ - Cl⁻ Co-transport

In intestinal epithelium ⇒ Na+- Glucose Co-transport
Na+- Amino Acid Co-transport

In Distal ileum ⇒ Na+- Bile salt Co-transport

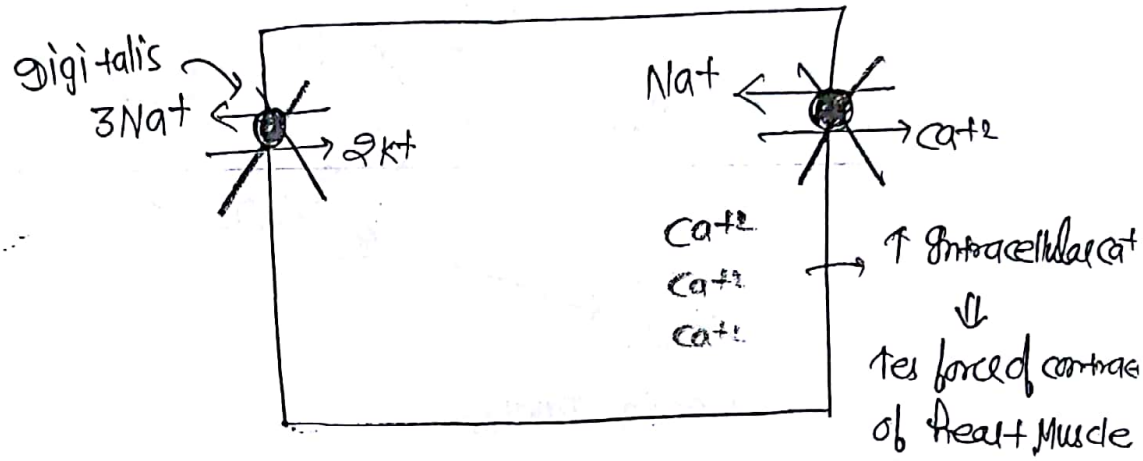
In Thyroid ⇒ NIS (Na+- Iodide Symport)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

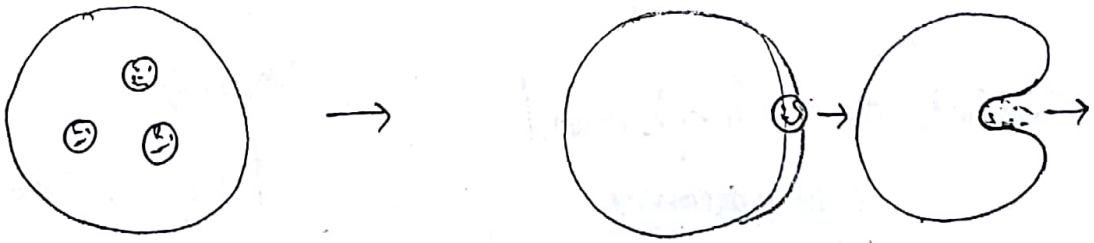
COUNTER TRANSPORT :→

In PCT :→ $Na^+ - H^+$

In Myocardial cell :→ $Na^+ - Ca^{+2}$



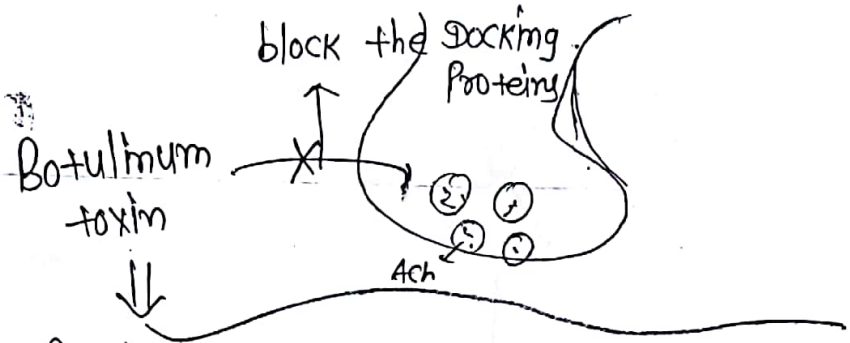
EXOCYTOSIS



- Yes Total Area of cell Membrane
- We Need ⇒ Ca^{+2}
  ATP
  Docking Proteins

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

- Docking Proteins
  - Syntaxin / T-SNARE Protein
  - Synaptobrevin / V-SNARE Protein
  - SNAP-25



- 2 Pathways of Exocytosis

Non-constitutive OR Regulated Pathway
⇓
Synthesis of Enzyme/hormone/Neurotransmitter
⇓ b/b
Processing
⇓ b/b
Storage ⇒ b/b ⇒ Release
(Most imp. Step)

Constitutive Pathway.
↳ also Regulated Pathway
⇓
Synthesis
↓ b/b; No storage
Release

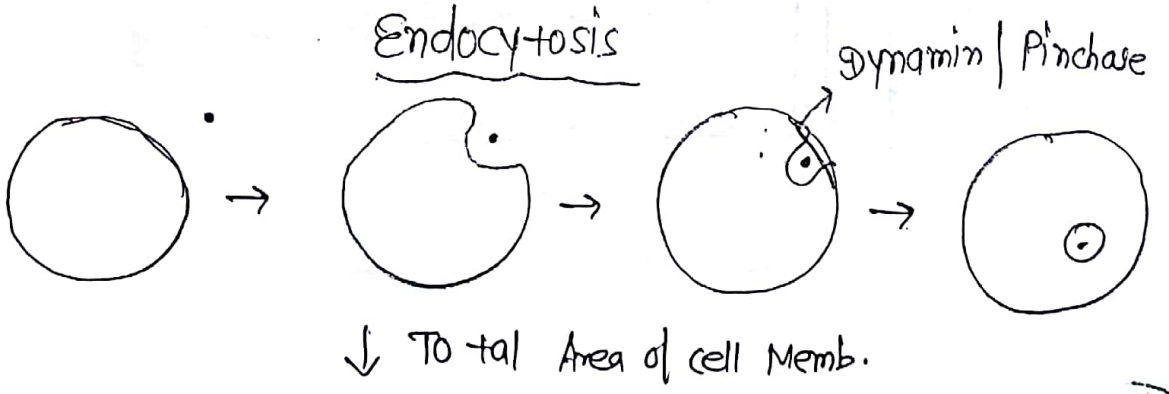
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

eg of Non-constituted Pathway :→

- Secretion of Insulin by β-cells
- Secretion of Glucagon by α-cells
- Secretion of Ach at NMJ;
- Secretion of selotonin by Raphe Magnus Nucleus cells
- Secretion of Enzyme by Pancreatic Acinal cells.

eg of constituted Pathway :→

- Immunoglobuling by plasma cells
- Collagen by fibroblasts

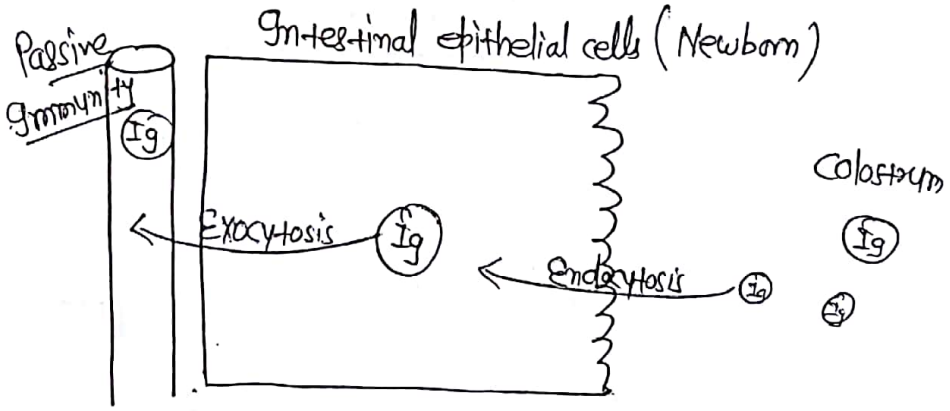


↓ Total Area of cell Memb.

⇒ Endocytosis & Exocytosis occur simultaneously; Never alone so; cell Membrane size = Constant.

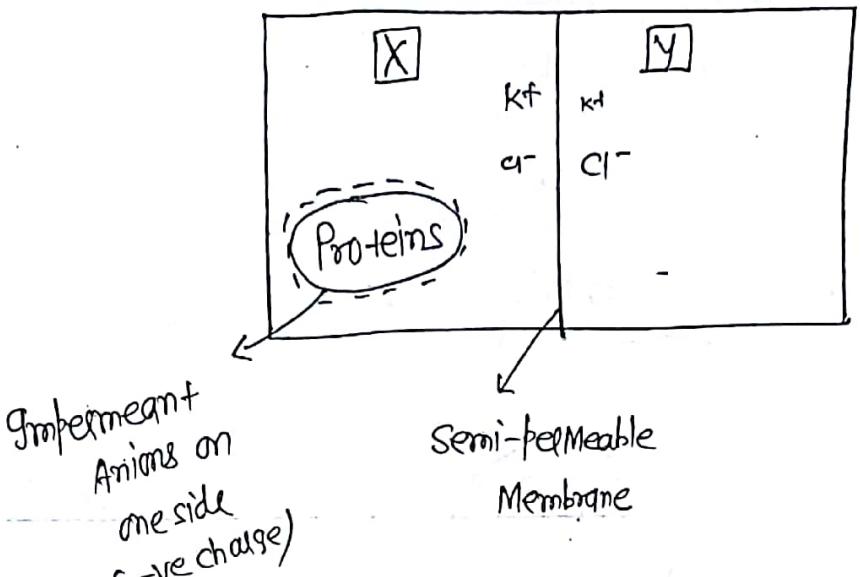
- Ca^{+2}
- ATP
- clathrin — Receptor Mediated Endocytosis
- caveolin — ⊕ in Endothelial cells
  - For Absorption of Nutrients
- Dynamin/ Pinchase

TRANSCYTOSIS / CYTOPEMPSIS



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

DONNAN EFFECT ⇒ Seen on diffusible ion ↓ Cl^- & K^+



At eqm ⇒ [K+] in X > [K+] in Y

Cl^- in Y > Cl^- in X

Result ⇒ i) Unequal distribution of diffusible ion @ eqm;

ii) More No. of osmotically active particles on one side

Where to see ⇒ b/w Intracellular & Extracellular compartment

– seen b/w Intravascular & Extravascular compartment

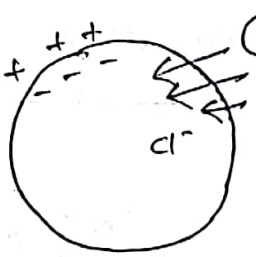
Gibbs – Donnan eqm ⇒ At eqm

$$\frac{[K^+_X]}{[K^+_Y]} = \frac{[Cl^-_Y]}{[Cl^-_X]}$$

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

$$\Rightarrow \underbrace{[K^+_X]\,[Cl^-_X]}_{\text{Products of diffusible ion on one side}} = \underbrace{[K^+_Y]\,[Cl^-_Y]}_{\text{Products of diffusible ion on other side}}$$

* NERNST Equation :⇒



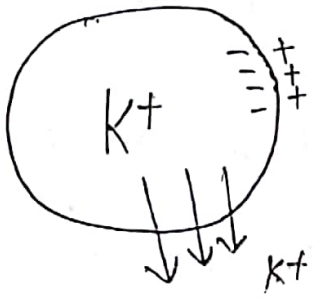
if cell Memb. is free Permeable to chloride

⇓

At a time ⊖ve charges inside the cell Repels Cl⁻ & stop Movement

⇓

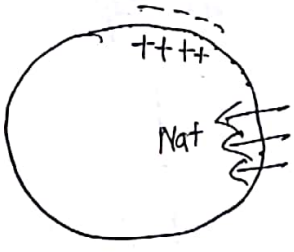
eqm potential. (⊖ve)



At a time ⊖ve charges Inside (Made by K+) cell attracts K+ & stop Movement

⇓

eqm potential (⊖ve)



At a time ⊖ve charges Inside cell Repel Na+ & stop Movement

⇓

eqm potential (⊖ve)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

• If the cell Membrane becomes freely permeable to ion

↓

Magnitude of potential difference for that ion at eqm is called "eqm potential / Nernst Potential". It can be calculated by Nernst eqn :-

(There is No change in concn of ion @ eqm).

$$E_{(mV)} = 2.3 \frac{R\pi}{FZ} \log \frac{C_1}{C_2}$$

R = Gas constant

T = Absolute temp.

F = Faraday constant

Z = valency

At 37°C;

$$2.3 \frac{R\pi}{F} = 61.5$$ **

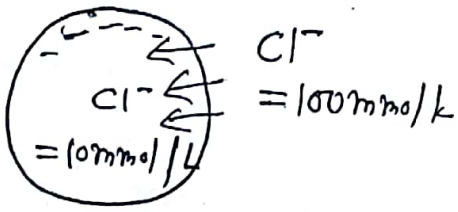
$$E_{(mV)} = \frac{61.5}{Z} \log \frac{C_1}{C_2}$$

http://mbbshelp.com WhatsApp +1 (408) 805-1307

Q9.

$2.3 \frac{RT}{F} = 60mv$

$E_{Cl^-} = ?$



2 steps Method

i) calculate the potential

ii) Decide sign

$E_{Cl^-} = \frac{2.3RT}{FZ} \log \frac{C_1}{C_2}$

$= \frac{60}{1} \times \log \frac{100}{10} = \frac{60}{1} = 60$

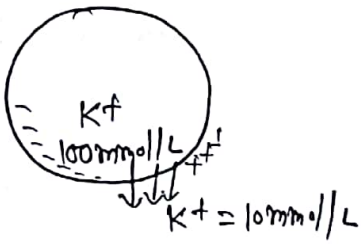
$= \ominus 60mv$

Q10

$2.3 \frac{RT}{F} = 60mv$

$E_{K+} = ??$

$E_{K+} = -60mv$



Q11

$E_{Na+} = +60mv.$

QQ $\frac{2.3RT}{F} = 60mv$

E_{Ca+2} in X w.r.t Y

X	Y
$CaCl_2$	$CaCl_2$
10mmol/L	100mmol/L
	Ca^{+2} freely permeable @ here

$\frac{2.3RT}{FXZ} \log \frac{C_1}{C_2} \Rightarrow \frac{60}{2} \log 10.$

$= +30mV.$

* (N) Value of Eqm potential ⇒

$E_{K+} = -90mv$

$E_{Cl-} = -70mv$

$E_{Mg+2} = 0mv$

$E_{Na+} = +61mv$

$E_{Ca+2} = +125mv$

Resting Membrane potential

- GOLDMAN HODGKIN KATZ eqn / OR / Constant field eqn
  - → Concn gradient of 3 ions (Na^+; K^+; Cl^-)
  - Cell Membrane permeability.

$$RMP = -61.5 \log \frac{C_{Cl^-_o} \times P_{Cl-} + C_{K+_i} \times P_{K+} + C_{Na+_i} \times P_{Na+}}{C_{Cl^-_i} \times P_{Cl-} + C_{K+_o} \times P_{K+} + C_{Na+_o} \times P_{Na+}}$$

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

At Rest; $P_{K+} >>>> P_{Cl-} > P_{Na+}$

QQ
- Which ion contribute Maxim to RMP
- Most diffusible ion @ Rest
- Cell Membrane is most permeable to which ion @ Rest

} $K+$

QQ
Tes Extracellular $Na+$ effect on RMP ??

a) More ⊖ve

b) Less ⊖ve

c) ~~Same~~

*

		RMP
Most Neurons	⇒	−70mv
Large Motor Neurons	⇒	−90mv
Skeletal Muscles	⇒	−90mv
Cardiac Muscles	⇒	−90mv
PaceMaker Cells	⇒	−50 to −60mv
Smooth Muscle cells	⇒	−45 to −65mv
Hair cells (cochlea)	⇒	−65mv
Rods & cones	⇒	−40mv
RBCs	⇒	−10mv

* RBC Membrane @ Rest
↳ $P_{Cl-} > P_{K+}$

P_{Cl} = Permeability of Cl-
P_{K+} = Permeability of $K+$

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Q9. Effect of hypokalemia on RMP ⇒

↓ K+

↓

↑ conc^{n} gradient for K+

↓

↑ tendency of K+ to leave cell
(↑ diffusion potential of K+)

↓

Inside becomes More −ve w.r.t outside

↓

K/as "Hyperpolarization"

↖ Less in potential
↓es in excitability.

K+ 140 mmol/L

K+ (3.5 - 5.0 mmol/L)

140 − 5 = 135

140 − 2 = 138

Symptoms ⇒ ① Muscle weakness (M/c symptom)

Q9 Effect of hyperkalemia on RMP ⇒

↑ K+

↓

↓es conc^{n} gradient of K+

↓

K+ 140 mmol/L

K+ 3.5 - 7.0 mmol/L

conc^{n} gradient = 140 − 5.0 = 135

= 140 − 10.0 = 130

↓

↓es tendency of K+ to leave the cell

↓

↓es Diffusion potential of K+

↓

Inside becomes Less ⊖ve w.r.t. outside

↓

K/a "Depolarization"

↳ ↓es Polarization

↑es excitability

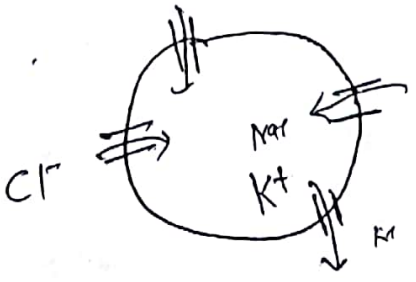
M/c symptom ⇒ Arrythmia

* CHANNELS → Voltage gated channels

→ Ligand Gated channels

→ Mechano Sensitive channels

Ca^{+2} → Phosphorylation



via channels ions comes only according to their Conc^n gradient.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

- Dimer → Cl^- channels (In bacteria, Animals)
- Trimer → ENaC
  α, β, γ
  ↙
  transport Na^+.
- Tetramer → K^+ channel

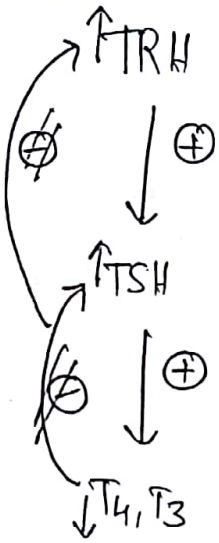
  Aquaporin
- Pentamer → Cl^- channel (In humans)
  Ligand gated channel (Ach Receptors)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

FEEDBACK MECHANISM

Negative

- Most control system function as Negative feedback Mechⁿ.
- Stabiliging Mechⁿ.



Positive

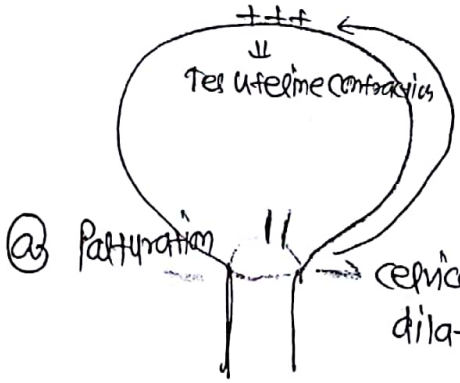
- eg ⇒ C = clotting;
  Ca^{+2} Release from Sarcoplasmic Reticulum during Muscle contraction.

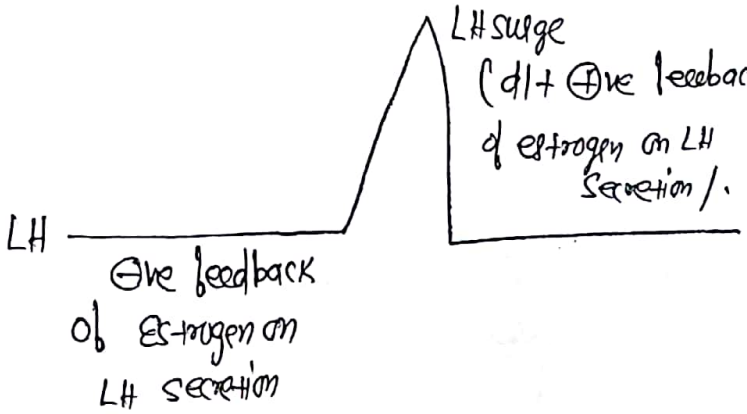
L = LH surge

A = Action Potential

P = Parturation

S = Shock

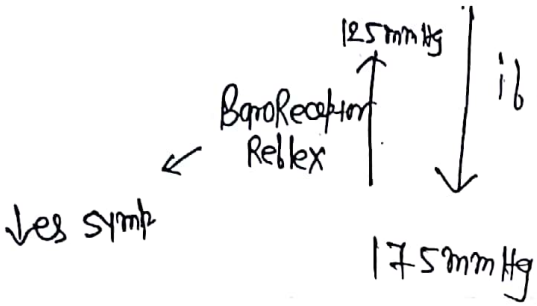




* Gain of the feedback system :⇒

Gain ⇒ correction over Error is gain. = $\frac{\text{correction}}{\text{Error}}$

(99) (N) Mean Arterial Pressure ⇒ 100 mm Hg



⇒ Correction = 50 mm of Hg.
Error = 25 mm of Hg

Gain = $\frac{50}{25}$ 2 = 2

(98) (N) MAP

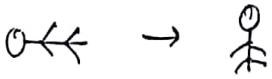
100 mm Hg —— Hemorrhage ——→ 70 mm Hg

90 mm Hg ←—— BR Reflex
Tes symp.

Gain = $\frac{20}{10}$ = 2

* Baroreceptor control Mech^{n} — Temp. control system

Gain 2 — (33)

(88)  ↓ in his BP by 10 mm of Hg;
Baroreceptor ↑ his B.P by 8 mm Hg

Gain ⇒ 4 = $\frac{8}{2}$ = 4.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

FEED FORWARD MECHANISM ⇒ K/a "Adaptative control"

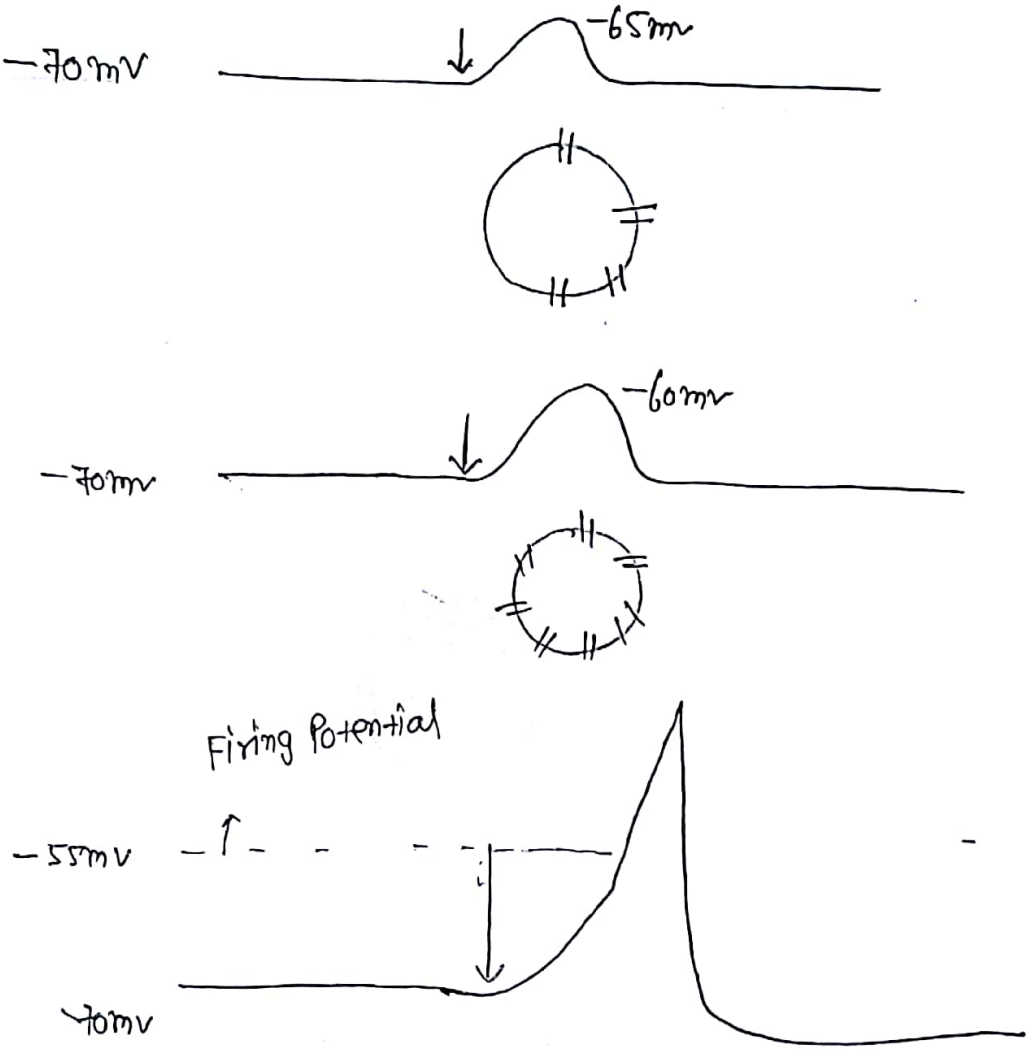
↳ Seen in control of Motor activity

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

NERVE PHYSIOLOGY

Local Potential & Action Potential :→



Local potential

- Graded Response
- By Subthreshold Stimuli
- Decremental changage
  - Yes over time & place.
- Not self propagated
- May/Maynt followed by Some action.
- Depolarising / Hyperpolarising
  - ⇓ EPSP
  - ⇓ IPSP (Inhibitory Post-Synaptic Potential).
- Summation ⊕
  - SPATIAL
    - ↓ over space
    -
    - No. of Subthreshold Stimuli given simultaneously ⇓ Produce Action potential
  - TEMPORAL
    - ↓ over time
    -
    - ↑ frequency of Sub-threshold Stimuli ⇒ Produce Action potential

Action potential

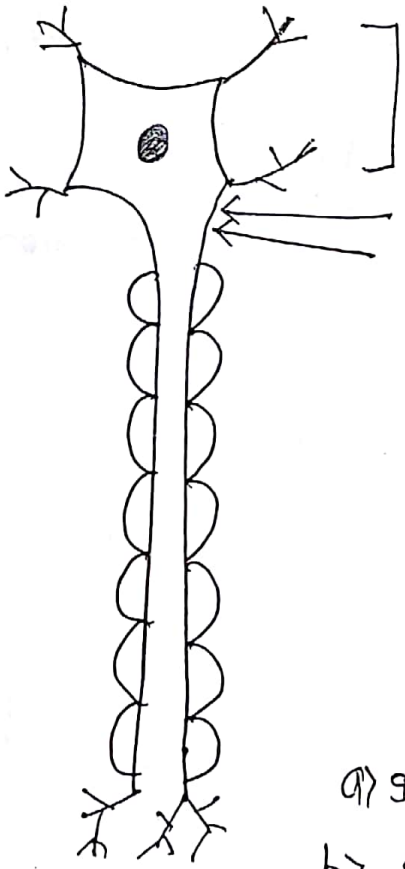
- All-or-None Response
- by threshold or supra-threshold stimuli
- travel ✗ decrement
- Self propagated
- followed by Same action
- Always depolarizing.
- Summation ⊖

LOCAL POTENTIAL

ACTION POTENTIAL

eg ⇒ . EPSP ;
. IPSP ;
. Receptor potential ;
(Generator potential)
. Motor end plate potential
(At NMJ)

* Site of generation of Action potential :⇒



SOMA Dendritic zone QQ
(Graded electrogenesis)

Axon hillock (Part of cell body) Very high conc^n of Na+ channel / unit Area
Initial segment

QQ. Site of generation of Action Potential in Spinal Motor Neuron

a) Dendrites
b) Soma
~~c) Axon hillock~~
d) Axon

a) Dendrites
b) Soma
c) A-H
~~d) Initial segment.~~

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Initial Segment can generate Action potential b/c of
  - ↳ very high conc^n of Nat channel / unit area

QQ Conc^n of Nat channel / unit Area

Nodes of Ranvier ⇒ 2,000 - 12,000 / sq Micrometers

Initial Segment ⇒ 500 / $(\mu m)^2$

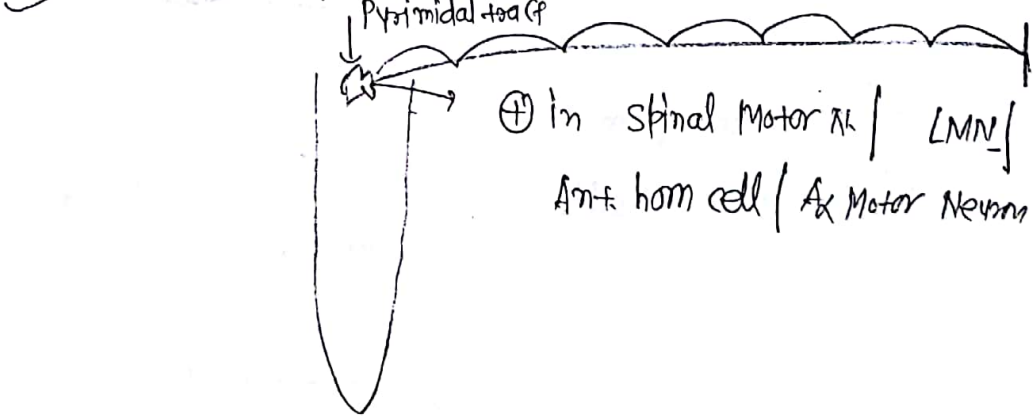
Sulfae of Myelin ⇒ 25 / $(\mu m)^2$

↙

Least

QQ Site of Generation of Action potential in Sensory Neuron :

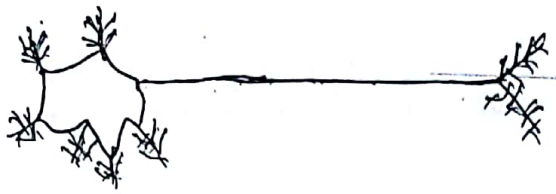
i) Soma
ii) Dendrites
iii) Initial segments
iv) Initial / 1st Node of Ranvier



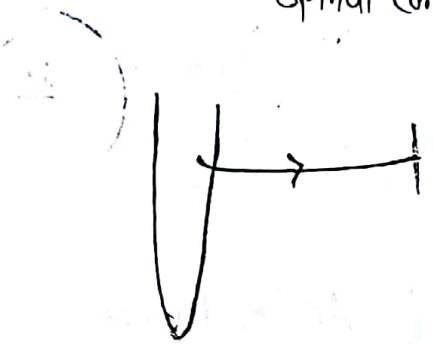
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Spinal Motor Neuron

- Multipolar Neuron



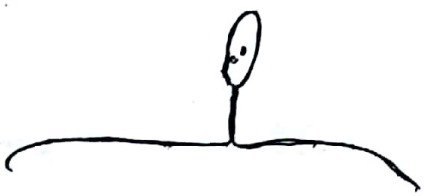
- Cell body – Anti Horn of Spinal cord



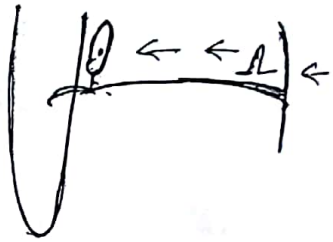
- Carry impulses from Spinal cord to Periphery

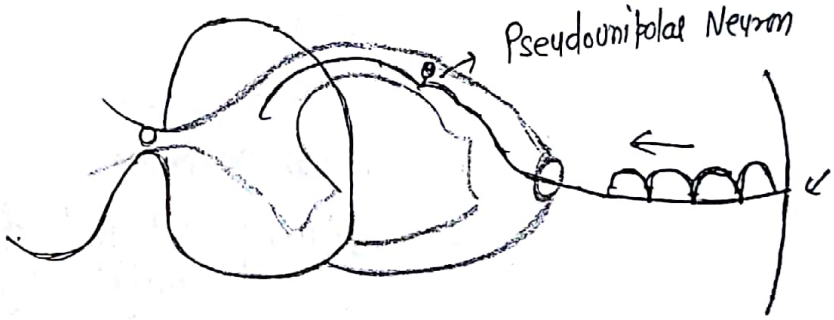
1st order sensory Neuron

- Pseudounipolar Neuron



Dorsal Root Ganglion

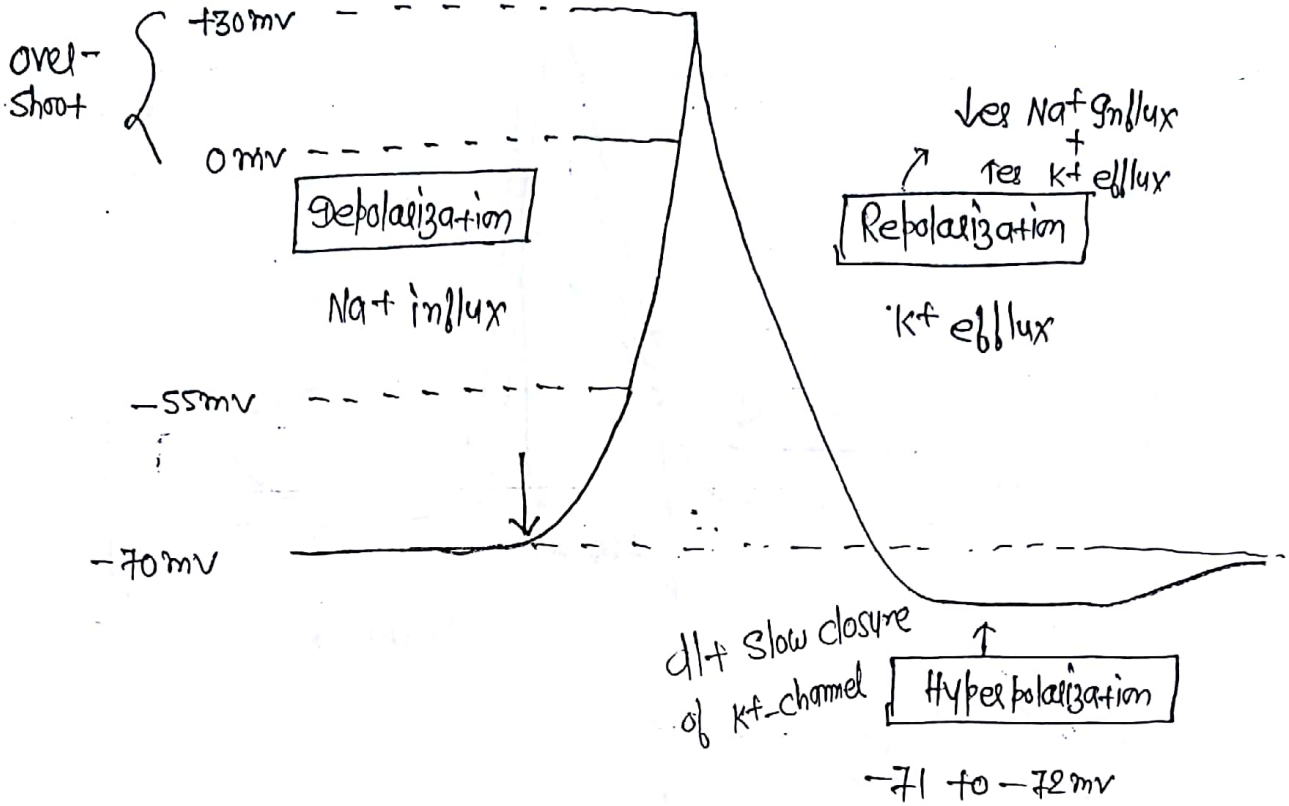




- Carry Impulses from Periphery to Spinal cord.

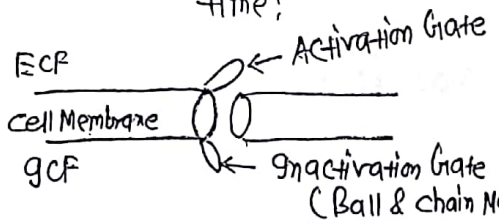
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Phases of Action potential :⇒



Na+ channels

- Fast channels
- -70 to +30mv
- closure is dependent on time:

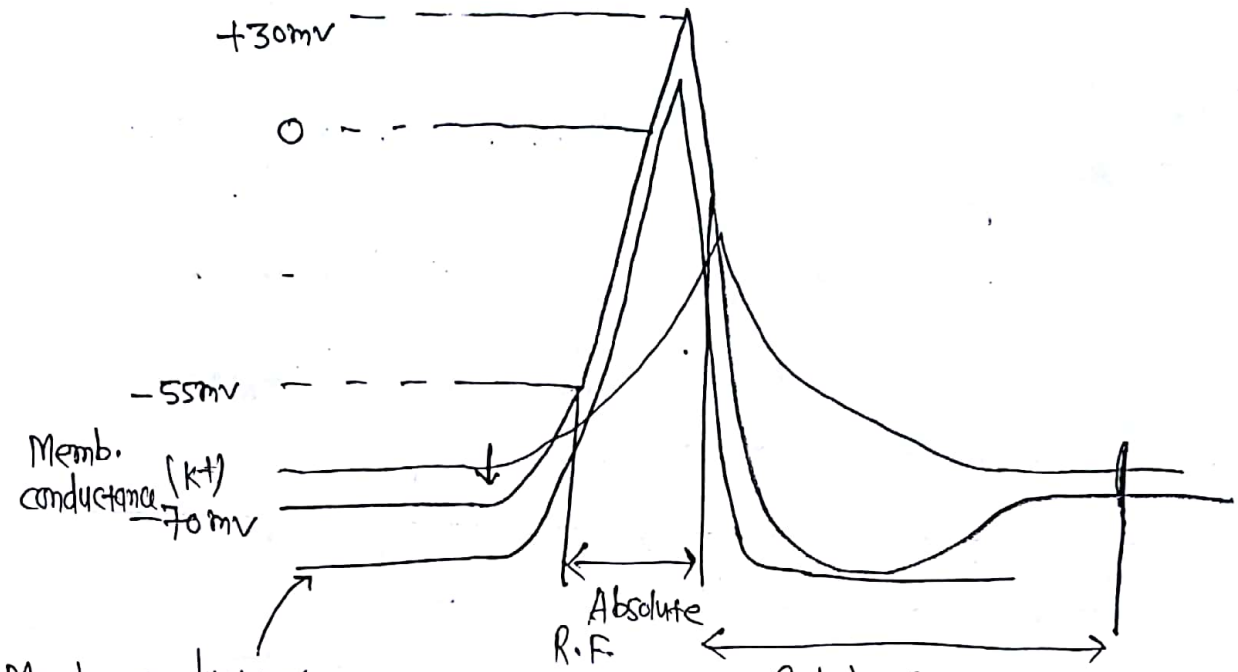


K+ channels

- Slow channels
- -70 to +30mv
- closure is dependent on time

* Membrane conductance for Na+ & K+ during Action potential

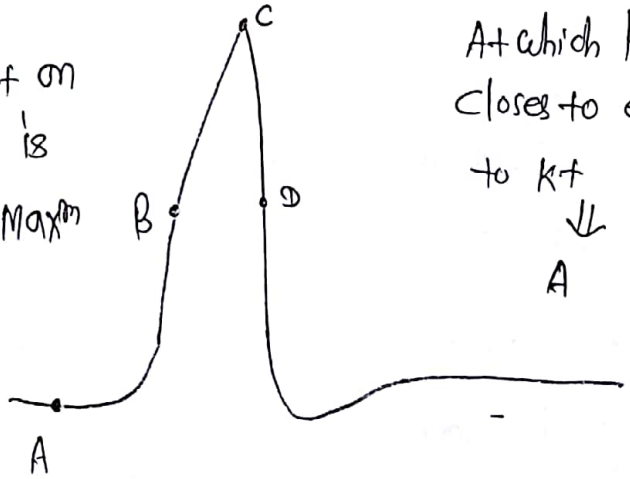
↳



QQ. At which point on Action potential is Memb. conductance Maxm for Sodium

⇓

C



At which point on A.P. closes to equilibrium potential to K+

⇓

A

At which point Memb. conductance Maxm for K+

⇓

D

At which point on A.P. closer to E_{Na^+} (equilibrium potential of Na+)

⇓

C

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

REFRACTORY PERIOD

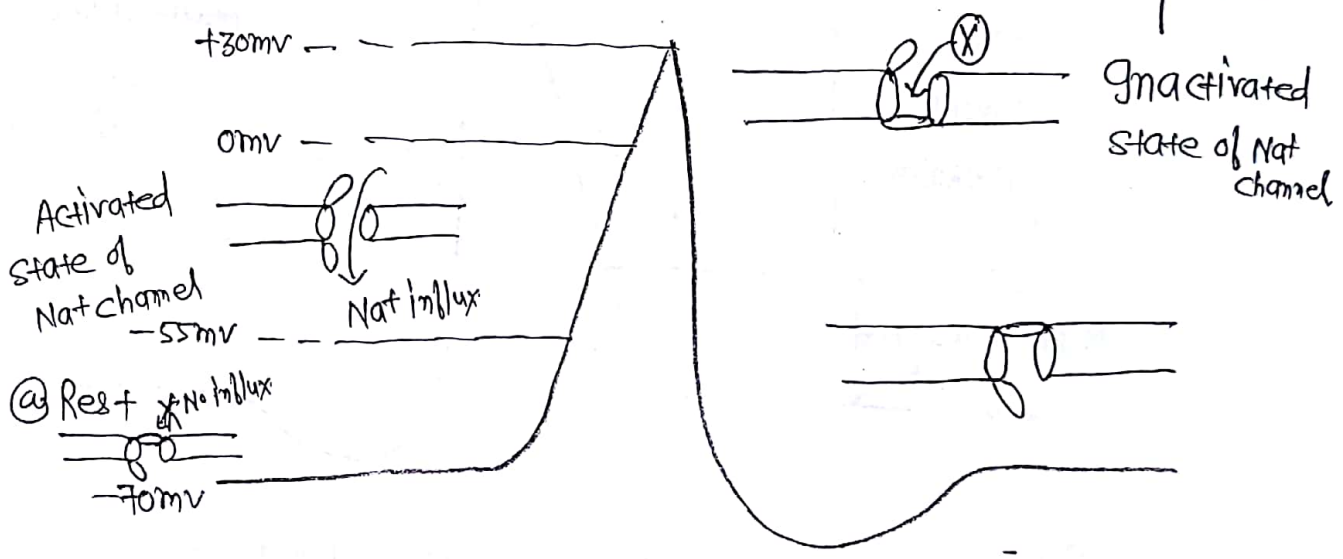
Absolute Refractory Period

From firing level till Repolarization is 1/3rd complete

It is Responsible for Absolute Refractory Period

Relative Refractory Period

From 1/3rd Repolarization till End of hyperpolarization

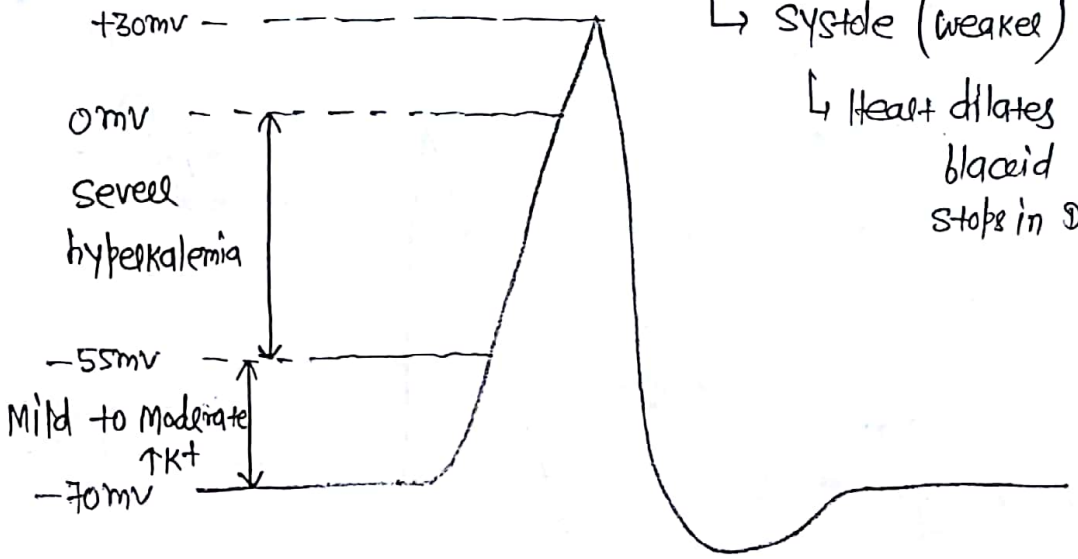


http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Hyperkalemia

Mild – Moderate hyperkalemia
↓
Depolarization
↓
↑ excitability
↓
Arrythmia

Severe Hyperkalemia
↓
Persistant Depolarization State
↓
↕ excitability (blc of Inactivated Nat channel)
↓
↓ contractility
↳ systole (weaked)
↳ Heart dilates
flaccid
stops in Diastole



QQ. Neuron is least excitable during :-
a) Depolarization
b) Repolarization
c) Hyperpolarization

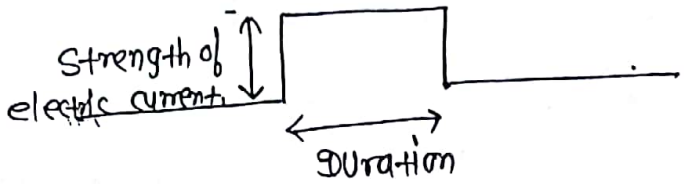
Qn hypercalcemia ⇒ Heart stops in systole (calcium Rigor)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

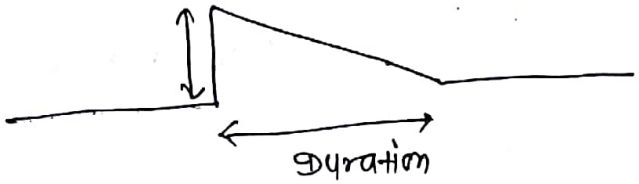
ACCOMODATION

– It is slowly Rising Subthreshold stimulus ; fails to produce a Response.
↳ electric current.

A)

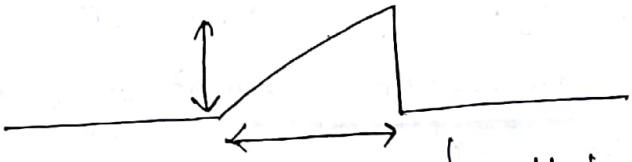


B)



Least Likely to Reproduce Response

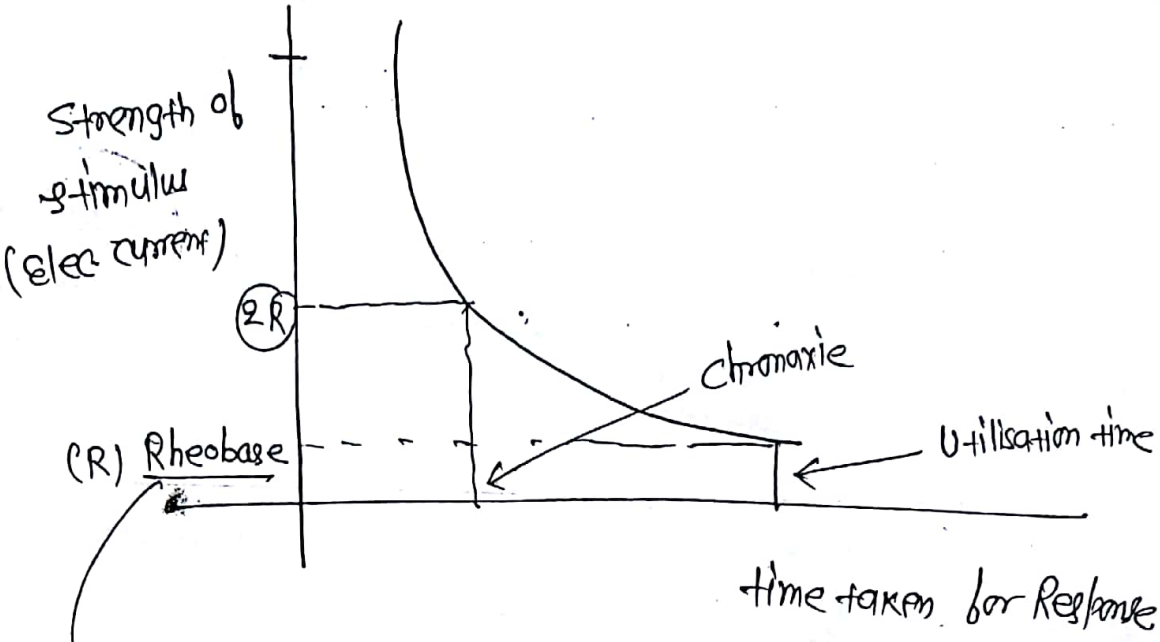
C)



Slowly Rising.

↳ Nat channel open & Kt also open
⇊
b/c time taken to open; it has

STRENGTH - DURATION CURVE



→ Minm strength of stimulus (E. current) ≤ when applied for a prolonged / Not defined Period of time; produces a Response

(2) Utilisation time ⇒ Time taken by Rheobase current to produces a Response.

chronaxie ⇒ Time taken by a current ; which is twice the Rheobase

** {Lessel the Chronaxie ⇒ More excitable tissue}

$Chronaxie_{(Nerve)} < Chronaxie_{(Sk.\ Muscle)}$

- Nerve libres ⇒ (A) (B) (C)

$chr_A < chr_B < chr_C$

↑ Diameter
↑ Surface Area
↑ No. of Nat channel
↓ time taken for Response

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Chronaxie $_{\text{Skeletal Muscle}}$ < Chronaxie $_{\text{C.M.}}$ < Chronaxie $_{\text{Smooth Muscle}}$

QQ. After N. injury ⇒ Yes Chronaxie

but as Regeneration begins ⇒ Yes Chronaxie

* After N. injury → Strength–duration curve done in Regular intervals

* FACTOR AFFECTING VELOCITY OF CONDUCTION OF N. IMPULSE

① Diameter ⇒ Large diameter

⇓

↑ Surface area

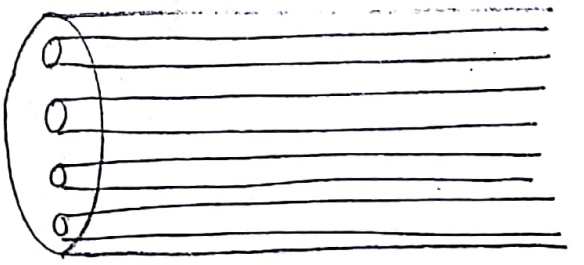
⇓

↑ No. of Na+ channel

⇓

Yes Velocity.

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots$$



↑ Diameter ⇒ ↓ Axoplasmic Resistance (R_A or R_i)

↓

↑ Velocity of conduction

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

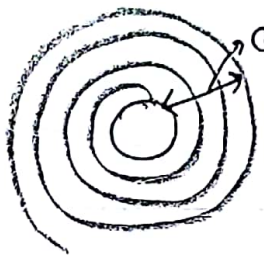
Q. Large diameter N. fiber has

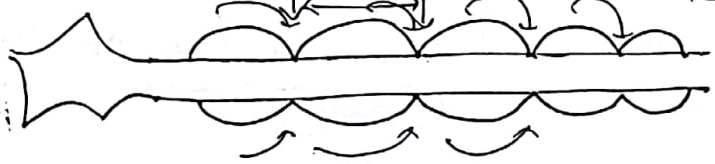
a) ~~Low R_A~~ (→ ∴ Fes velocity)

b) High R_A

② Myelin ⇒ • Lipid Rich ;

• Insulators. like work





Saltatory conduction

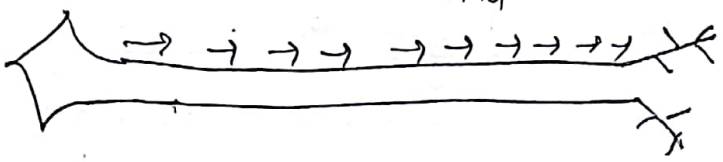
Myelin Nerve → high Memb. Resistance (R_A)

↳ it Fes velocity of conduction.

QQ A Large diameter ; Myelina N. fiber has Low Ra ; high $\frac{R_M}{4}$ Membrane Resistance

QQ Faster velocity ⊕ in N. fiber has

High $\frac{Rm}{Ra}$ Ratio.



Unmyelinated N. fibre

⇓

Less Resistance, but velocity Less as compare to Myelinated N. fibre

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Small diameter always Unmyelinated.

③ Membrane capacitance ⇒

- Cell Membrane ⟶ High capacitance
  - Lipid bilayer
    - Acts as Parallel plate capacitor
  - + Myelin
    - ↑ Res Memb. Resistance
    - ↓ Ves Memb. capacitance

QQ. Large diameter ; Myelin N. fiber has Low R_A ; High R_M ; Low capacitance

QQ Fastest velocity ⊕ in N. fiber ∵ High Resistance (RM) Low capacitance

if Nothing in question takes R_M ⇒ Resistance

QQ Nodes
- Low Resistance (RM) ; High capacitance

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

CLASSIFICATION OF NERVE FIBERS

ERLANGER & GASSER CLASSIFICATION

- It is for Sensory, Motor; Autonomic kind of Neurons

A
- A — $A\alpha$
  - $A\beta$
  - $A\gamma$
  - $A\delta$

(Myelinated)

↓ Diameter
↓ Velocity

B — B

C — C = Unmyelinated

$A\alpha$ = Somatic Motor ----------> No Number given

Proprioception (Fastest Sensory conduction) ----> I

- I_a ((Sensory fibres from Muscle spindle)
- I_b (Sensory fibres from Golgi tendon organ).

$A\beta$ = Purely Sensory fibres

↳ for Fine touch; Vibration
Proprioception (for Muscle spindle)
Deep pressure (POKING) } ---- II

$A\gamma$ = Motor fibres to Muscle spindle ---------- No Number given

LLYOD & HUNT'S CLASSIFICATION

- It is for Sensory Neurons
- Numerical classification

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

A_δ = Fast Pain, Temperature (cold) } — III
Somatic Mechanoreceptors

B = Pre ganglionic Auto. — No Number given

C = Post ganglionic Sympathetic — No Number given

↳ Crude touch, Pressure, Slow pain, Temp (cold & warmth); ITCH; Tickle — IV

Total No. of Neurons = 100 Billion Neurons
⇓
Glial cells ??? Neurons

- % of Human genes code for CNS = 40 %
- Unmyelinated = Type IV
- Most Numerous = C
- Fine touch = Aβ
- Crude touch = C
- Pressure = C
- Deep pressure = Aβ
- Vibration = Aβ
- Slow pain = C
- Fast Pain = A_δ
- cold = A_δ & C
- warm = C

Afferent from Muscle spindle
⇓
Ia, II

Afferent from Golgi tendon organ
⇓
I_b

Motor to Extrafusal Muscle fibers
⇓
A_α

Motor to Intrafusal Muscle fibers
⇓
A_γ

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

SUSCEPTIBILITY

PRESSURE ⇒ A > B > C

↙

A_α is More Susceptible (Saturday Night Palsy OR Sunday Morning Palsy)

HYPOXIA ⇒ B > A > C

LOCAL ANESTHESIA ⇒ C > B > A X

B > C > A X

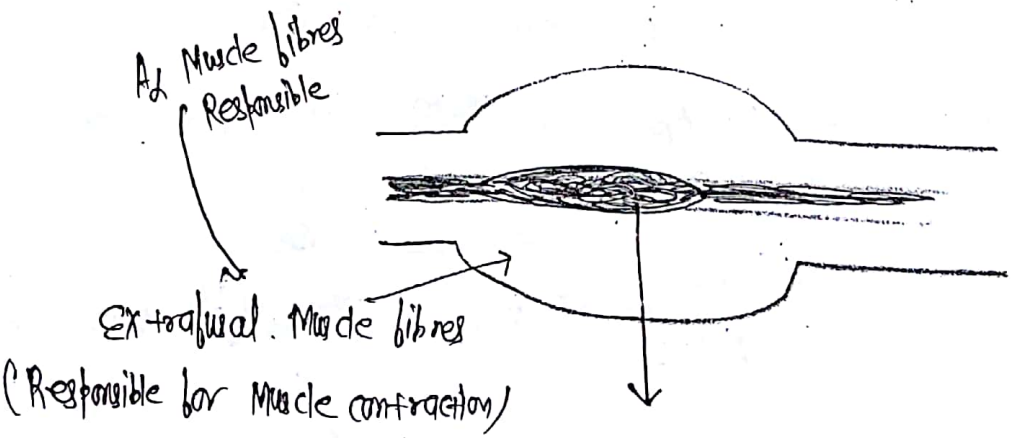
$A_\gamma > A_\delta = A_\beta > A_\alpha > B > C$ AIIMS Nov 19

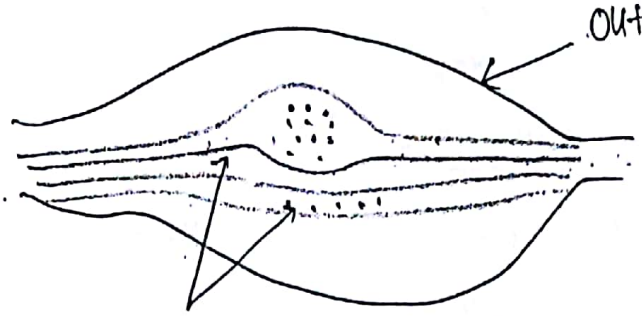
↓ Most Susceptible

↳ Least Susceptible

MUSCLE SPINDLE

- Receptor for Muscle Length (Stretch)





Intrafusal Muscle fibers (5-6 in No.)

Nucleal Bag (1-3)

Nucleal chain (4-5 in No.)

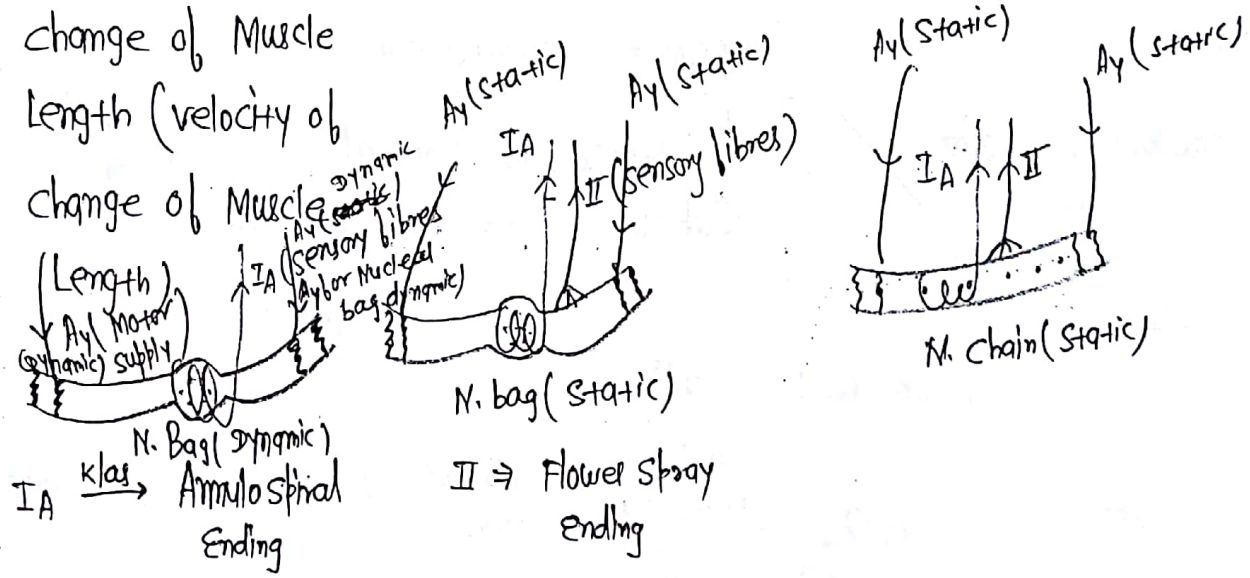
Nucleal Bag (Dynamic)

Nucleal Bag (Static)

Means for N. chain (Static Response)

Detects Rate of change of Muscle Length (velocity of change of Muscle Length)

Detect Steady Length.



IA → Klas → Annulospinal Ending

II ⇒ Flower Spray Ending

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Muscle spindle can be stimulated in 2 ways :-

i> ↑ Length of Muscle (Stretch)

⇓

Stimulate Muscle spindle

ii> ↑ Ay Motor Neuron discharge

⇓

causes Contraction of Ends of Intrafusal Muscle fibers

⇓

Stretches Receptor portion of Intrafusal Muscle fibers.

⇓

↑ Firing Rate

(Stimulate Muscle spindle).

AXOPLASMIC TRANSPORT

conduction of Action Potential

⇓

Ele.

↳ Refers to Physical transport of Substance through Axoplasm

↳ We Need. Ca^{+2}

ATP

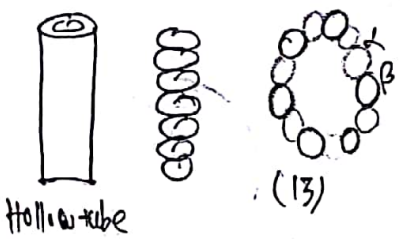
Microtubules

↳ Hollow tube

↳ Made of tubulins — α — β

Anterograde transport. ↓

↑ Retrograde transport



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Microtubules ⇒ 2 Ends

"+" ⇓ Assembly end

"−" ⇓ Disassembly End.

↳ ↑↑ Serve as "Tracks".

Microfilaments ⇒ Solid tubes
(Sometimes serve as "Tracks")

Molecular Motors ⇒ Kinesin
Dyenin
Myosin V

Types of Axoplasmic transport

Fast

- Antelograde
  - ↳ 400 mm/day
  - towards "+" end
  - Requires Kinesin ; Myosin V
  - Transport ⇒ Neuropeptide; Vesicles; Mitochondria; Reticulum ; Lysosomes
- Retrograde
  - ↳ 200 mm/day
  - towards "−" end
  - Dyenin

  Transport ⇒ Neurotropic virus (Rabies virus), Tetanus toxins! Nerve growth factors

Slow always Antelograde
0.5 to 10 mm/day

Q9 Neurofilaments doesn't Require for Axoplasmic transport.

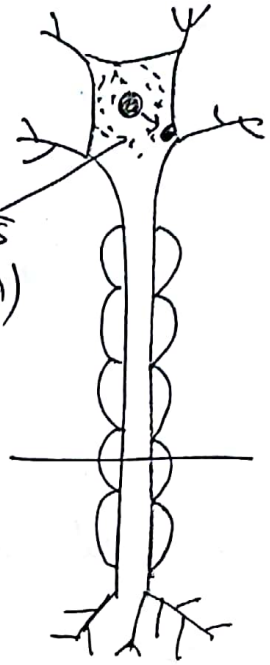
WALLERIAN DEGENERATION

- Seddon's classification of Nerve Injuries :-

		Degeneration	Regeneration
NEUROPRAXIA	⇒ Temporary loss of Function	−	−
AXONTEMESIS	⇒ Neurilemma is Intact	+	+
NEURONTEMESIS	⇒ Neurilemma is destroyed	+	−

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

WALLERIAN DEGENERATION



Change in cell body

⇒ early 24–48 hrs

↳ Chromatolysis

Nucleus Moves to Periphery

Change in Distal segment

Within few hours of injury

↳ Swelling of Axis cylinder

On 3–5 days

↳ Axonal degeneration

8th day

↳ Myelin Degeneration starts

32nd day

↳ Myelin Degeneration complete

* Similar changes in Proximal segment but upto Nearest Node of Ranvier

QQ 1st change after N. injury ⇒

~~a)~~ Chromatolysis
b) Axonal deg.

a) Chromatolysis
~~b)~~ Axonal degeneration starts (Swelling)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

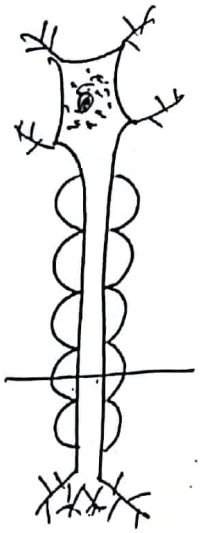
#

Sequence of events after Axonal injury :

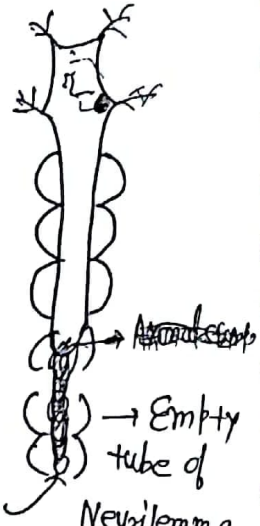
Chromatolysis → Axonal degeneration

↓

Ghost tube ← Myelin degeneration



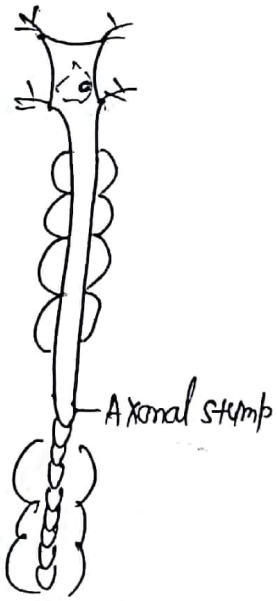
⇒



Macrophage ⇓

Ghost tube

⇓



Regeneration :⇒

Sprouting of Axonal stump

↓

Enters into Ghost tube

↓

Myelin is Laid Down

In Sheets

- Rate of Regeneration

↓

1mm/day or 1inch/Month.

⇒ Regeneration usually complete by 1 year

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

SKELETAL MUSCLE PHYSIOLOGY

- Skeletal Muscle
  - Voluntary
  - Striated

They have :-

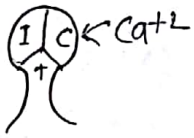
① CONTRACTILE PROTEINS :-

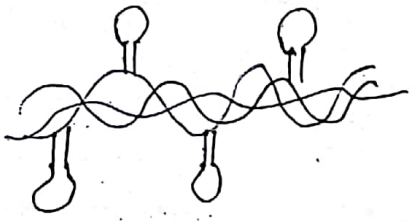
- ACTIN — 2 Strands of Actin in double helix

- MYOSIN

② Regulating proteins :-

- Tropomyosin → 1 Molecules of Tropomyosin covers 7 Active Site of Actin
- Troponin
  - Globular protein ⇒





↓ after Ca^{+2} attaches to Tropomyosin-C

Conformational change in Troponin

↓

causes Tropomyosin to slide

↓

Result in Active Sites on Actin

↓

Actin–Myosin cross bridge formation & cross bridge cycling

③ Structural Protein ⇒

↳ Actinin ⇒ binds actin to Z-Line

Titin ⇒ binds Z-Line to M-Line

↳ Responsible for Elasticity

↳ Forms "Scaffolding" (Structural Support)

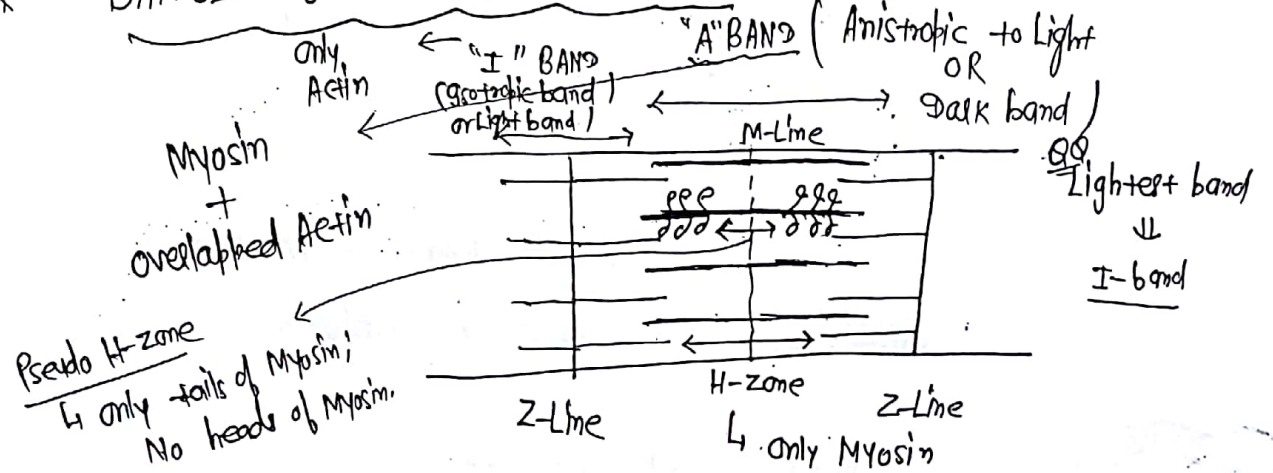
↳ Largest known Protein

$M_w \approx 3,000,000$

Mutation in Titin ⇒ Tibialis Muscular dystrophy

Desmin ⇒ Binds Z-Line to Plasma Membrane

* BANDS ON SKELETAL MUSCLE :→

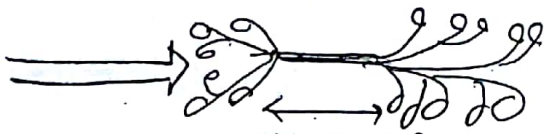


SARCOMERE ⇒ $\frac{1}{2}$ I-Band + A-band + $\frac{1}{2}$ A-band

M-Line ⇒ Connect Myosin Molecules to each other

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

*



ONLY MYOSIN (A BIS); No head

Thick filament ⊖

⇓

"Bunch of Golf Sticks"

B/w two Z-Line = Sarcomere.

* Pseudo H-Zone ⇒ Formed by Reversal of Polarity of Myosin heads.

* During Muscle contraction :→ The I-band ↓es

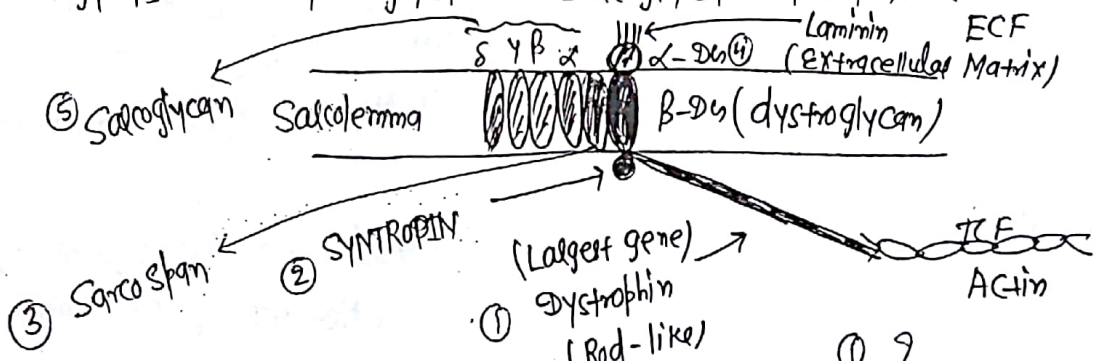
H-Zone = ↓es | disappears

(QQ) A-band = UNCHANGED

SARCOLEMMAL PROTEINS

Muscle fiber = Muscle cell

* It is "Dystroglycan – Sarcoglycan" Complex.



① ② ③ ④ ⑤ ⇒ all are Sarcolemmal protein

⇓

Laminin is Not Sarcolemmal protein

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

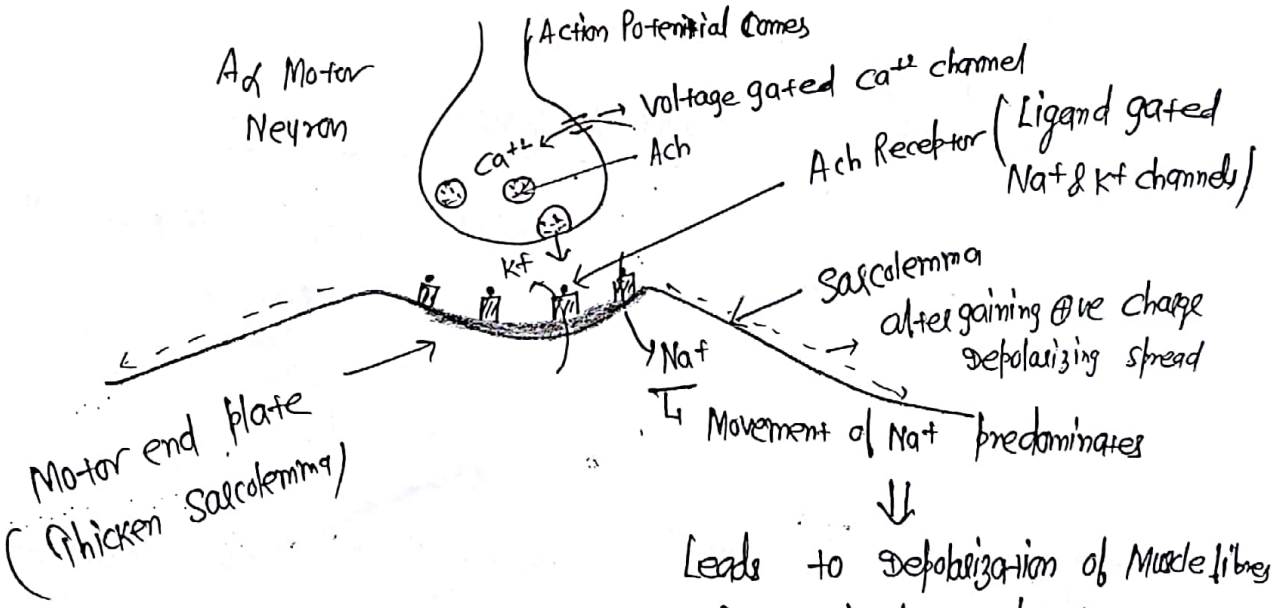
if dystrophin ⊖ ⇒ Duchenne's Muscular dystrophy

if dystrophin ⊕; but Reduced ⇒ Becker's Muscular dystrophy

if Sarcoglycan ~~Mutation~~ ⇒ Limb Girdle dystrophy
(Mutation of sarcoglycan)

* Function of dystrophin ⇒ Probably Amplifies force generated by Actin & Myosin.

* NEUROMUSCULAR JUNCTION

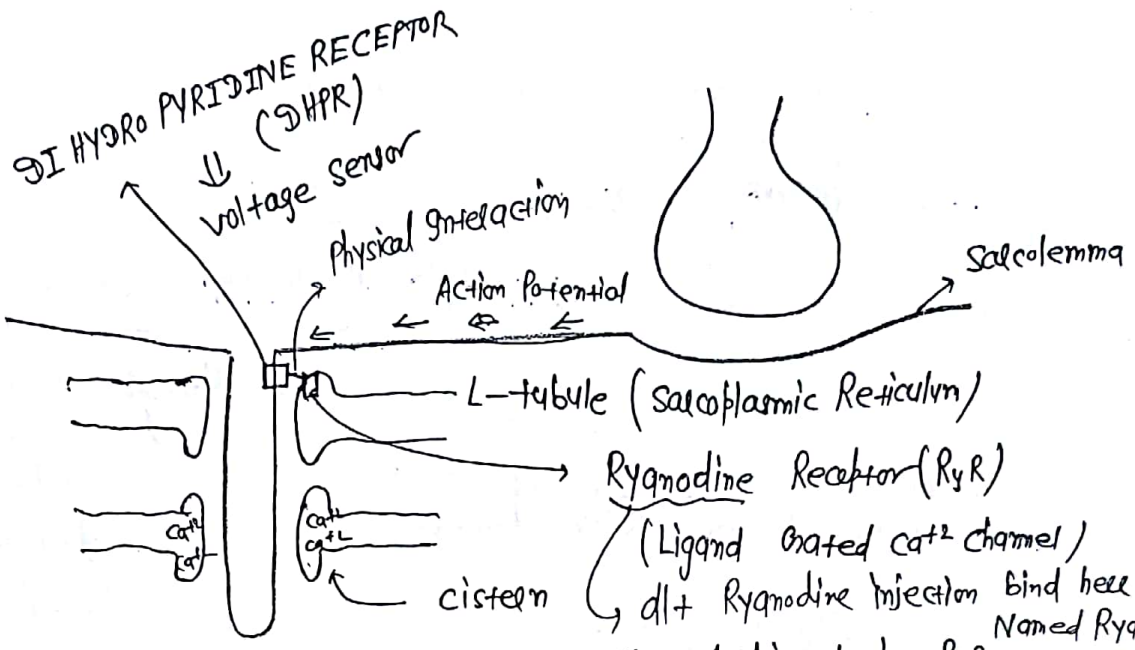


LAMBERT EATON SYNDROME ⇒ Ab against Pre-synaptic voltage gated Ca^{+2} channel

MYASTHENIA GRAVIS ⇒ Ab against Post-synaptic Ligand gated Na+ & K+ channels

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

SARCOTUBULAR JUNCTION



⇓

Triad ⇒ cistern + T- tubule + cistern

* as DHPR get conformational change

⇓

RyR gets interaction ~ DHPR & Release Ca^{+2}

⇓

K/as " Ca^{+2} Induce Ca^{+2} Release"

→ Excitation - contraction coupling

↳ Agent ⇒ Ca^{2+}

* Trigger for Muscle contraction ⇒ Availability of Sarcoplasmic Ca^{+2}

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(QQ) Muscle contraction continues till :-

a) ~~Ca^{+2}~~ Ca^{+2} is available;

b) ATP is available;

(QQ) Relaxation of Muscle by :-

Removal of Sarcoplasmic Ca^{+2}

↳ by 1° Active transport

↳ through SERCA

↳ by hydrolyze 2 ATP (each ATP) Ca^{+2} goes into Sarcoplasmic Reticulum.

→ So; it is active process.

ACTIN - MYOSIN CROSS BRIDGE CYCLING

- Responsible for sliding filament theory of Muscle contraction.

* When a Muscle @ Rest ⇒

Myosin head is in a ⇒ High Energy / High affinity state!

Recocking of Myosin head / Hydrolysis of ATP → COCKED STATE

ATP —ATPase→ ADP + Pi + E

↑ it doesn't mean Relaxation ↳ seen after Ca^{+2} goes

Myosin head utilize the energy & take shape along it

Ca^{+2} → energy of Myosin head

Power stroke ←

Detachment of Myosin head ← conformational change ← ATP Attaches to Myosin head

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Sequence ⇒

Power Stroke

⇓

ATP attaches to Myosin head

⇓

Detachment of Myosine head

⇓

Hydrolysis of ATP

⇓

Recocking of Myosine-head,

* In Rigor Mortis Case ⇒ Cell Membranes became leaky

↓

Ca^{+2} comes out of Sarcoplasmic Reticulum & comes in Sarcoplasm.

↓

but there is No ATP to goes Inside the Sarcoplasmic Reticulum

← Result in contracted state

* Only 1 ATP Requires in Actin - Myosin cross-bridge cycling

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

TYPE-I of Muscle fibres

	Type-I	Type-II
S →	Slow, Small	Fast; Large
O →	oxidative	Glycolytic
R →	RED	White

R
Y

- QQ Faster Myosin ATPase Activity ⇒ II
- QQ Longer twitch duration ⇒ I
- QQ Having More Mitochondria ⇒ I
- QQ Higher cap. Density ⇒ I
- QQ More Myoglobin ⇒ I
- QQ Easly fatiguability ⇒ II

I ↓ Slow; Sustained contraction

II ↓ Brief Powerful control.

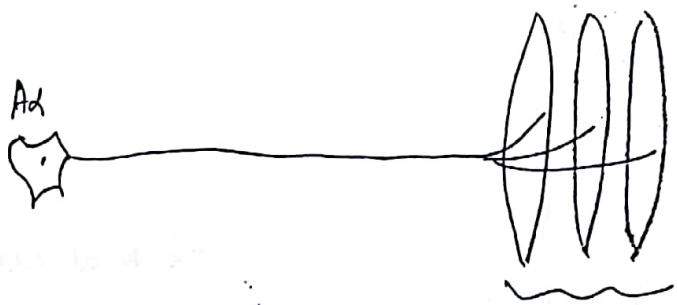
* Size principle ⇒ During Muscle contraction (Graded)

⇓

1st Type-I muscle fibres comes → then → Type-II Muscle fibres comes (so: Reserve Muscle fibres)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

MOTOR UNIT ⇒ Single A_α Motor Neurons + all Muscle fibres it supplies.



ONLY one type of Muscle fibres in one Motor Unit.

Extraocular Muscle ⇒ Very fine control Needed

⇓

4-5 Muscle fibres / Motor Unit

Muscles of Back ⇒ No need of fine control

⇓

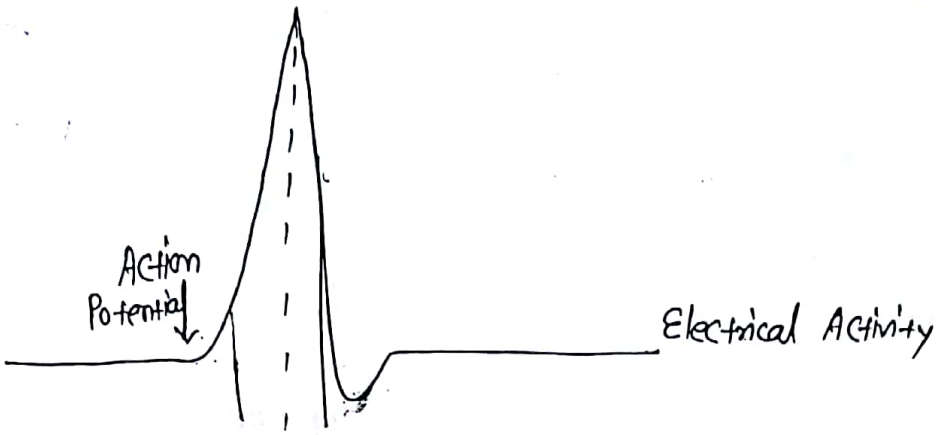
600 Motor fibres / Motor Unit.

* **Nomenclature of Motor Unit** :→

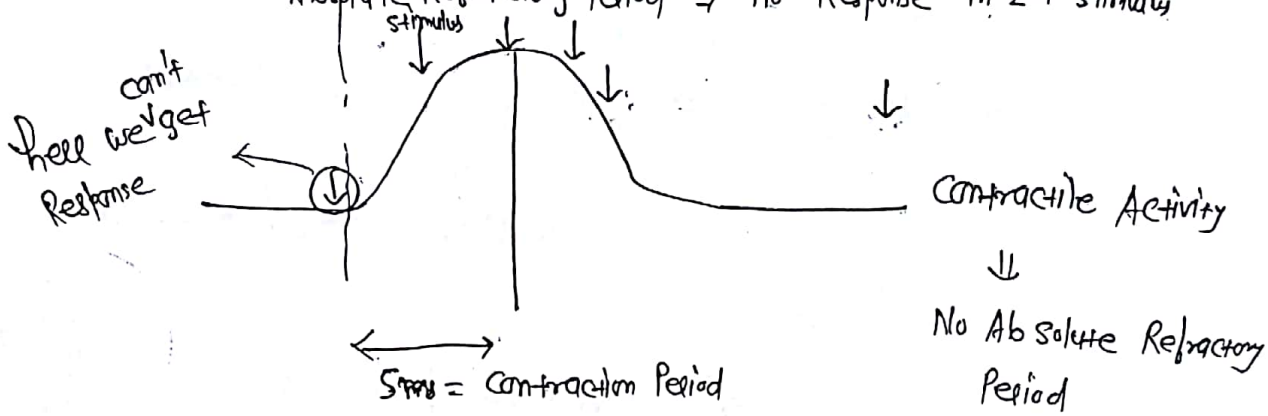
	I	IIa	IIb
M. fibres	Slow; oxidative (SO)	Fast; oxidative; Glycolytic (FOG)	Fast; Glycolytic (FG)
Motor Unit	(S) SLow	(FR) Fast & Resistance to fatigue	(FF) Fast & fatiguable
eg :-	Standing ⇓ "S" Motor Unit of calf Muscle	Walking ⇓ "S" Motor Unit + "FR" Motor Unit	Running ⇓ S + FR + FF Motor Unit

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

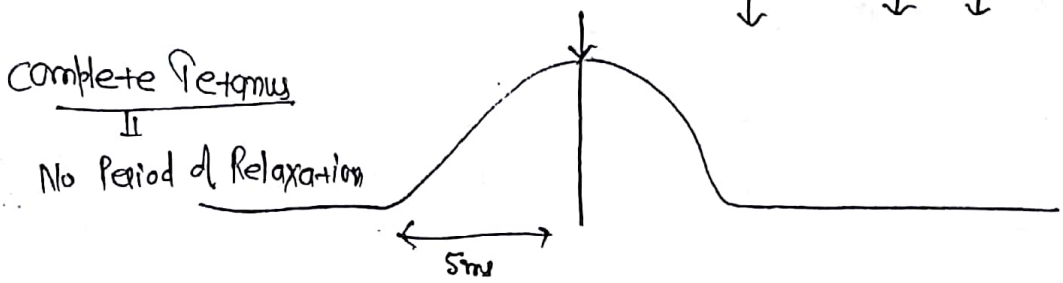
* COMPLETE & INCOMPLETE TETANUS



Absolute Refractory Period ⇒ No Response in 2nd stimulus



Tetanus ⇒ State of continous contraction.



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

⇒ On Successive Stimulation ↑ Height of Successive contraction

⇓

K/as "Beneficial effect/ Staircase/ Treppe"

⇓

d/t accumulation of the cat^{++} in S

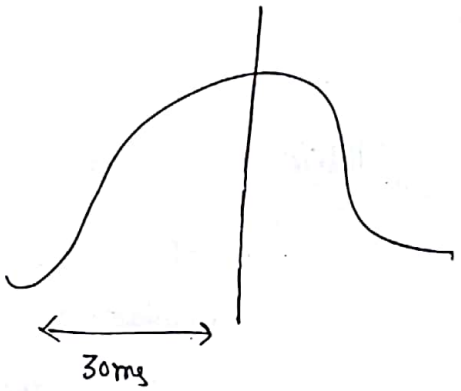
TETANIZING FREQUENCY ⇒ $\frac{1}{\text{Contraction Period (in sec)}}$

$= \frac{1}{5 \text{ ms}} = \frac{1000}{5} = 200$ Stimuli/sec.

$= 200$ Hz.

* if frequency of Stimulation is > 200 Hz ⇒ complete tetanus
* if frequency of Stimulation is < 200 Hz ⇒ Incomplete tetanus

QQ.



Tetanizing frequency

⇓

$\frac{1000}{30} = 33.33$ Hz.

* Day-to-Day activities can't possible without Tetanus.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

TYPES OF MUSCLE CONTRACTION

ISOTONIC

Tone | Tension = Same

Length = ↓

External work = done

Heat Release = More

eg ⇒ all day to day activities

ISOMETRIC

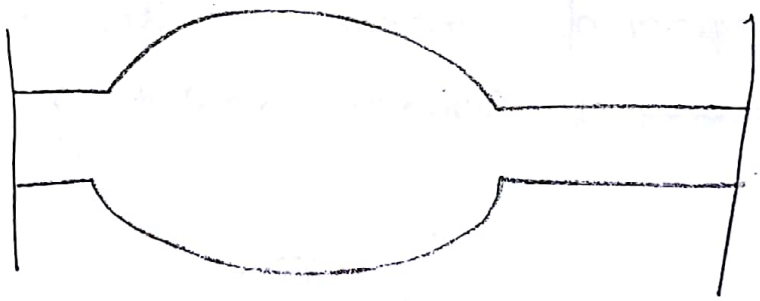
Length = Same

Tension = ↑

No External work

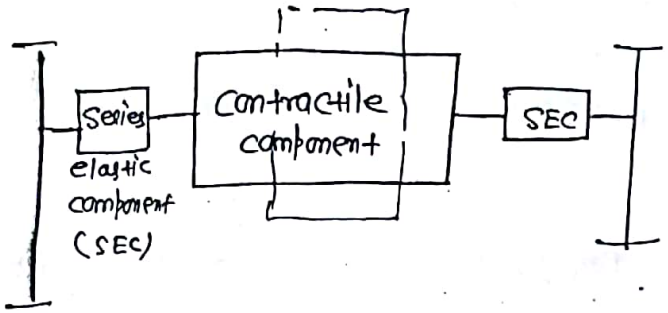
eg ⇒ Place hand on wall & Push against it.

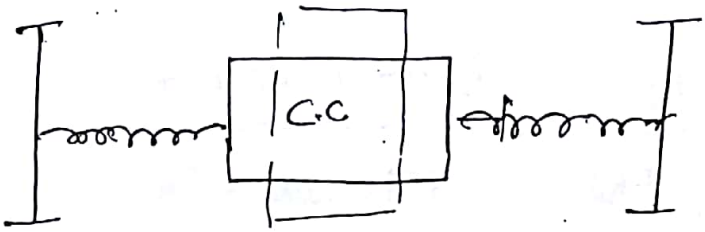
How does isometric contraction takes place ??



Muscle

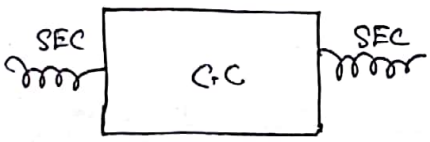
- Contractile components
- Elastic components
  - Elastic fibres in tendons
  - Titin





Isometric
⇓
- ↓ Contractile component
- Stretch of series elastic component
- Total Length = Same

In Isotonic contraction ⇒



Istonic
↓ Contractile component

Series elastic component
⇓
Folded

HEAT RELEASED DURING MUSCLE CONTRACTION

	ISOTONIC	ISOMETRIC
i) Resting heat	⊕	⊕
ii) Initial heat		
↳ Activation heat	⊕	⊕
↳ Shortening heat	⊕	⊕
iii) Recovery heat (Stop giving stimulus & heat generated by Muscle)	⊕	⊕

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

iv) Relaxation Heat ⇒ a ⊕ ⊖

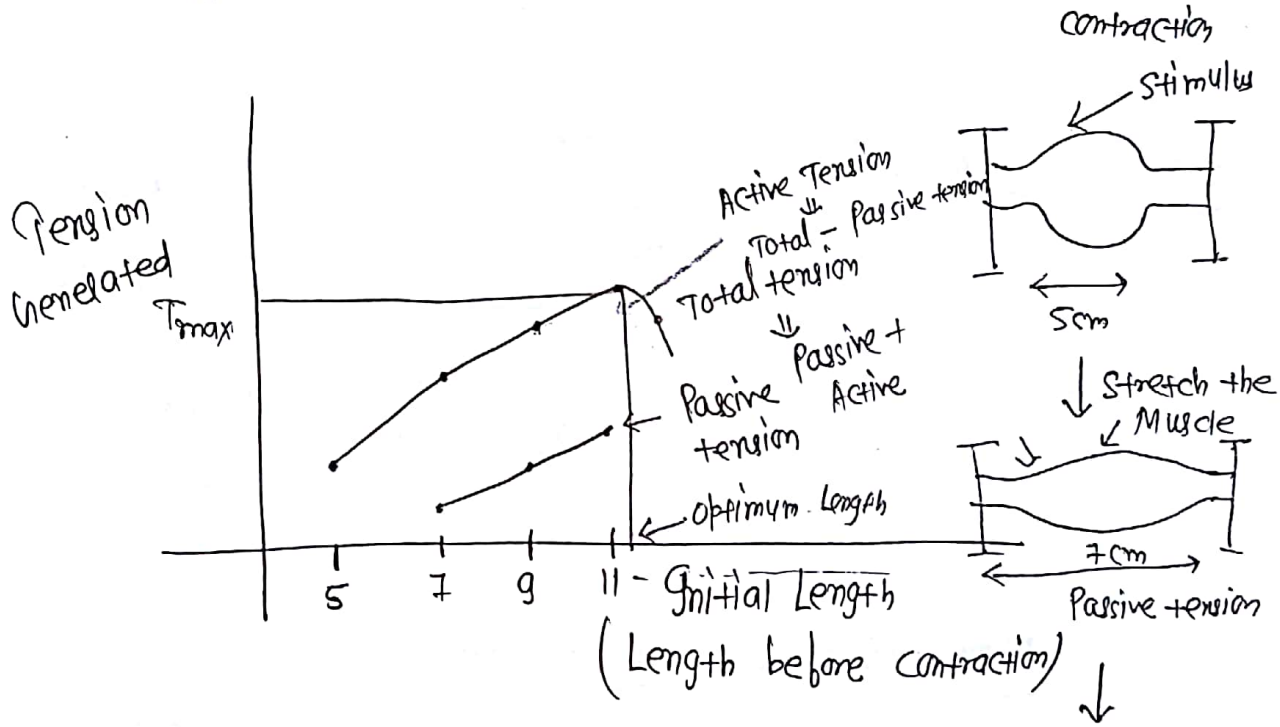
↑ a (Total heat)

* Total heat genelation is More in ⇒ Isotonic contraction

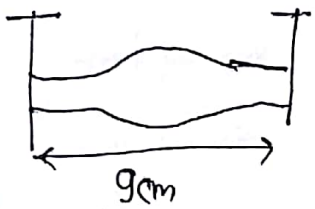
LENGTH- TENSION RELATIONSHIP

FRANK – STARLING's LAW

– Applicable for isometric contraction; Not for Isotonic contraction



During isometric Muscle contraction; More the Initial Length; More is the total & Active tension generated; but upto a Physiological Limit; beyond which further Inc in Initial Length; Dec the total & active tension generated



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

In case of cardiac Muscle :→

⇒

↑ Venous Return

⇓

↑ Filling (↑ End diastolic volume / ↳ Preload)

⇓

↑ Initial Length

⇓

↑ Tension generated

⇓

↑ Stroke volume ⇐ ↑ cardiac output but up-to physiological limit.

In Dilated cardiomyopathy ⇒ ↑↑↑ Initial Length

↓

↓ Tension generates

⇓

↓ stroke volume ⇒ Failure (common)

Optimum Length ⇒ It is that Initial Length ; at which if Muscle contracts isometrically ; then the total & active tension generated is maximum.

QQ At optimum Length ; All are Max^m except ⇒

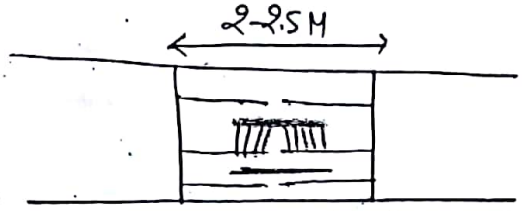
(A) Total tension;

(B) Active tension;

(C) Passive tension

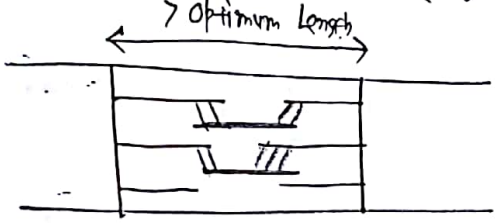
Optimum Length ⇒ Corresponds to Sarcomere Length of 2-2.5 M

↳ Maximum overlap b/w Actin & Myosin
↳ Maximum Number of Actin - Myosin cross bridges
↳ also K/as "Resting Length".

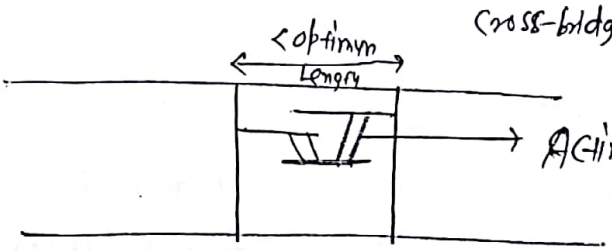


Optimum Length

If Initial Length is More than optimal Length ⇒ Less Actin-Myosin cross-bridge (+)



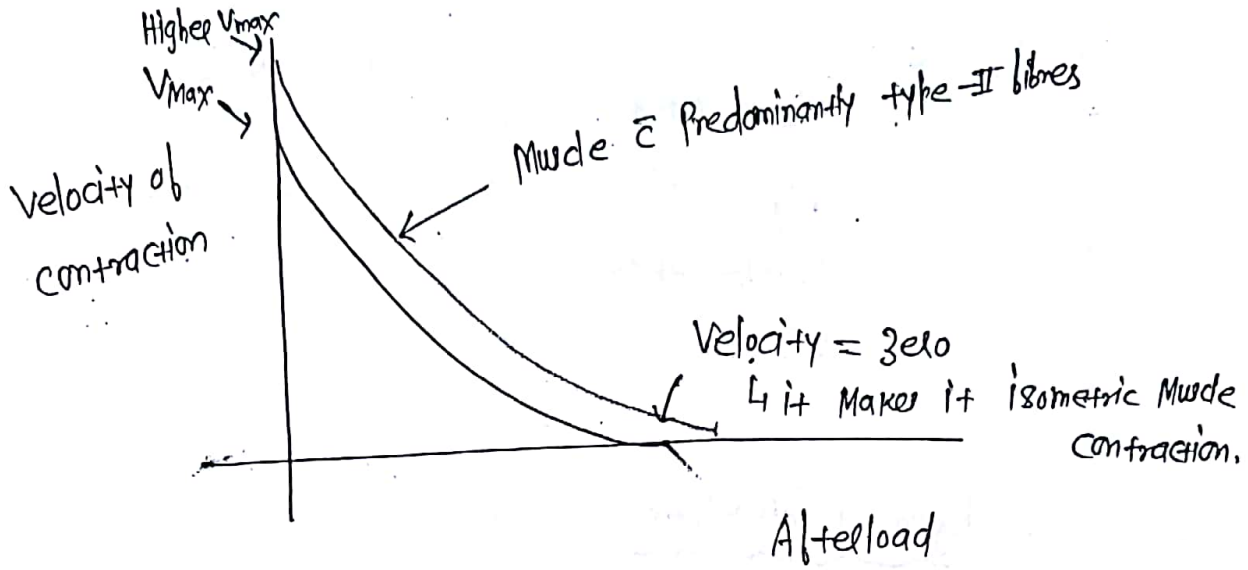
If Initial Length is Less than optimal Length ⇒ Less Actin-Myosin cross-bridge (-)



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

LOAD-VELOCITY RELATIONSHIP

- Valid for Isotonic Muscle



Afterload for the heart ⇒ Total Peripheral Resistance

* SOURCES OF Energy during exercise :-

1. ATP Stores ⇒ Sustain the exercise for 1-2 sec only
   ⇓ In Trained Athelefes → 3sec
   1st source of energy

2. ATP from Creatine phosphate ⇒ Sustain the exercise for 7-8 sec

   Klas "Phosphagen system"
   ↳ Sustain 8-10sec

3. ATP from Glycolytic Metabolism ⇒ Sustain the exercise for 1-1.5min

4. ATP from oxidative Metabolism ⇒ Sustain for Long time

Energy Substrate ⇒ 1st Stored then Glucose then Fatty acid
Glycogen
↳ After 1 or 2 hours of Exercise

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Phosphagen system (Major source) :→

For 100 metre sprint
Diving
Long jump
High jump
Javelin throw
Discus

* Phosphagen + Glycolytic :→

200 metre Run ;
100 m Swim ;

* Glycolytic :→ (Major source)
400 m Run
200 m Swim

* oxidative :→ For Any Prolonged duration of exercise →
- Marathon
- Boxing
- Rowing

TRAINING OF ATHELETE

ENDURANCE TRAINING

⇉ ↑ Stamina
⇉ ↑ Efficiency of CVS & Respiratory System to tolerate exercise

STRENGTH TRAINING

⇉ ↑ Strength/Power
⇉ ↑ Bulk of Muscle (Hypertrophy)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

⇒ Load ⇒ Submaximal

Duration ⇒ Prolonged

⇒ Tes oxidative capacity

⇒ Achieved by ⇒ Walking
Jogging
Swimming

⇒ Load ⇒ Maximal OR
Near Maximal

Duration ⇒ Brief

⇒ Tes 'Glycolytic capacity

⇒ Achieved by ⇒ Training;
Gymming.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

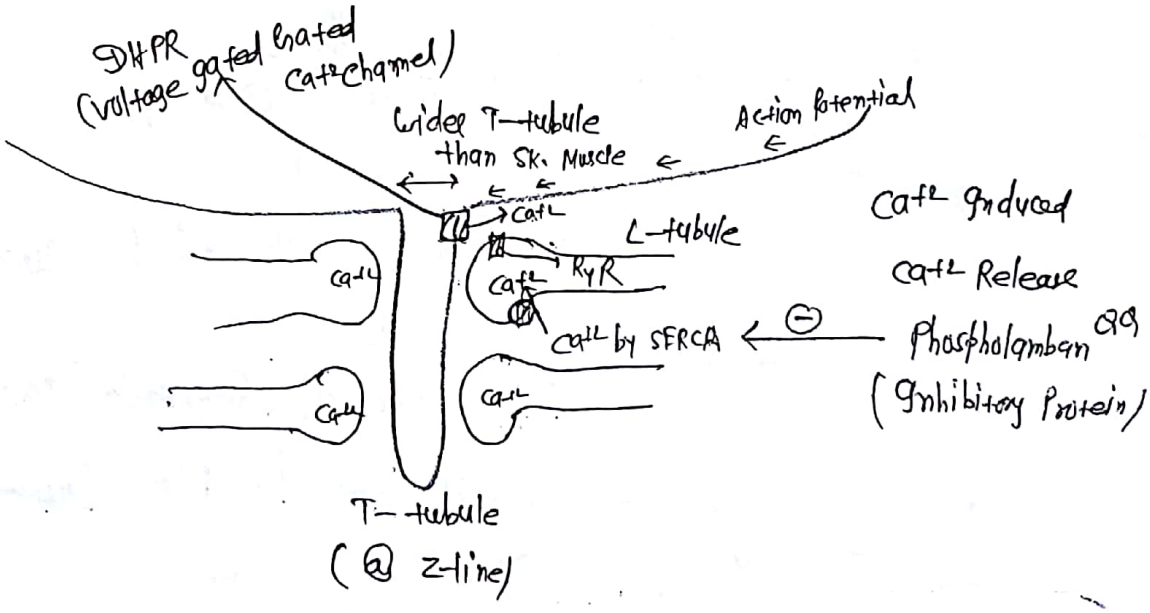
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

CARDIOVASCULAR SYSTEM

Cardiac Muscle ⇒

- Striated
- Involuntary Muscle
- Extensive branching
- Intercalated Discs
  - At Z-line
  - ↑ Cell-to-cell cohesion
  - d/t it heart is "Mechanical syncytium"
- Gap Junctions ⊕
  - At Z-line
  - d/t it heart is "Functional syncytium"

*



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

	Skeletal Muscle	Cardiac Muscle
T-tubule ⇒	At A-I junction	At Z-line
Sarcoplasmic Reticulum ⇒	Better developed	
Source of Ca^{+2} ⇒	S.R	ECF + S.R
DHPR ⇒	Voltage Sensor	Voltage gated Ca^{+2} channel
Relaxation ⇒	SERCA	SERCA + Na^{+}-Ca^{+2} Antiport

* if we Remove Phospholamban protein

⇓

↑ SERCA activity

⇓

↑ Rate of Removal of Sarcoplasmic Ca^{2+}

⇓

↑ Rate of Relaxation (Muscle)

↳ Klas "Lusitrophy"

by ↑ Sympathetic Activity

⇓ β-sympathetic
↑ cAMP

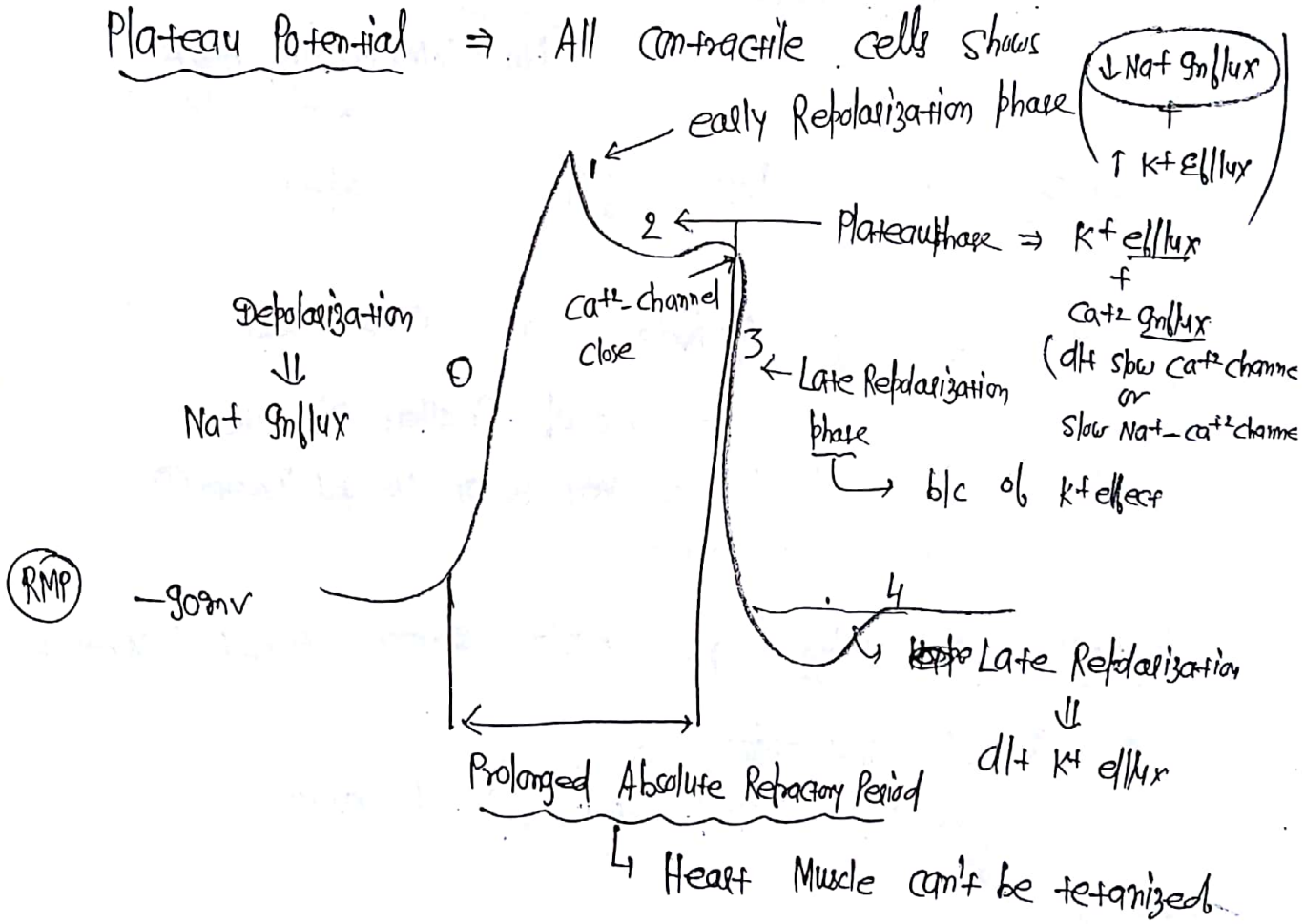
Phosphorylation of Phospholamban

* ↑ Symphathetic ⇒

⊕ve chrono-tropic (↑ Heart Rate)
⊕ve Ino-tropic (↑ Force)
⊕ve Bathmo-tropic (↑ Excitement)
⊕ve Dromo-tropic (↑ conductivity)
⊕ve Lusi-tropic (↑ Muscle Relaxation)

* Electrical Activity of Heart ⇒

Plateau Potential ⇒ All contractile cells shows



* Conducting System of Heart ⇒

Modified contractile cells.

i) SA Node

ii) Inter Nodal tracts — Anterior, Middle, Posterior

iii) AV Node ⇒ Nodal delay. (as it passes through AV Node it slow)
92 ms = 0.92 sec

iv) Bundle of His

v) Bundle Branches — (RT), (LT)

vi) Purkinje fibres

No NMJ ⊕ in Heart.

Fastest. ⇒ Purkinje fibres ⇒ 4 m/sec

Slowest conducting ⇒ AV Node ⇒ 0.05 m/sec
↳ b/c of Smallest Diameter & very few or No gap junction ⊕.

Advantage of Nodal delay ⇒ Atria contract Ahead of ventricles

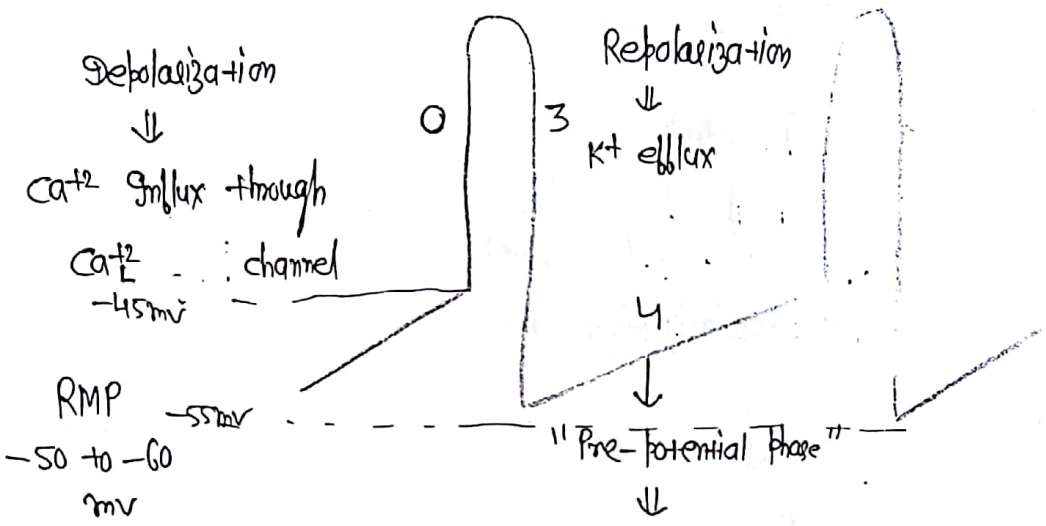
* Atrial contraction Responsible for ↳ and Rapid filling of ventricle

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Pacemaker Potential ⇒ @ SA Node & AV Node

All of Rest have "Plateau potential"
⇓
eg = Bundle of his; Purkinje cells
↳ also in contractile cells.

PACEMAKER POTENTIAL



⇓

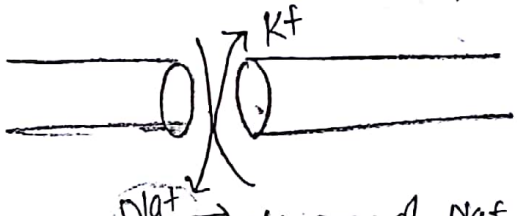
"Spontaneous depolarizing till firing Level"

↳ by gain of ⊕ve charge

⇓

① by ↓ K+ efflux

② by opening of "F" channel (it permits Movement of both Na+ & K+)
↳ Funny



b/c both electrical & chemical gradient ⊕

⇒ Movement of Na+ predominates & cause Net gain of ⊕ve charge

(3) Ca^{+2} influx through Ca_T channels

(Q9) Pre-potential starts ∵

↳ ↓ in K^+ efflux

Main Reason for Pre-potential

↳ Ca^{+2} influx through Ca_T channels.

* Effect of Sympathetic discharge on Pacemaker Potential

↑ Symp.

↓ β Receptor (↑CAMP)

↓ Depolarization Time

↓

↑ HR

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

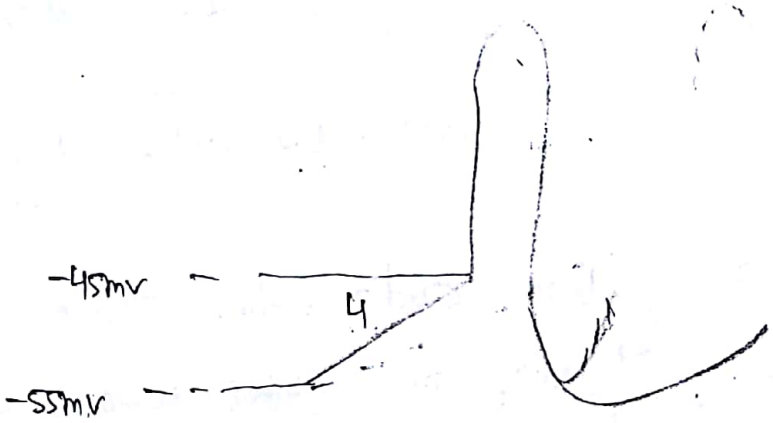
* Effect of Parasympathetic discharge on Pacemaker Potential

↑ P.S. → via G-protein → opens K_{Ach} channels in phase 4

↓ CAMP → ↓ Phosphorylation channel → Less open & Result in ↑ Depolarization time

↓ Slope of Phase 4 (QQ)

↑ Depolarization time → ↓ H.R.



QQ Parasympathetic affects Phase 4 & 0 both.

* Intrinsic Rate of discharge of SA Node] → 100/min

↓ b/c of Resting vagal tone

Resting heart Rate → 70-80/min [i.e vagus is effective @ Rest

QQ Heart Rate of Transplanted Heart

↳ 100/min (No connection ε Symphathetic & Palasymphathetic)

↳ In exercise; epinephrine from Adrenal Medulla works here

Atheletes ⇒ has very high Resting vagal tone

⇓

Bradycardia @ Rest

↳ Advantage ⇒ high cardiac Reserve

⇓

Maxm cardiac output − Basal cardiac output.

In (N) Individual ⇒

Basal cardiac output = 5L/min

Maxm cardiac output = 20-25 L/min

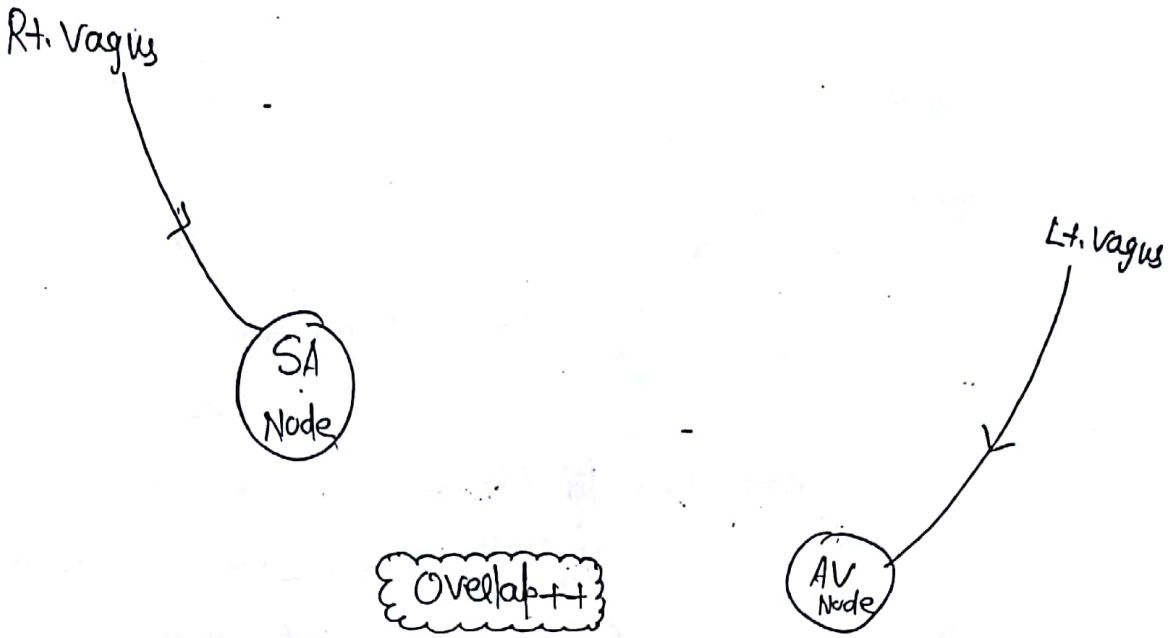
↳ 4-5 times Yes

In Atheletes ⇒ Basal cardiac output = 4.0 L/min

↓ 6-7 times Yes

Maxm cardiac output = 25-28 L/min

http://mbbshelp.com WhatsApp: +1 (402) 235-1397



*

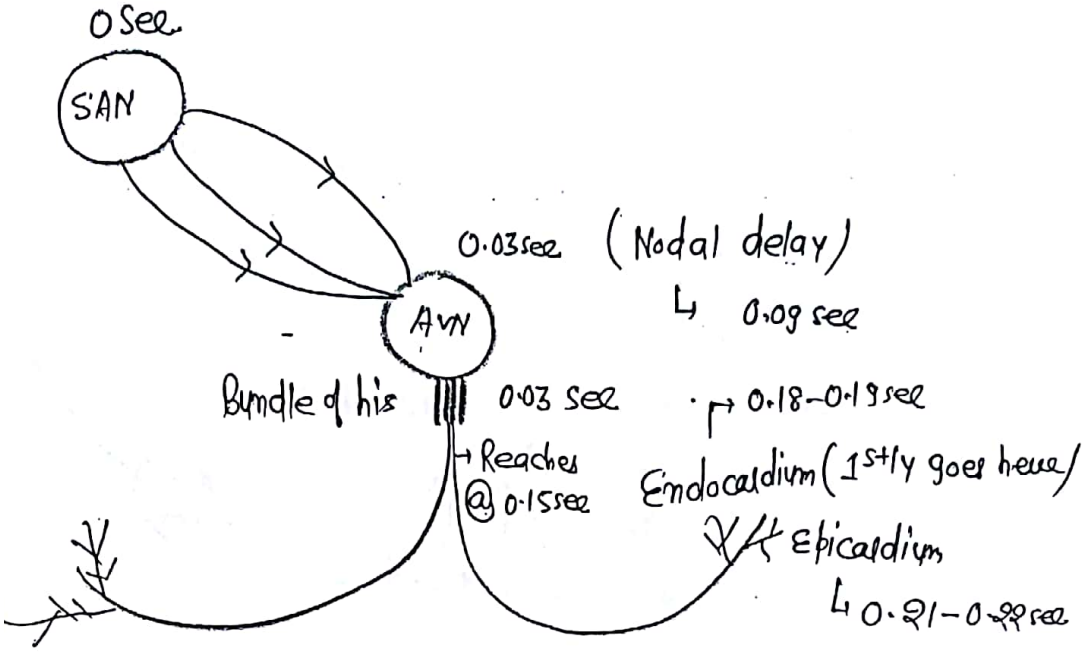
	Heart Rate	Force of contraction
Sympathetic	↑	↑
Parasympathetic	↓	⊖

(No vagus to ventricles)

QQ Parasympathetic is prt. in all except:

a) SAN;
b) AVN;
c) Atrial Myocardium
d) Ventricle Myocardium

CONDUCTION OF CARDIAC IMPULSE



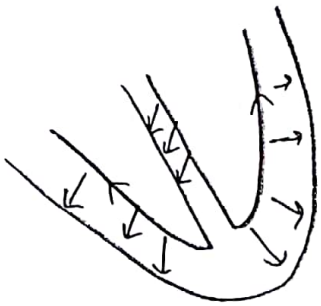
VENTRICLE DEPLORIZATION

1St to depolarize ⇒ Left upper part of Interventricular septum

↓

Septal depolarization (Left → Right)

↓



Endocardium then Epicardium QQ 2016 NEET

↓

Last to depolarize ⇒ Base of heart (Epicardium)

- Pulmonary conus
- Small superior most portion of Interventricular septum Near Base of heart

* VENTRICULAR REPOLARIZATION ⇒

1st part to Repolarize ⇒ Apex; Epicardium

Last part of Repolarize ⇒ Base; Endocardium

* During Repolarization Heart is already in contracted state

⇓

there is very high pressure in Endocardium (b/c of circular Nature)

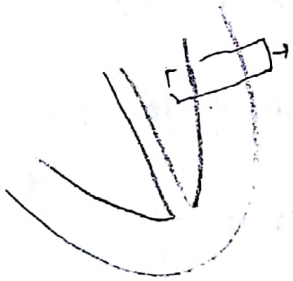
⇓

This high pressure doesn't permit ionic change

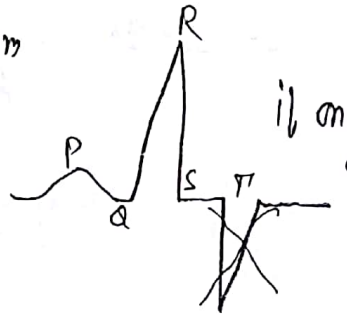
⇓

Repolarization is from Epicardium → Endocardium

Q: Isolated piece of vent. Myocardium



→ Shows both electrical activity & conductional activity

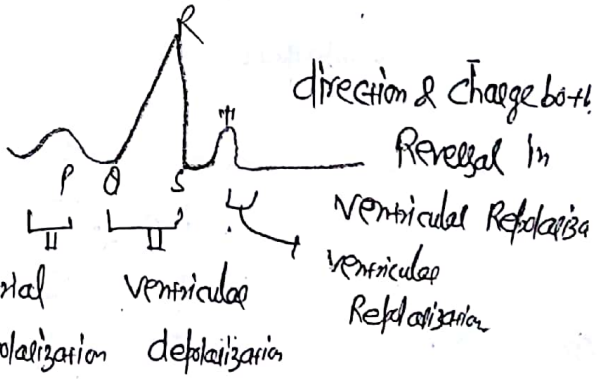


if only Reversal of Charge was taking in ventricular Repolarization

Repolarization is from ⇒ both surface has equal pressure

a) Endo → Epi

b) Epi → Endo



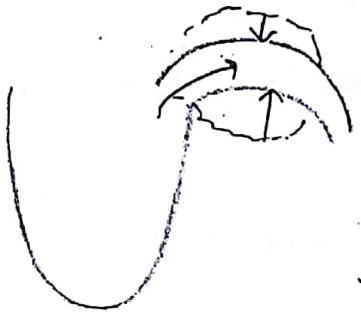
direction & Charge both Reversal in

VESSELS

1. WINDKESSEL VESSELS

↳ Aorta & Large Arteries

Elastic tissue ++



during diastolic

↳ Diastolic Blood Pressure

⇩

Elastic Recoil of Aorta & Large Arteries;

depend on Total Peripheral Resistance

2. Resistance vessels

↳ Arterioles (only 1/4 of TBV present here). ← Least % of blood volume

Smooth Muscle ++

Symphathetic ++

↑ Symphathetic innervation of more Smooth Muscle

↓

Vasomotor contraction

↓

↓ Radius

↓

↑↑↑↑ Resistance

$R \propto \frac{1}{r^4}$

↳ Small changage in Radius

↳ Large changage in Resistance

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

③ Exchange vessels ⇒ Capillaries

4 ~ 5% of Total blood volume

⇓

No Smooth Muscle

No Symphathetic Innervation

* Pre-capillary Sphincters & Terminal Arterioles } Respond to Local Metabolite.

⇓

↓PO_2, ↑PCO_2, ↑H+, ↓PH, ↑Lactic acid, ↑Adenosine, ↑temp., ↑K+ } Local hypoxia

⇒ Causes Relaxation of pre-capillary sphincters & terminal arteriole.

⇓

↑ Capillary flow.

O_2 sensitive K+ channel ← PO_2 → Pulmonary vasoconstriction

↓PO_2

↓

Closure of O_2-sensitive K+ channel

↓

↓ K+ Efflux

↓

Depolarization

↳ vasoconstriction

ATP dependent K+ Channels → Vasodilation (Rest all area)

↓PO_2

↓

↓ATP

↓

Opening of ATP dependent K+ channels

↓

↑K+ efflux

⇓

Hyperpolarization ⇒ Vasodilation

Resting Skeletal Muscle blood flow :→

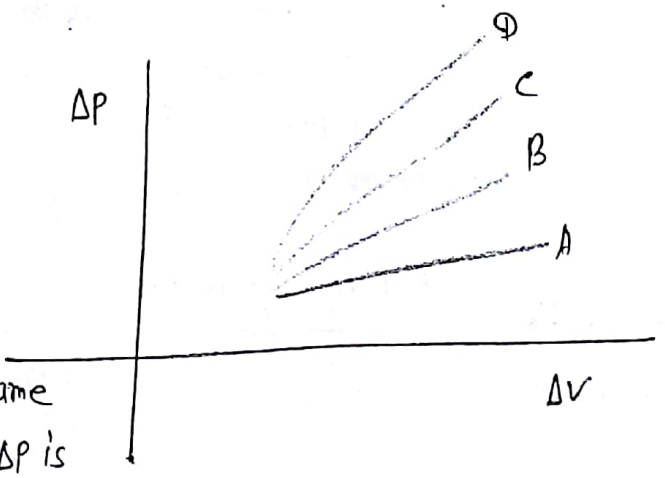
3-4 ml/min/100 gm of tissue

On exercise ↓ Local Metabolites (20-25 times)

80-90 ml/min/100 gm of tissue

④ CAPACITANCE VESSELS ⇒ Venules; Veins & Vena cava

- ~ 2/3rd of blood volume present on venous side (60%)
- have capacity to expand



Which one is vein

↓

(A)

↳ on the same change of volume ΔP is least b/c of expansion

Compliance ↓ distensibility of vein

Small veins = 46% of blood volume

Large veins = 14-18% of blood volume

→ Sympathetic (+) ⇒ Arteriole ← ↑ sympathetic → Vein

Arteriolar constriction

↑ MAP ← ↑ DBP ← ↑ TPR

Venoconstriction

↓ venous compliance ⇒ ↑ venous Return

⑤ Shunt Vessels ⇒ Arterio-Venous Anastomosis

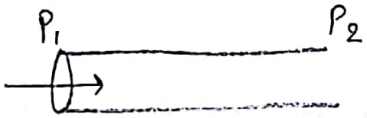
- Prt. in: Finger tips ⊕, Ear lobes ⊕
- Function ⇒ Temperature Regulation.
- Sympathetic-Supply ⊕

gmp.

HEMODYNAMICS

① Based on ohm's Law :→

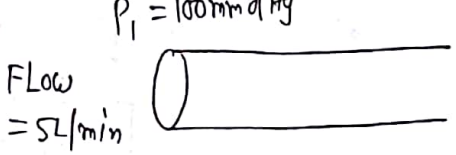
$$\text{Flow} = \frac{P_1 - P_2}{\text{Resistance}}$$



Flow ∝ ΔP

Flow ∝ 1/Resistance

Q: Resistance in Wood Units ??

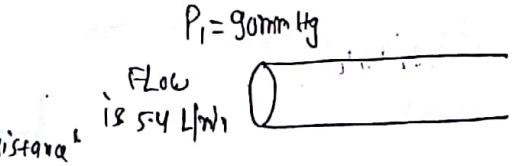


$$\text{Resistance (Wood Units)} = \frac{\Delta P \text{ mm Hg}}{\text{Flow L/min}} = \frac{100-0}{5} = 20 \text{ mm Hg min/L}$$

20 Wood Units

Q. Resistance in R Units ??

(PRU) ⇒ Peripheral Resistance Unit



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

$$\text{Resistance (PRU)} = \frac{\Delta P \text{ (mm of Hg)}}{\text{Flow (ml/sec)}} = \frac{90-0}{90} = 1 \text{ PRU}$$

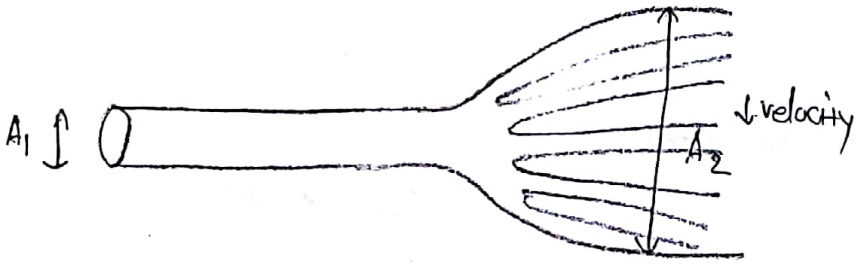
$$\frac{\text{gm} \times 1000}{60 \times 16} = 90$$

② Velocity of Flow :→ It is Inverse of total cross sectional Area

Aorta ⇒ $4.5\ cm^2$ (Total cross-sectional Area)

Capillaries ⇒ $4500\ cm^2$ (Total cross-sectional Area)

(QQ) Maxm velocity ⇒ @ Aorta



$$V_1 \times A_1 = V_2 A_2$$

$$V_1 A_1 = V_2 A_2$$

③ HAGEN – POISEUILLE'S LAW :→

$$R = \frac{8\eta L}{\pi r^4}$$

η = Viscosity (depend on RBC count)

L = Length

r = Radius

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

We know;

$$\text{Flow} = \frac{\Delta P}{R} = \frac{\Delta P \times \pi r^4}{8\eta L}$$

$$\text{Flow} = \frac{\pi}{8} \times \frac{\Delta P r^4}{\eta L}$$

Flow $\propto \Delta P$; Flow $\propto \frac{1}{\eta}$;

Flow $\propto r^4$; Flow $\propto \frac{1}{L}$

In Anemia ⇒ blood viscocity ↓

↳ Result in hyperdynamic circulation

(QQ) Radius is ↑es by 50% ; blow ↑es by

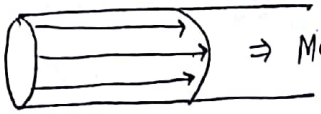
~~a) 5x~~; b) 8x; c) 10x; d) 16x

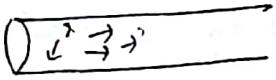
$$x + \frac{50}{100}x = \frac{3}{2}x \qquad \frac{8r}{16} = 5 \text{ times}$$

(QQ) Radius & Length of a vessels are both double ; Flow ↑es by how many times

a) 5x; ~~b) 8x~~; c) 10x; d) 16x

(4) Laminal blow & Turbulant blow ⇒

Laminal flow ⇒  ⇒ Max^m velocity @ centre

Turbulant flow ⇒ 

Tendency for turbulance → Given by Reynold's No.**

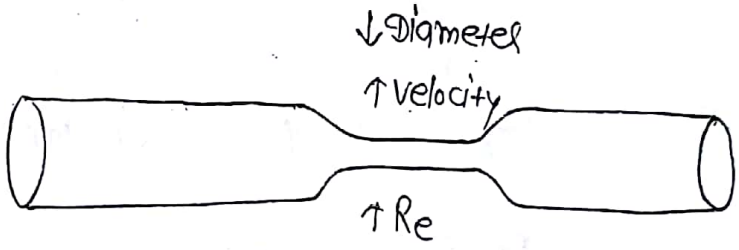
$$\Rightarrow \boxed{Re = \frac{\rho V D}{\eta}}$$

Most imp. factor
↳ velocity of flow

ρ = Density
D = Diameter (cm)
V = velocity of flow (cm/sec)
η = viscosity (Poise)

$Re > 3000 \Rightarrow$ Turbulent flow

$Re < 2000 \Rightarrow$ Laminar flow

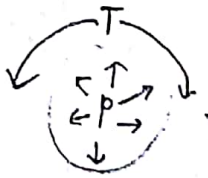


Korotkoff Sounds → Seen turbulant flow
↳ heard dft turbulent flow.

↳ bic velocity of Flow is Most imkortant Factor in Reynold's Number

⑤ Laplace's Law ⇒

For thin walled visces

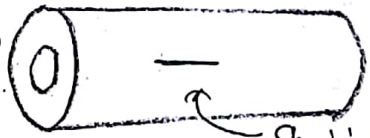


P = Distending Pressure
T = wall tension

$P = \frac{T}{r}$ (cylinder eg Bloodvessels)

$P = \frac{2T}{r}$ (sphere eg Alveolus) → $T = \frac{Pr}{2}$

$\boxed{T = Pr}$; capillary ⇒ ↓ wall tension



Incision & check wall tension

- capillaries don't Rupture inspite of being thin walled

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* If wall thickness (w) is significant :-

$$T = \frac{Pr}{w} \quad ; \quad T = \frac{Pr}{2w}$$

QQ. Left ventricle wall stress (wall tension) can be ↓ by ↑ in :-

a) Distending Pressure;

b) Radius

$$T = \frac{Pr}{2w}$$

↳ In Dilated cardiomyopathy patient there is less wall tension

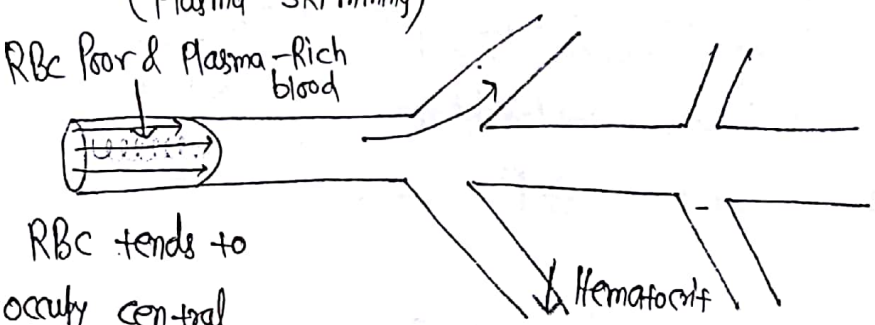
c) Afterload (Total Peripheral Resistance)

↳ In case of Heart.

d) ~~Wall~~ Wall thickness

(6) FAHRAES - LINDQUIST Effect :-

(Plasma skimming)



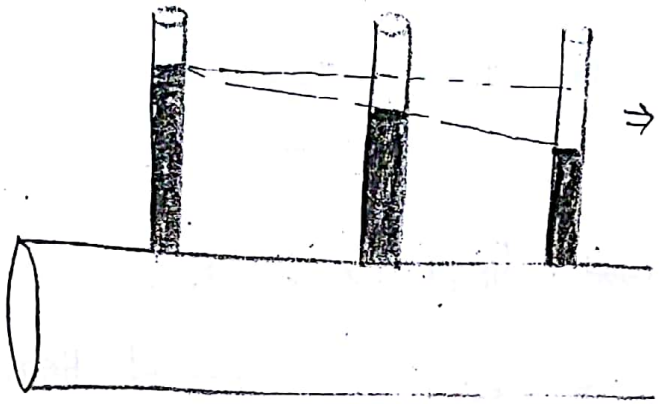
↓ Blood viscosity in vessels < 1mm in diameter

• It helps to Maintain the flow

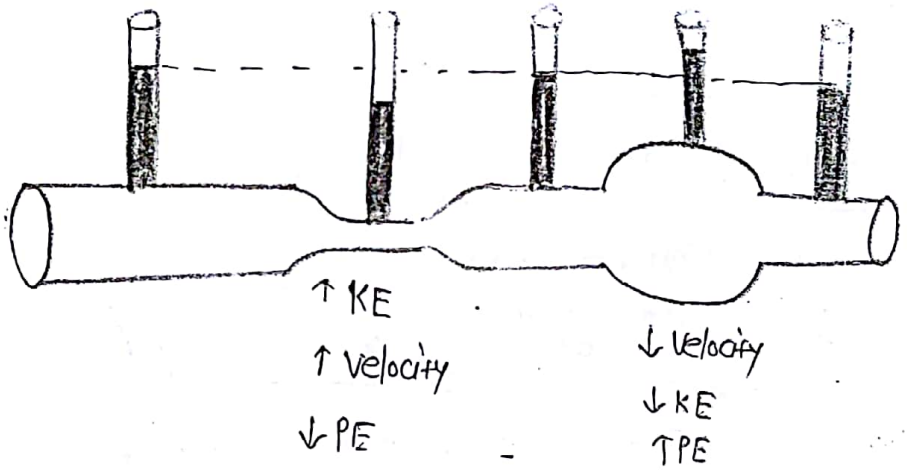
⑦ BERNOULLI'S ⇒

Total energy = Kinetic energy + Potential energy

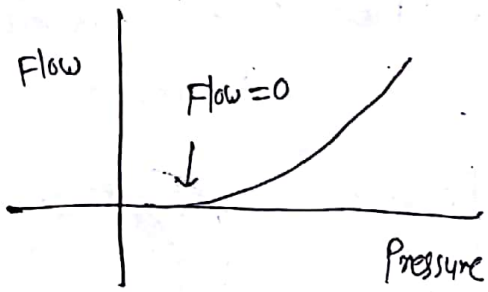
Total energy of Flow = Kinetic energy of Flow + Potential energy (Lateral pressure exerted by flowing bloods).



⇒ ↓ Lateral Pressure along Length of tube (b/c of loss of energy d/t friction)



⑧ Critical closing Pressure ⇒ It is the pressure in small & thin walled vessels; when there is No Flow



⇓

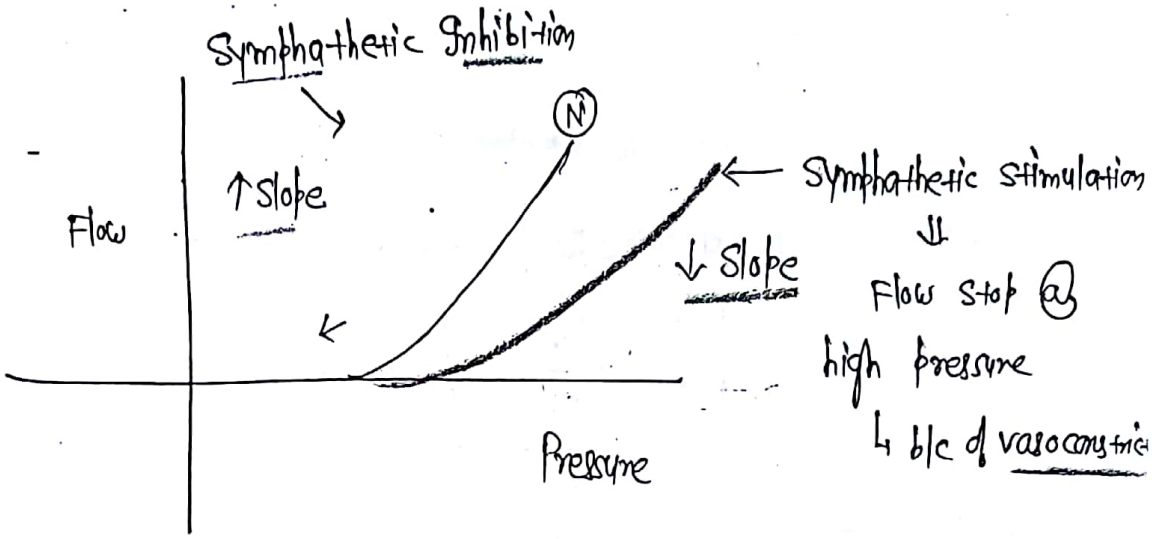
Reason ⇒ i) Collateral inflow into the Arteriolar Meshwork;
ii) Rouleaux formation

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

iii) External Tissue Pressure > Distending pressure Inside vessel.

iv) High Vascular Smooth Muscle tone (eg in Arterioles)

QQ.



* Parasympathetic Not Seen @ blood vessels few exception only.

MYOCARDIAL O_2 demand

- "Hard working organ"
- Oxidative Metabolism (< 1% ⇒ Glycolytic)
- Fuel for heart -- Fatty acids

QQ Basal O_2 demand ⇒ Quiescent heart
↳ 2ml/min/100gm of tissue

Demand of Skeletal Muscle @ Rest ⇒ 0-2 ml/min/100gm of tissue

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Beating heart @ Rest ⇒ 9ml/min/100gm

* Factors Aes Myocardial O_2 demand :⇒

① Heart Rate;

② Duration of systole;

③ Intra Myocardial tension

$$T = \frac{Pr}{2w}$$

④ Work done by heart = Stroke volume X Mean Arterial Pressure

↑ SV ↑ MAP

↑ Vol. work ↑ Pressure work

In AR In AS

↑ O_2 demand ∵ As in Pressure work is

∨

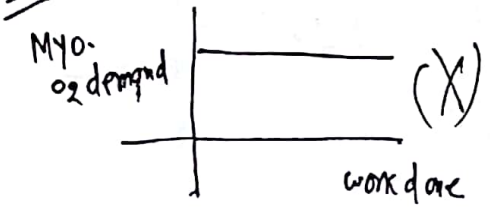
∴ In volume work

⇒ In patient of AS higher O_2 demand than AR.

⇓

So; Pt. of As. Commonly presents ∵ Angina

QQ. Work done & Myo. oxygen demand = ~~Constant~~ Relationship



(X) Almost Linear Relationship

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

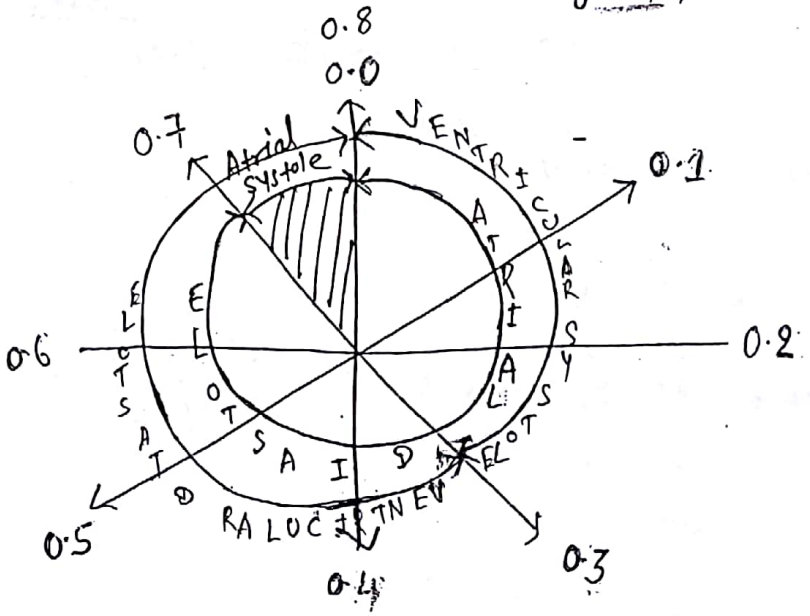
CARDIAC CYCLE **

* Electrical & Mechanical changes which occur in heart from one beat to Next.

* Cardiac cycle time = 0.8 sec

CARDIAC CYCLE S.G

- Atrial event
  - Atrial systole (0.1 sec)
  - Atrial diastole (0.7 sec)
- Ventricular event
  - Ventricular systole
    - Isovolemetric contraction
    - Phase of Rapid ejection
    - Phase of slow ejection
  - Ventricular Diastole
    - Isovolemetric Relaxation
    - 1st Rapid filling phase
    - Diastasis
    - 2nd rapid filling phase (Atrial Systole)



* ATRIAL PRESSURE (Atria ⇒ Low pressure zone)

Diastole ⇒ 0-3 mm Hg

Atria
↳ Primer pump

Systole → Right Atrial Pressure ⇒ 4-6 mm Hg
→ Left Atrial Pressure ⇒ 6-8 mm Hg

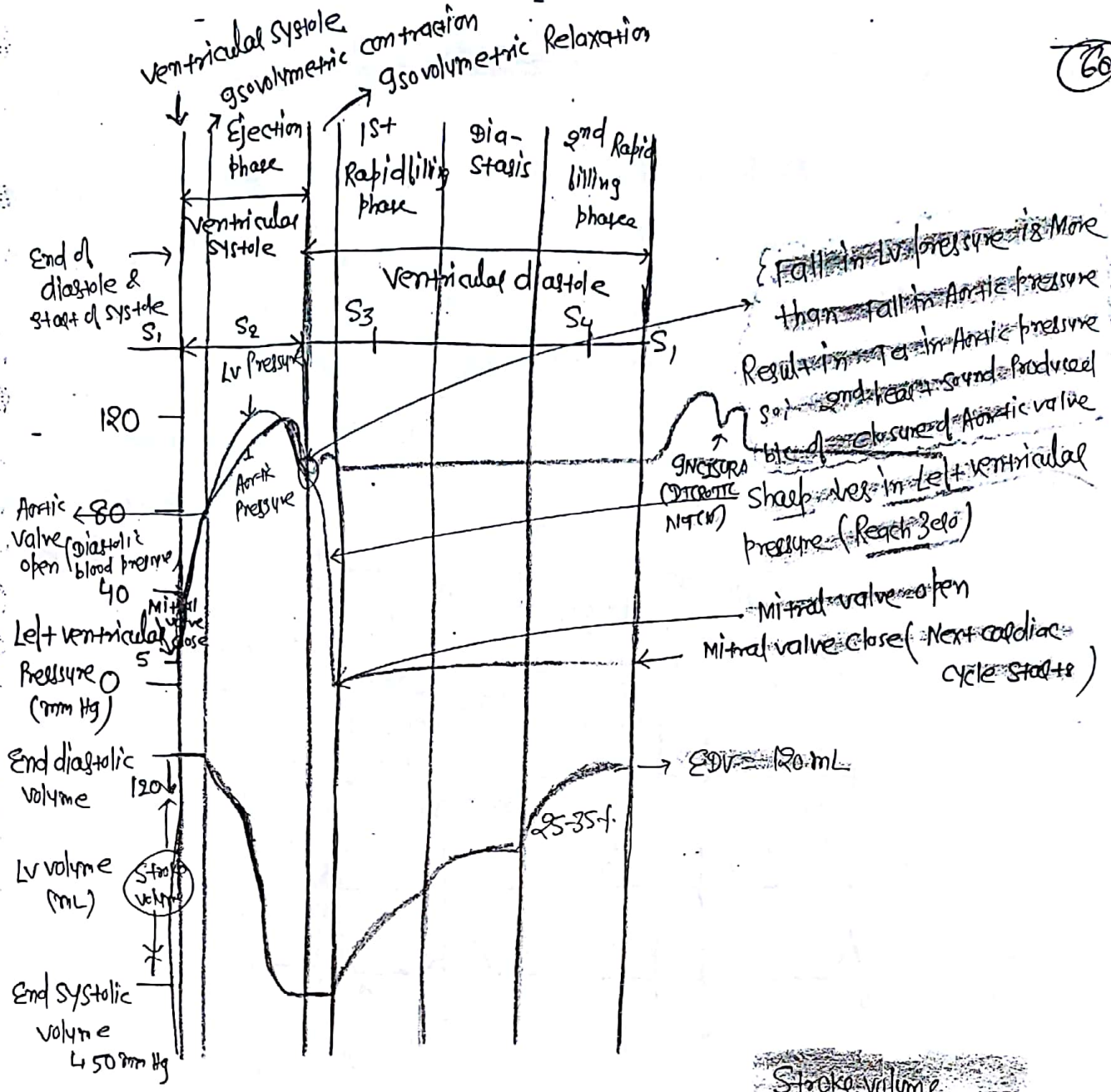
Pressure of Left Atrial Pressure is More d/t "Physiological shunting"

↳ Part of venous blood from coronary circulation & Bronchial circulation directly into Left Atrium (So, it Receives More blood)

* VENTRICULAR PRESSURE :-

	Systolic Pressure	Diastolic Pressure	MAP
Left ventricle	120 mm	0 (0-5 mm)	—
Systemic circulation	120 mm	80 mm	100 mm
Right ventricle	25 mm	0 (0-5 mm)	
Pulmonary circulation	25 mm	9 mm	15 mm

http://mbbshelp.com WhatsApp: +1 (402) 235-1397



Stroke volume
↳ EDV - ESV

Ejection fraction
↳ $\frac{SV}{EDV}$ = 0.55-0.65
⇓
55-65%

S_1 ⇒ closure of Mitral valve

S_2 ⇒ closure of Aortic valve

S_3 ⇒ 1st Rapid filling Phase
↳ May be prt in children & Normal young adults
↳ ⊕ in condition of ↓ ves ventricular compliance
↳ as in Left ventricular hypertrophy, congestive cardiac failure.

S_4 ⇒ 2nd Rapid filling phase (Always pathological)
↳ coincides ∵ Atrial systole
↳ prt. in ↓ ves ventricular compliance

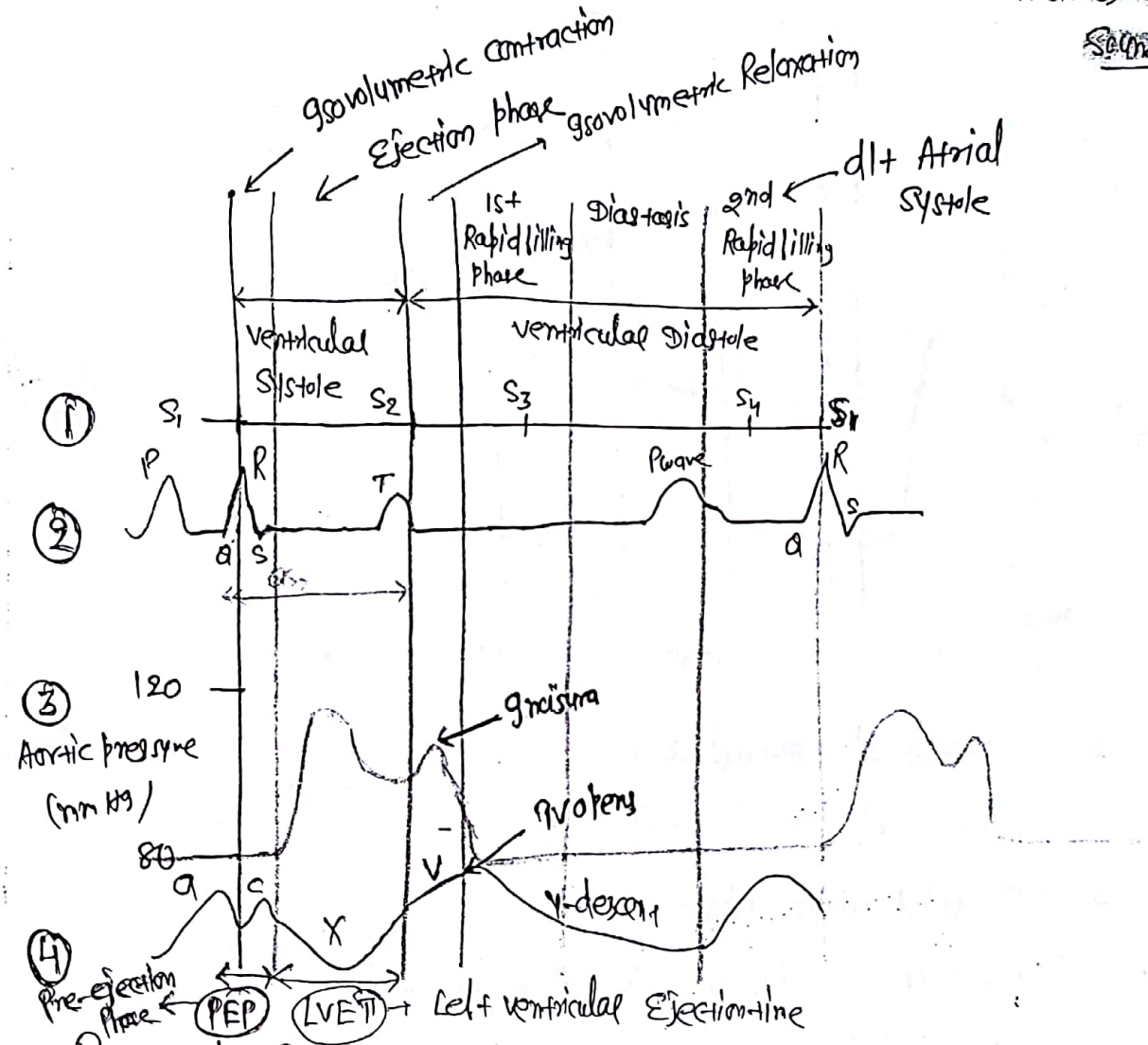
Always pathological

INCISURA ⇒ It is towards the end of ventricular systole;

↳ Left ventricular pressure became lower than Aortic pressure; So; Aortic blood tends to flow back into Left ventricle, but this stream of Aortic blood hits the Now close Aortic valve → INCISURA ON AORTIC PRESSURE CURVE

= Dicrotic Notch"

↳ coincides S2 heart sounds.



Peak of R wave coincides = onset of Isovolumetric Contraction phase (S_1)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

S_1 heart Sounds — coincides c → Peak of "R" wave

S_2 heart Sounds — " → End of "T" wave

S_3 heart Sounds — " → b/w "T" & Next "P" wave

S_4 heart Sounds — " → PR Interval.

Jugular Venous Pressure

- ~~Rt side seen~~
- It is better seen; as compare to left.
- JVP has definite upper Level
- Hepatojugular Reflux
- Multiple, positive waves
  - a, c, v
- Multiple Negative waves
  - x-descent; y-descent

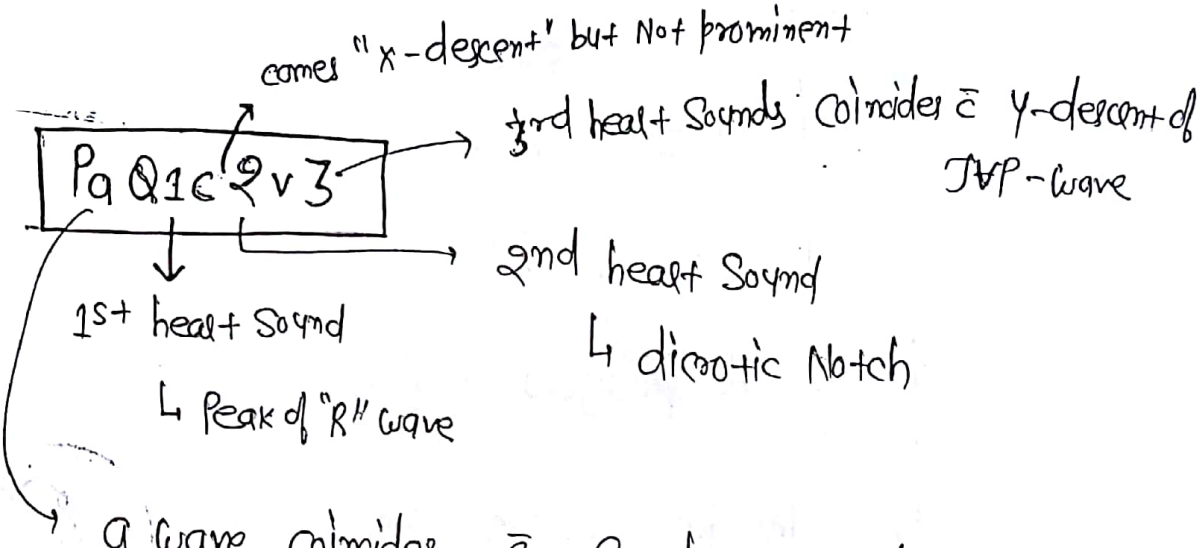
a-wave ⇒ Atrial systole

c-wave ⇒ Bulging of closed ~~Tricuspid valve into Right Atrium~~ during ~~isovolumetric contraction phase~~

X-descent ⇒ Downward Pull of closed Tricuspid valve during ejection phase

V-wave ⇒ due to Venous filling of Right Atrium just before opening of Tricuspid valve

Y-descent ⇒ Flow of blood from Right Atrium into Right Ventricle after opening of Tricuspid valve



* If we Record heart Sounds, ECG & Phonocardiogram Simultaneously ↓

QS_2 :- Total Electro-Mechanical Systole

↳ It is from onset of "Q" wave to the onset of "S2" heart sound

↳ It includes Ventricular contraction + Electrical conduction both (QRS complex)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Left ventricular Ejection time (LVET) :-

It is from the onset of carotid pressure Rise to Dicrotic Notch.

Pre-ejection Period (PEP) :- It is

QS_2 = LVET *

QS2 = LVET

(N) PEP / LVET = 0.35 *

(N) $\frac{PEP}{LVET}$ = 0.35

In conduction Abnormality $\frac{PEP}{LVET}$ → Yes (b/c PEP Prolong & LVET (N))

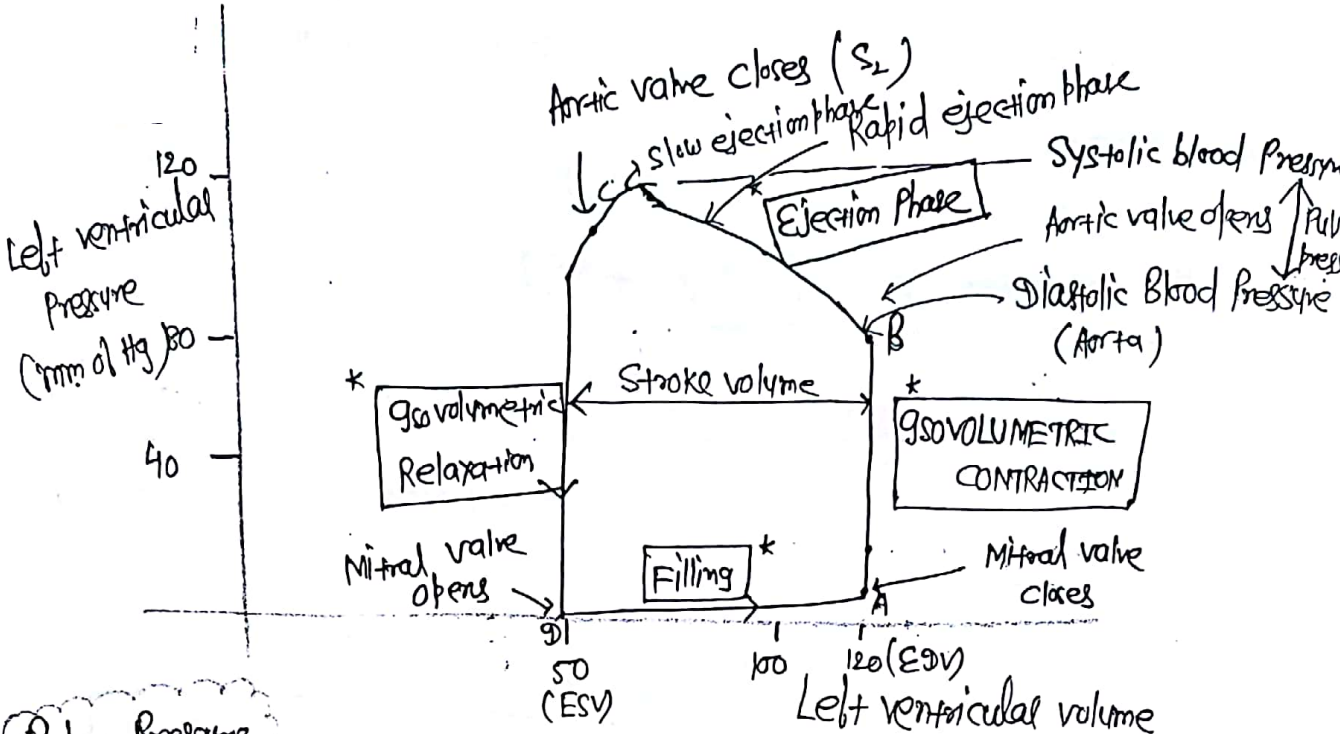
QQ Cardiologist

ECG
Phono cardiogram
Carotid pressure changes
} Recorded Simultaneously

his carotid pressure transducer Not functioning properly ?? Which of the following (N) ??

(A) only QS_2 ; (B) QS_2 & LVET ; (C) LVET & PEP ; (D) All

LEFT-VENTRICULAR PRESSURE VOLUME LOOP

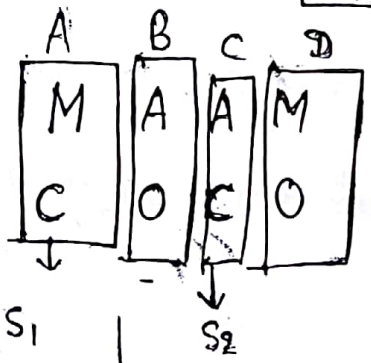


Pulse Pressure

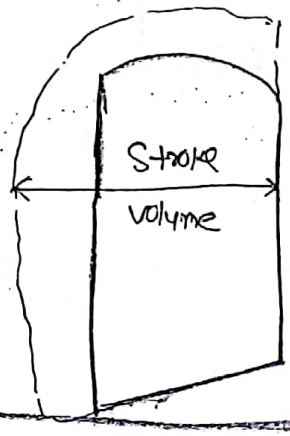
⇓

SBP − DBP

** **Ejection fraction** ⇒ **Stroke Volume** / **End diastolic volume**



Q. Which physiological condn



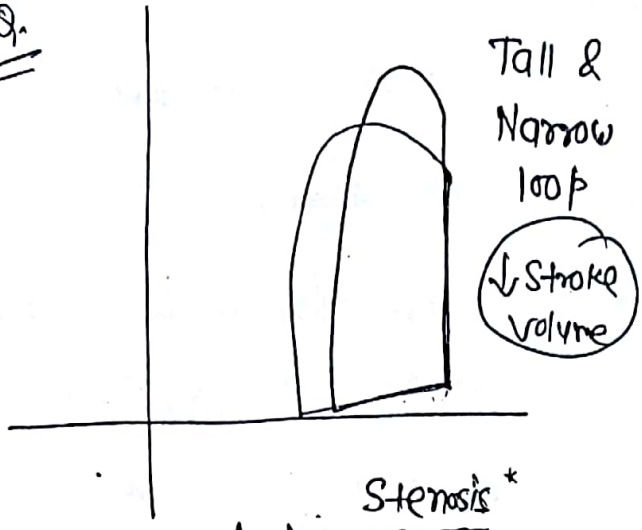
Symphathetic Stimulation of heart:

↑ Myocaldial contractility

↑ Stroke volume

↑ Systemic Peripheral Resistance

Qq.



Aortic Stenosis *

↓ End diastolic volume

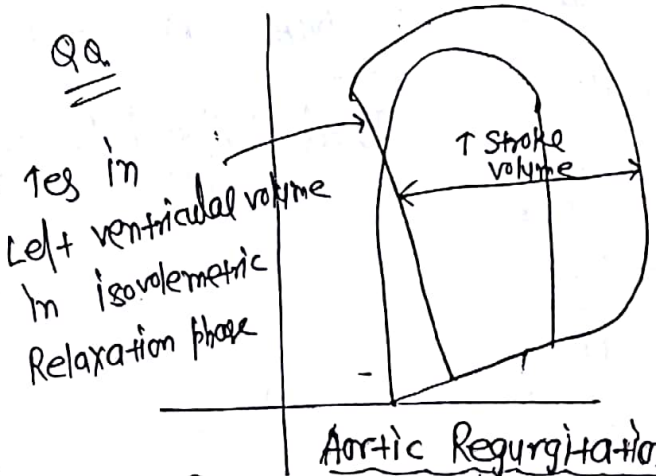
↓ Stroke volume

Mitral stenosis *

⇓

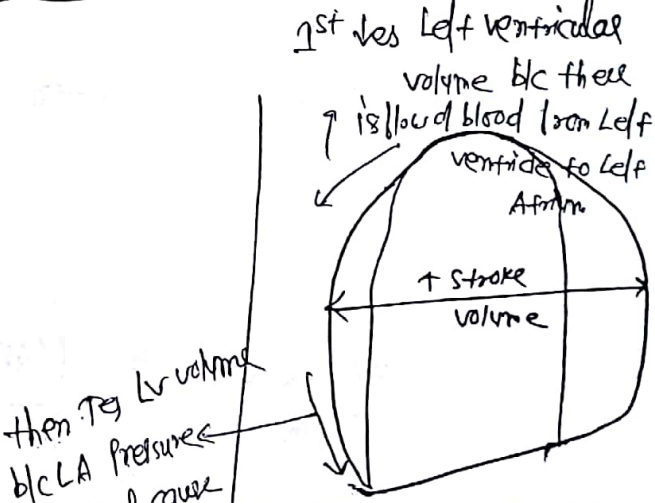
Left side shift of Loop

Qq.



↑es in Left ventricular volume in isovolemetric Relaxation phase

Aortic Regurgitation



then ↑es Lv volume b/c LA Pressure ↑es & cause ↑es the Lv volume

Mitral Regurgitation

Look @ Isovolumetric Relaxation phase

↓

higher Systolic Pressure *

↓

Lower systolic Pressure *

⇓

Right side shift of loop *

CARDIAC OUTPUT *

- Volume of blood ejected per ventricle/minute
  - Cardiac output = 5 Litres/min.
    - ↳ it means Left ventricular output is 5 Litres/min & also Rt. ventricular output is 5 Litres/min
    - Left ventricular output is 1-2 %. More b/c of "Physiological Shunting" *

Cardiac output = Left ventricular output = Systemic blood flow

Cardiac output = Right ventricular output = Pulmonary blood flow

→ C.O. = Systemic blood flow = $\frac{\text{MAP (Mean Atrial Pressure) − Rt. Atrial Pressure (RAP)}}{\text{Total Peripheral Resistance (TPR)}}$

⇒ C.O. ⇒ $\frac{\overset{100}{\text{MAP}} - \overset{0-3}{\text{RAP}}}{\text{TPR}}$

5 L/min

⇒ $\text{C.O.} = \frac{\text{M.A.P}}{\text{T.P.R}}$ **

⇒ $\text{M.A.P} = \text{C.O.} \times \text{T.P.R}$

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Cardiac output = Pulmonary Blood flow = (Mean Pulmonary Atrial Pressure − ΔP) / Pulmonary vascular Resistance

5 L/min 5 L/min

15 mm — 8 mm PCWP — (Left Atrial Pressure)

⇒ Cardiac output = Heart Rate × Stroke Volume

↑ Cardiac output ⇒ On Exercise (400–500 % Tes)
Anxiety (200 % Tes)
Excitement
Pregnancy
Standing to Lying Position (Tes venous Return)
Eating (30 % Tes)
Hyperthyroidism
Beri-Beri

↓ Cardiac output ⇒ Lying to Standing Posture (Tes venous Return)
Hemorrhage
Hypothyroidism
Myocardial Infraction

* No change in cardiac output :→ • Sleeping

• Moderate changage in Environment temperature

• Regulation of cardiac output :→

Heart Rate | **Stroke volume**

↑ Heart Rate ⇒ ↑ Cardiac output
(Sympathetic Stimulation)

↑ Sympathetic

↑ Heart Rate

(When the heart Rate ↑es
⇓
Duration of all the phases ↓es
↳ duration of diastole ↓es Much More than duration of systole)

↑ Force of contraction
⇓
Result in better emptying of ventricle
⇓
↑es Stroke volume
(↓es End Systolic volume) AIIMS May '18 **

Decrease end systolic volume

⇓

↑es cardiac output

Increase cardiac output

* When Heart Rate > 180-200/min

↓↓

↓↓ Diastolic Filling time

↓↓

↓ Stroke volume

↓↓

↓ Cardiac output

CO

Stroke volume

depends on

i) Myocardial contractility

Myocardial contactility

↑ Sympathetic

Inotropes

(Caffeine)

↑ contractility

↑ Stroke volume

↑ Cardiac output

ii) Venous Return

venous rectum

↑ Venous Return

↑ End diastolic Volume (Preload)

↑ tension generated

↑ Stroke volume

↑ Cardiac output

Frank-Starling Law, but

Upto a physiological extent.

* Factors which affects venous Return :-

i) Blood volume ; (↑es ⇒ Venous Return ↑es)

ii) Sympathetic Stimulation ;

↑ Sympathetic Stimulation
↓
Venous Constriction
↓
↓ venous compliance
↓
↑es venous Return

iii) POSTURE :-

Lying → Standing (↑es Peripheral Pooling
↓es venous Return)

Standing → Lying (↑es venous Return)

iv) Calf Muscle Contraction
↳ Exercise → ↑contraction ⇒ ↑ venous Return
K/as " Muscle Pump "

v) Deep Inspiration
↳ ↓ Pleural Pressure → ↑es venous Return

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Regulation of C.O.

HOMOMETRIC REGULATION

Homometeric regulation

- Includes factors ; which Tes cardiac output and are Independent of ventricular Muscle fiber Length.
- It includes; all factors which affects :-
  a) Heart Rate *
  b) Myocardial contractility *

HETEROMETRIC REGULATION

- Includes factors which affect Venous Return & ventricular Muscle fibes

* VASCULAR FUNCTION CURVES

I. VENOUS RETURN CURVE :-

Venous Return ⇒ Mean Systemic filling Pressure (P_{sf}) − Right Atrial Pressure (RAP) / Resistance to venous Return

5 L/min

1 mm

P_1 P_2

Mean Systemic filling Pressure (P_{sf}) ⇒ When heart stops beating ; circulation comes to stand ; still Pressure in all vessels (Arterial & veins) Equilibrates ⇒ This Pressure is called "Mean systemic filling pressure"

(N) = 7 mm of Hg.

Mean systemic filling

- It Represents Distending pressure in circulation @ a particular ~~Blood volume & vascular tone~~

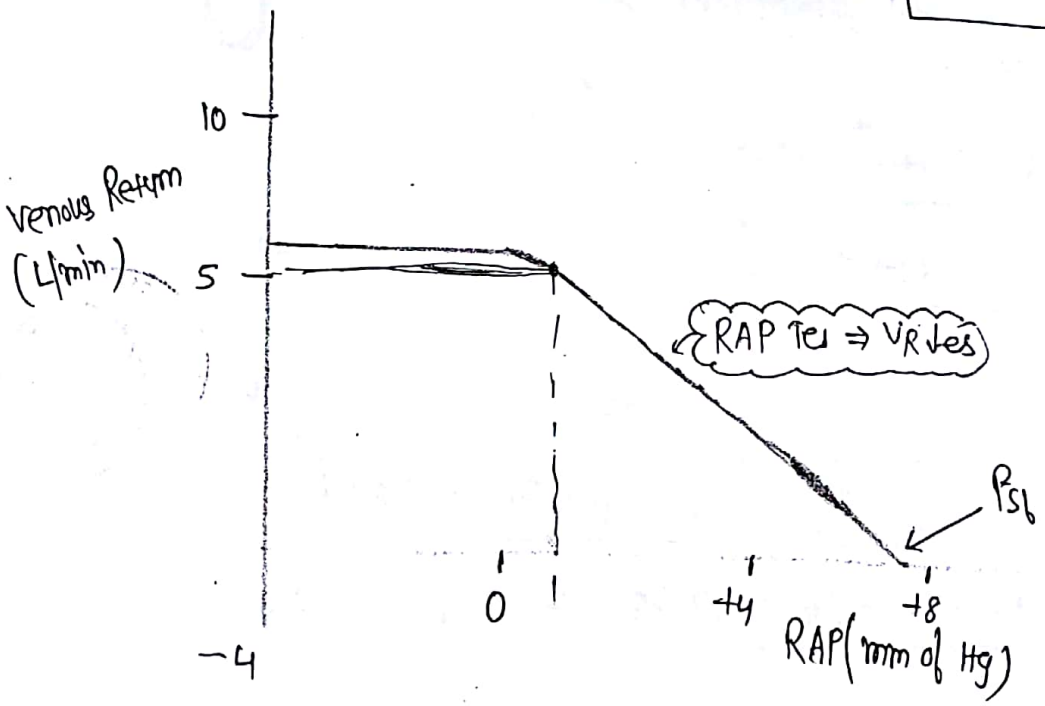
Blood volume and vascular tone

- 2 determinants

↳ Blood volume

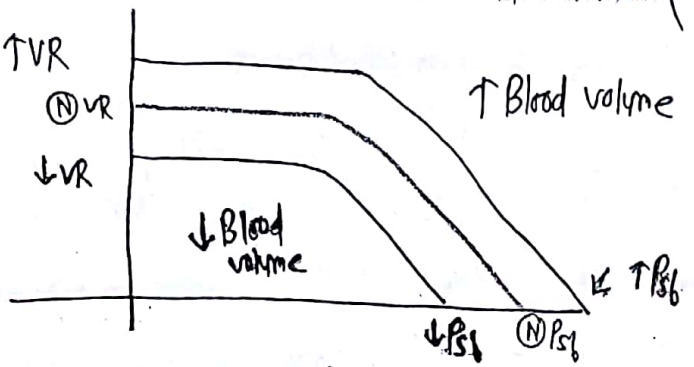
Venous tone.

$$V_R = \frac{P_{sf} - RAP}{Resist.\ VR}$$

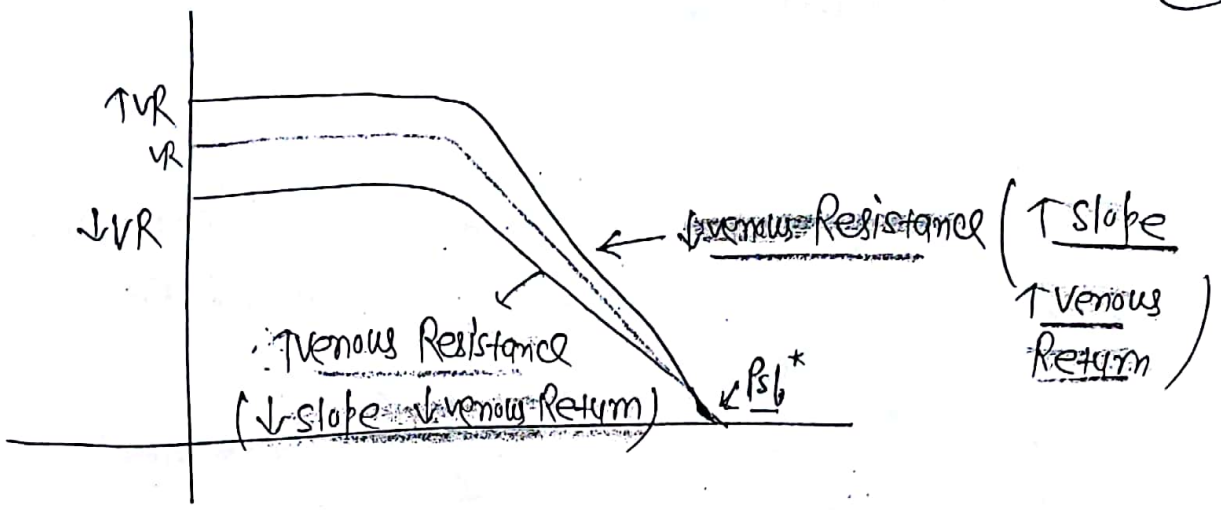


At Right Atrial Pressure (RAP) < 0 mm Hg ⇒ No further ↑es in venous Return (b/c veins tends to collapse)

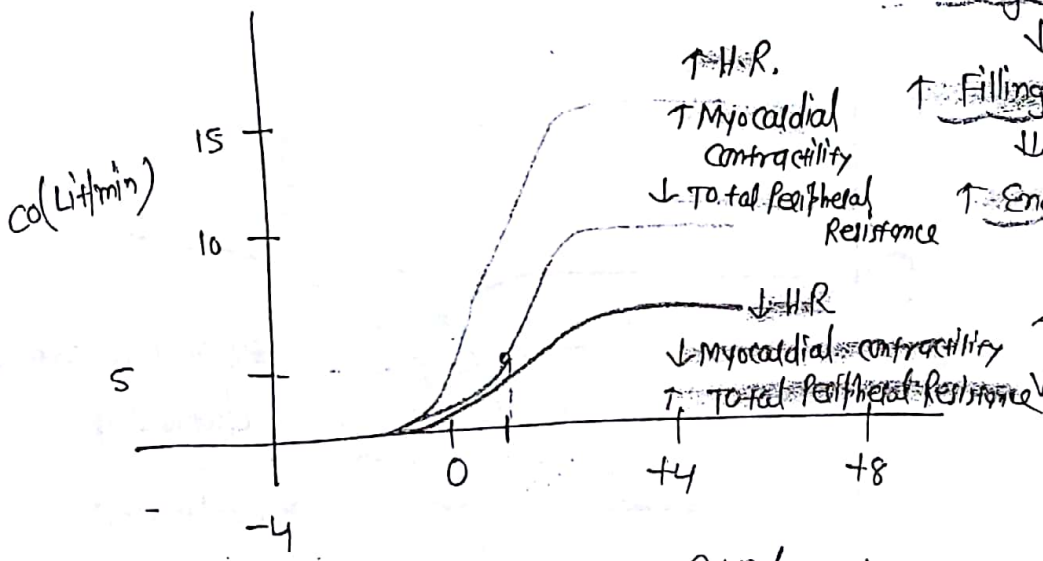
QQ.



QQ

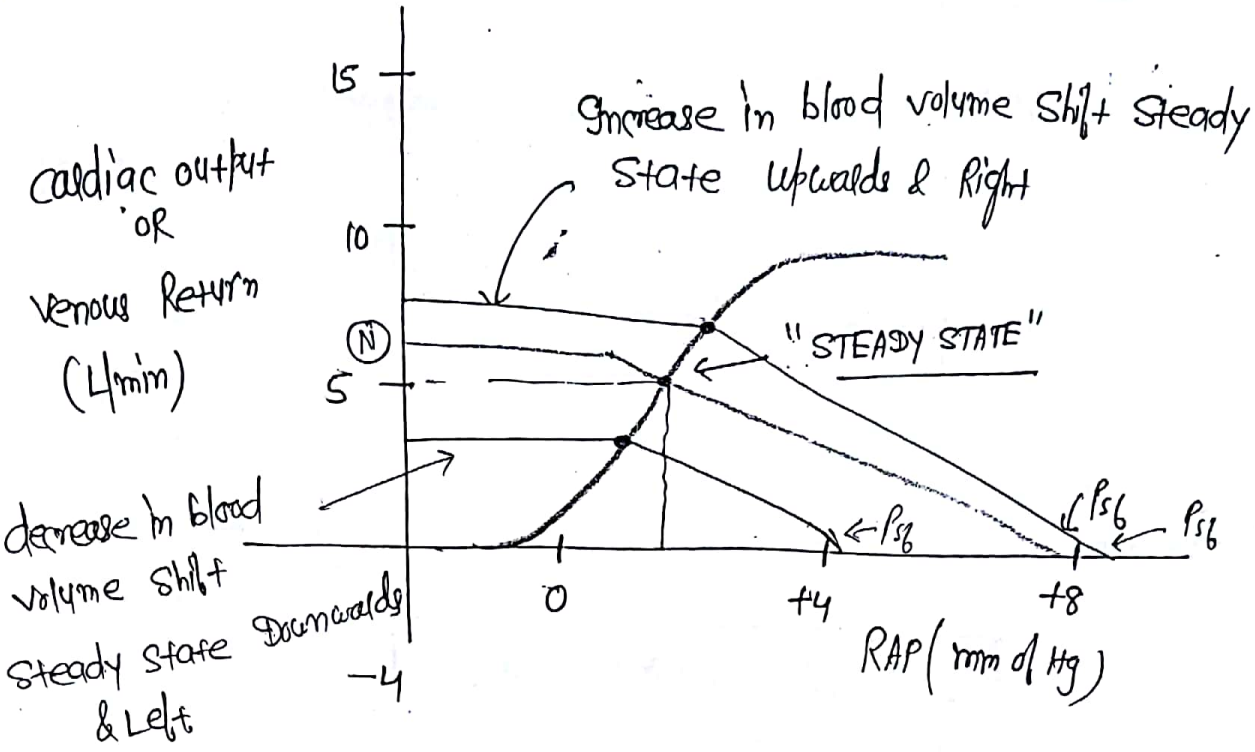


II. CARDIAC OUTPUT CURVES

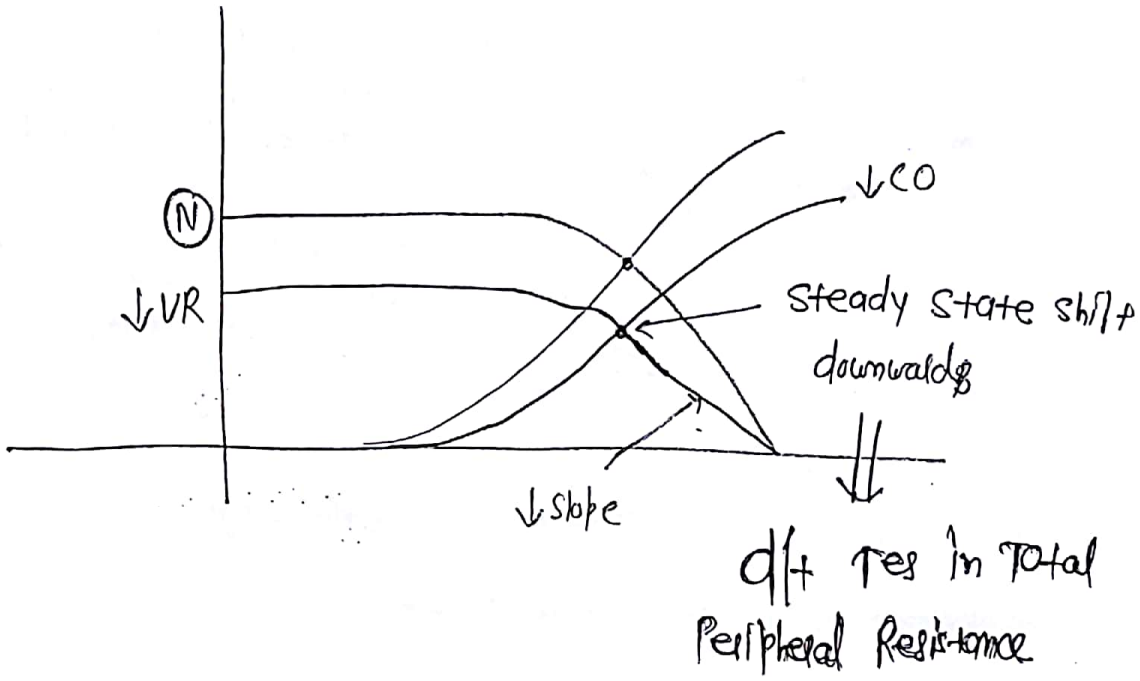


↑ Right Atrial pressure
⇓
↑ Filling of ventricle
⇓
↑ End diastolic volume
⇓
↑ Initial Length of ventricular muscle fiber
⇓
↑ Tension generated
⇓
↑ Stroke volume
↑ Cardiac output

Steady state :-

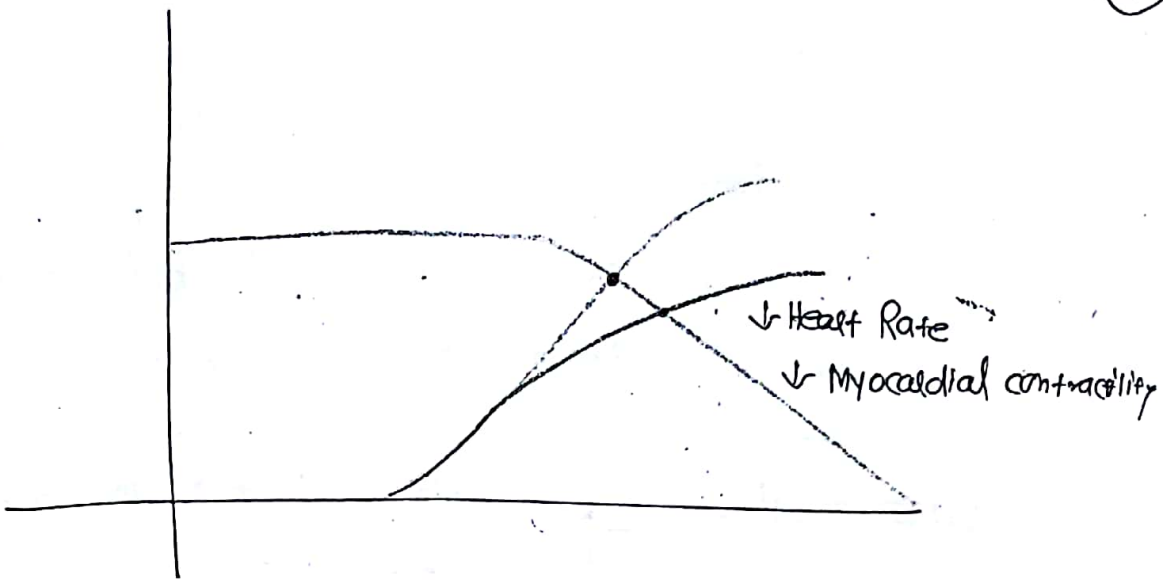


Q9.



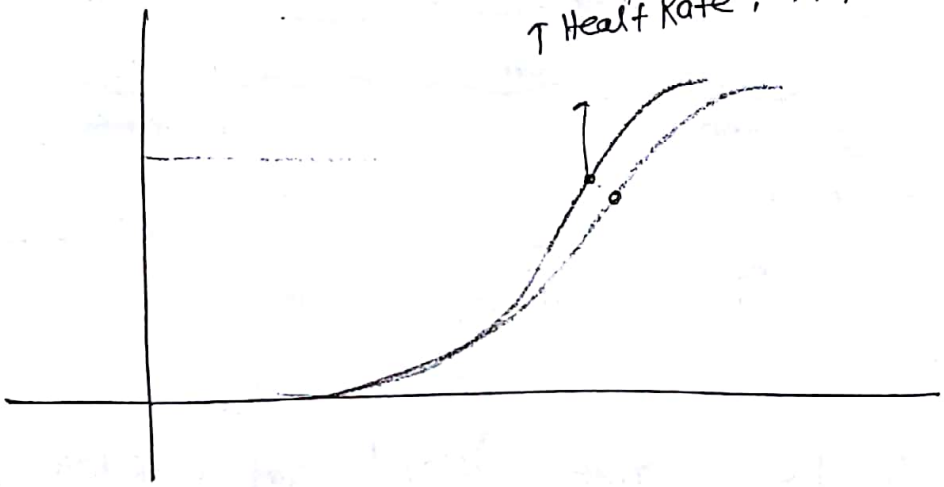
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

QQ



QQ

↑ Heart Rate ; ↑ Myocardial contractility



KK MEASUREMENT OF CARDIAC OUTPUT

(I) - NON-INVASIVE

↳ Echocardiography & Doppler Studies

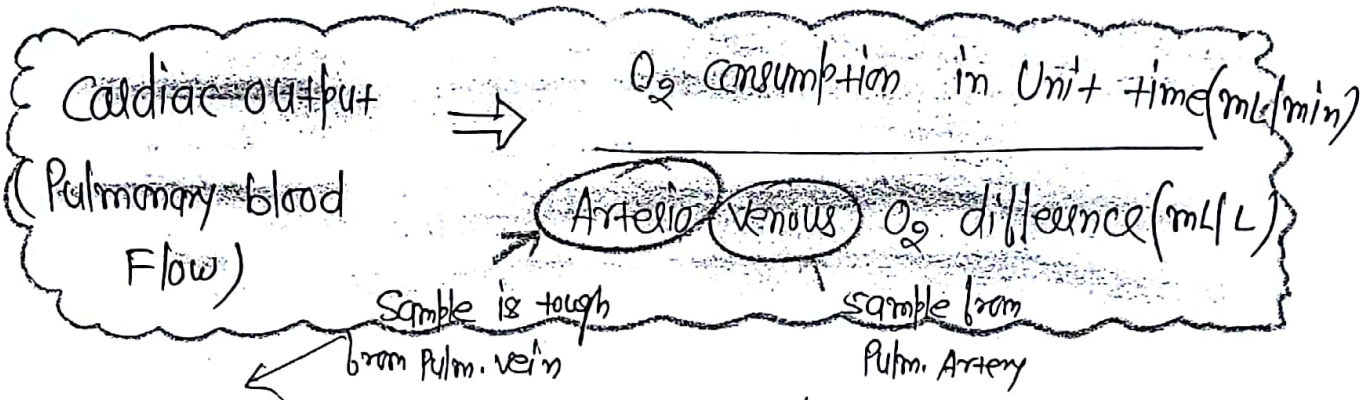
(II) INVASIVE

↳ Fick's principle

Dye dilution technique

Thermodilution technique

FICK'S PRINCIPLE - Amount of a substance taken up by organ / whole body in unit time is equal to the product of Blood flow through organ / whole body in unit time & Arterio-venous difference of that substance



So; taken up by any Systemic Artery $= \frac{250 \text{ mL/min}}{190 \text{ mL/L} - 140 \text{ mL/L}} = \frac{250}{50} = 5 \text{ L/min}$

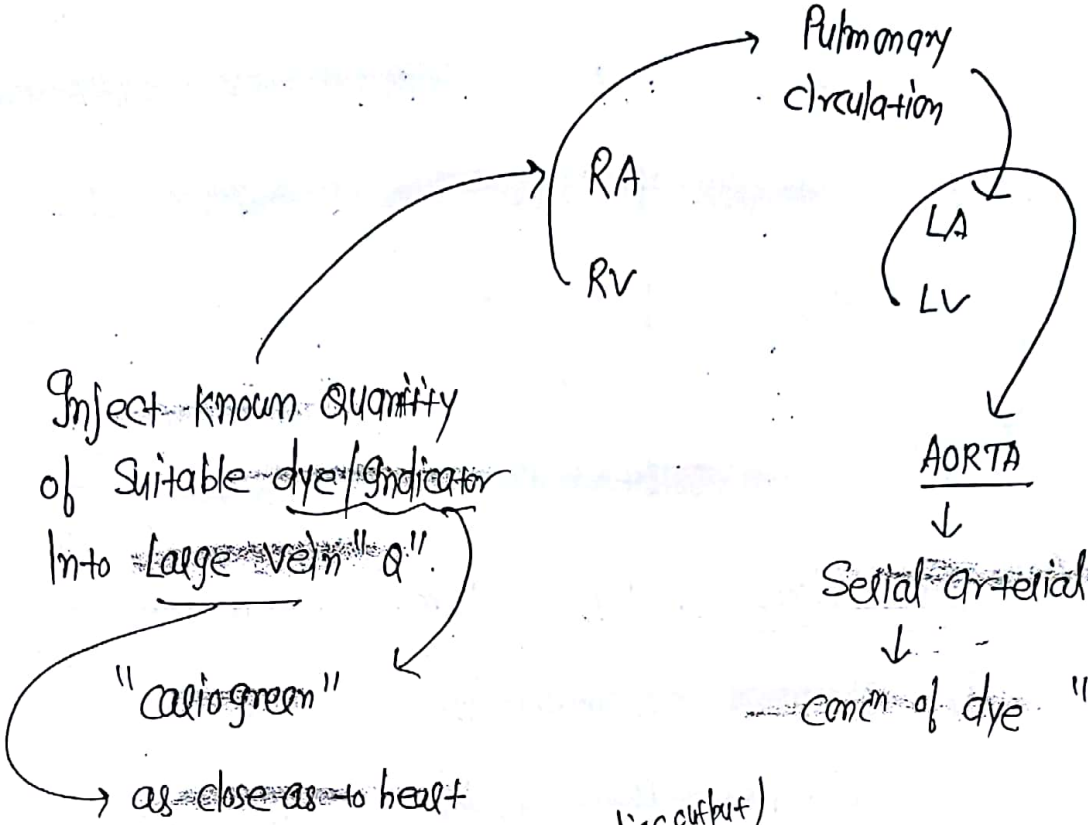
Q) In Fick's principle; Arterial sample is taken from
↳ Any Systemic Artery

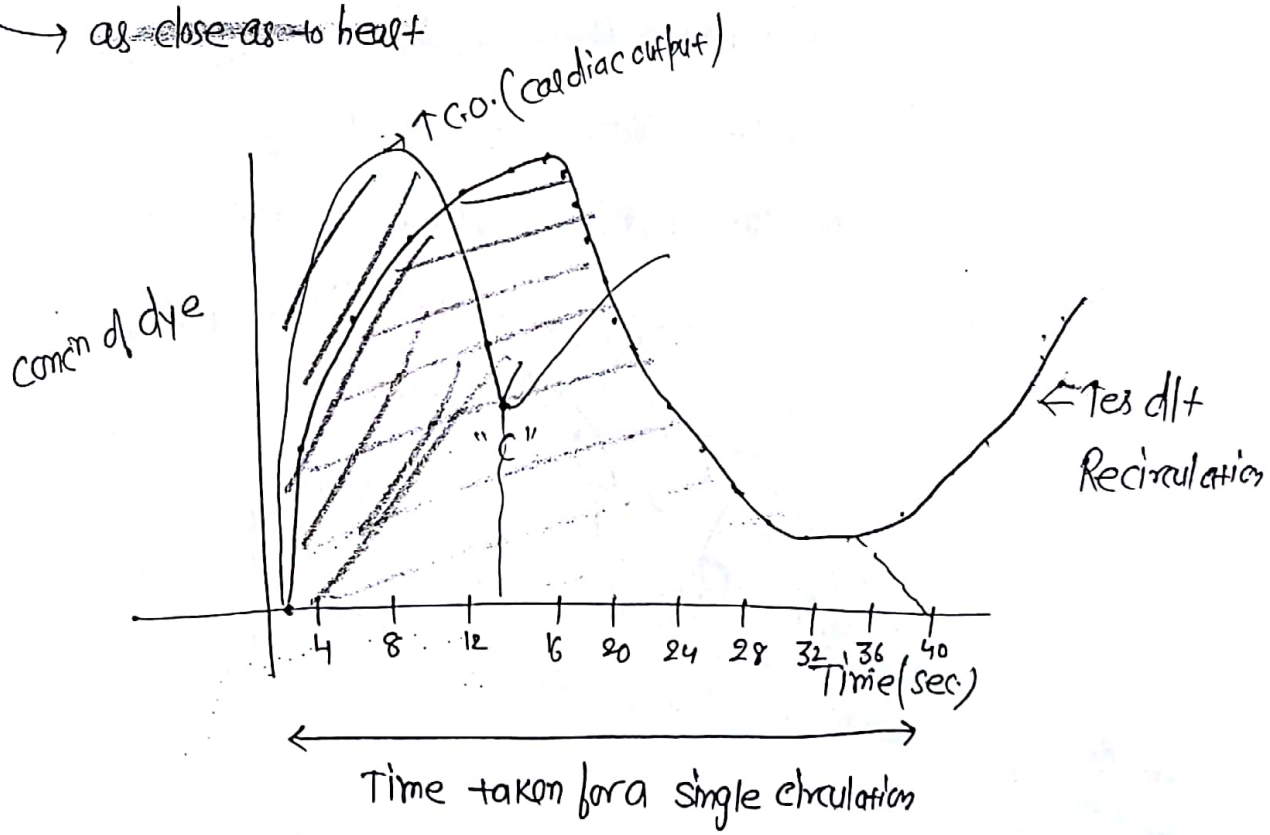
QQ) O_2 consumption 600 mL/min
Arterial O_2 .24 mL/mL of blood
Pulm. A O_2 .18 mL/mL of blood

Cardiac output $= \frac{600 \text{ (mL/min)}}{240 \text{ mL/L} - 180 \text{ mL/L}} = \frac{600}{60} = 10 \text{ L/min}$

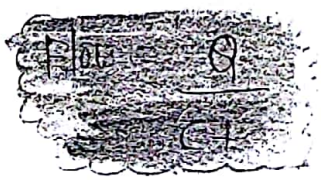
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

DYE - DILUTION TECHNIQUE :-





$$\text{Flow} = \frac{Q}{C\,t}$$



C = Concn of dye

Q = Volume of Injected dye

if "c" is less = More cardiac output

(N) time = 39 sec

THERMODILUTION TECHNIQUE ⇒ done in ccu settings *

Thermo dilution technique

↳ done by Pulmonary Artery Catheterization ↱ Swan Ganz catheter used

Pulmonary artery catheterization

Instead of dye use warm/cold saline

Instead of conc of dye : use temperature difference

temp. difference

↓

by thermistor

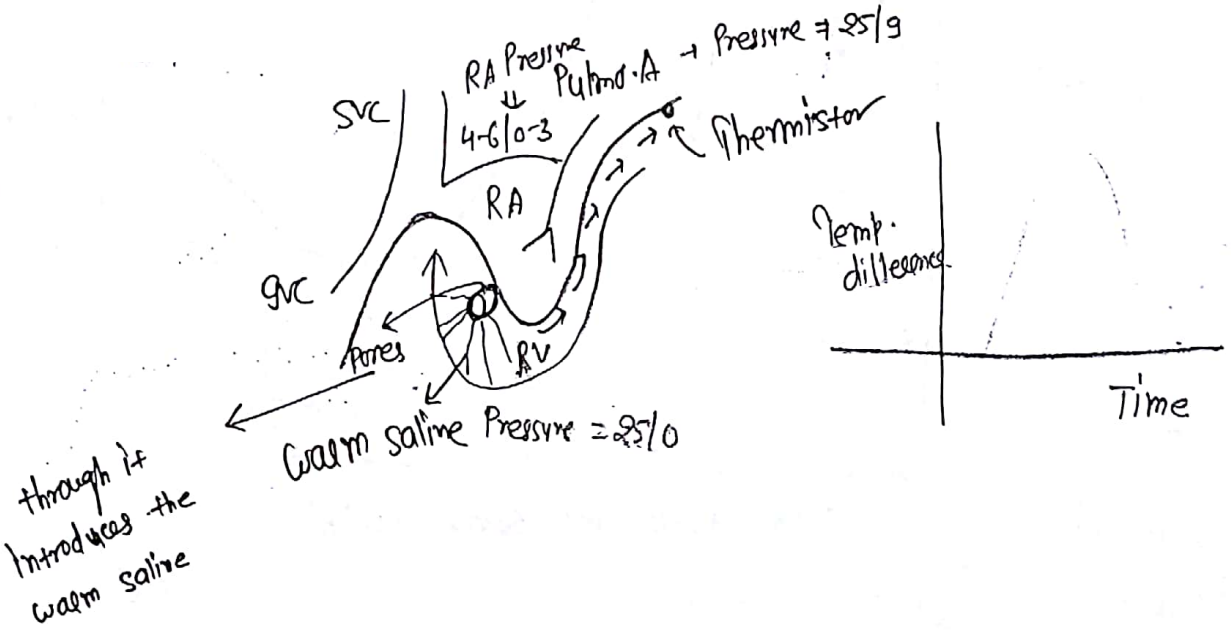
Thermistor

↳ ⊕ at tip of Swan Ganz catheter

K/as "Stewart-Hamilton" principle

* this technique will be Unreliable in conditions of →

1. Tricuspid Regurgitation
2. Pulmonary Regurgitation
3. Large ventricular septal defect
4. Very Low cardiac output.



BLOOD PRESSURE

SBP ⇒ Maxm pressure during systole

DBP ⇒ Minm pressure during Diastole

Pulse pressure ⇒ S.B.P − D.B.P.

MAP ⇒ $D.B.P + \frac{1}{3}$ P.P (Pulse pressure)

QQ Best Indicator of TPR ⇒

(1) DBP

(2) ~~MAP~~

2 determinants of Pulse pressure ⇒

a) Stroke volume ⇒ ↑SV ↑P.P. (AR)

↓S.V. ↓P.P. (AS)

b) Arterial compliance (A.C) ⇒ ↑ A.C ↓P.P.

Sclerosis ⟹ ↓ Ac TPP.

Sclerosis

QQ Ratio of Strove volume & Arterial compliance approx determine ⇒ SBP

DBP

PP ∝ $\frac{SV}{ART\ compliance}$

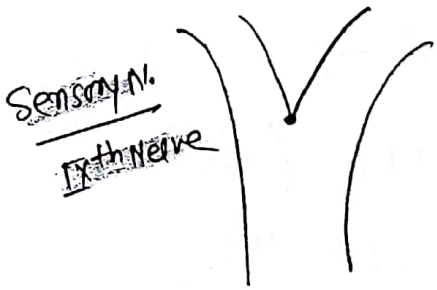
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

REGULATION OF B.P.

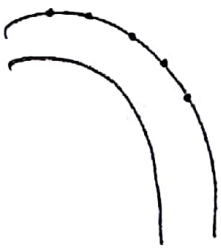
BARORECEPTOR MECH^N

Baroreceptor Mech

- "Buffer Nerves"
- Stretch Receptor — Stretch receptor
  - ↑ MAP → ↑ Stretch of vessel wall → ↑ Firing Rate
- Neural control
  - Response → Immediate
  - Adaptation ⊕
  - Imp. for Short term Regulation (Min. – to – Min. Regulation)



Carotid Sinus BaroReceptor

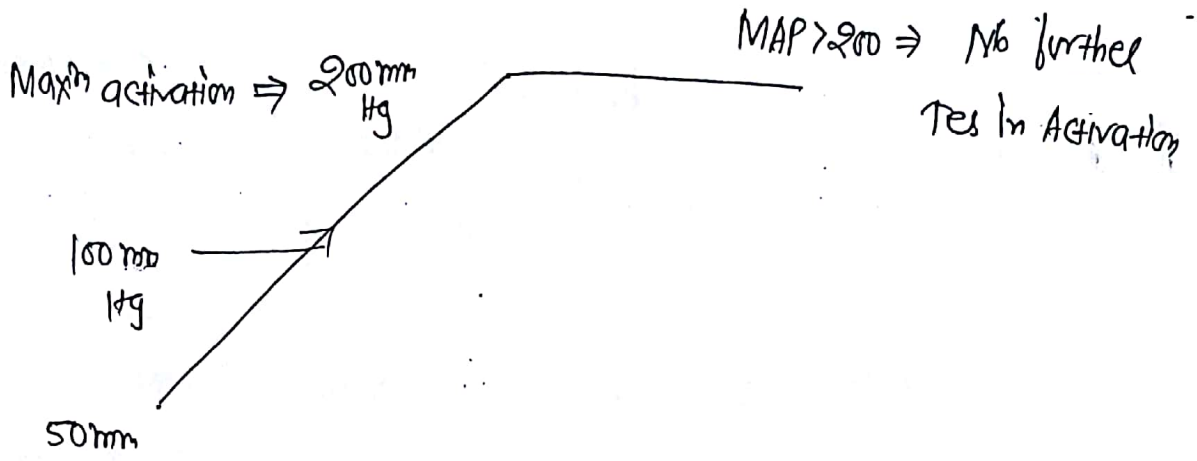


Aortic arch BaroReceptor

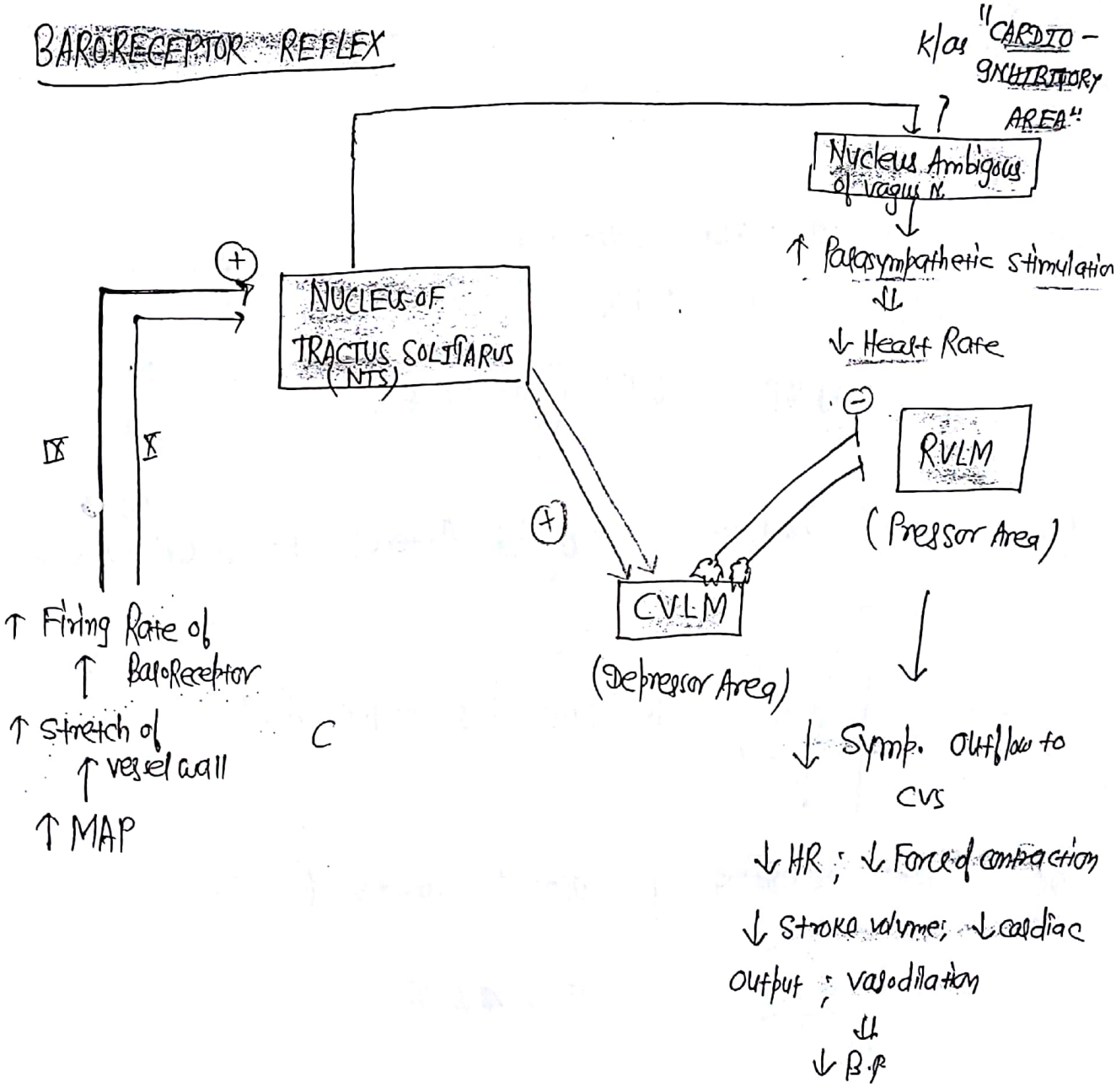
↳ 5th time more sensitive than Aortic Arch BaroReceptor

Threshold for Activation of BaroReceptor

↳ MAP of 50 mm Hg



BARORECEPTOR REFLEX



↑ MAP ⟶ ↑ Stretch ⟶ ↑ Firing Rate → ↓ Symphathetic, ↑ Palasymphathetic

↓ Heart Rate

dual Role by Sympathetic & Palasympathetic Stimulation ↓ B.P

↓ ↓MAP → ↓ Stretch → ↓ Firing Rate → ↑ Sympathetic, ↓ Palasympathetic

↑ Heart Rate

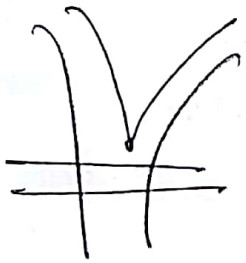
↑ B.P.

QQ. Calotid Sinus Stimulation :-

(A) ↑ B.P. ↑ HR

(B) ↓ B.P. ↓ HR (Modelate)

QQ B/L clamping of Calotid Arteries below calotid sinus



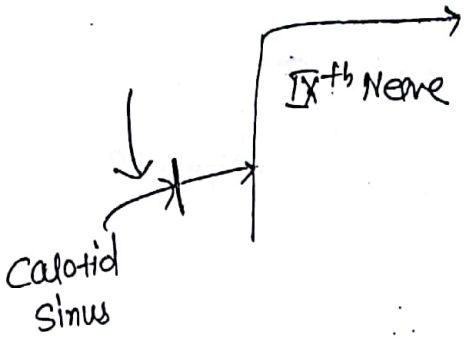
Modelate Tes In B.P. & ↑ HR

QQ B/L clamping of calotid Arteries @ carotid sinus

↓ B.P. & ↓ HR

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

QQ B/L Section of HERING's Nerve (Carotid Sinus Nerve)

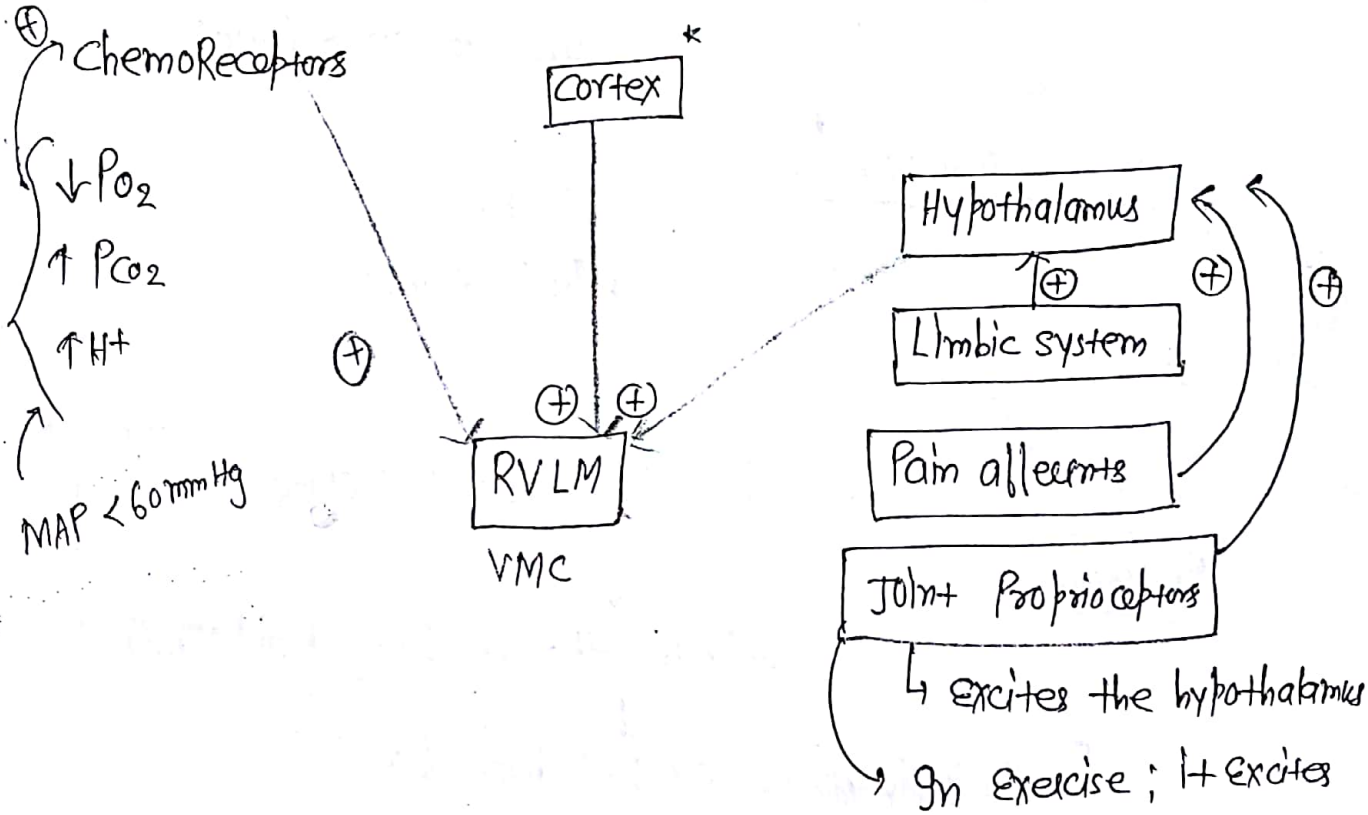


↑ In Sympathetic out flow

⇓

↑ In Blood Pressure & Heart Rate

OTHER INFLUENCES ON VASOMOTOR CENTER [RVLM] :-



CNS ISCHEMIC RESPONSE

- Seen b/w MAP of 65 & 140 mm of Hg
  ↳ cerebral blood flow is constant
  (Bcd Auto Regulation)

⇓

but if MAP < 65 mm of Hg ⇒ ↓es cerebral blood flow

⇓

CNS Ischemia

⇓

direct & very strong stimulation of Vaso Motor centre (VMC)

⇓

↑↑ B.P.
↑↑ HR

* Most powerfully activated @ MAP of 40 mm of Hg

⇓

Klas" LAST DITCH STAND"*.

* CUSHING's RESPONSE :→ ↑es Intracranial Pressure

↓

Compress the cerebral blood vessels

↓

↓ cerebral blood flow

↓

CNS Ischemia

↳ CNS Ischemic Response

Direct & very strong stimulation of VMC

↑↑ B.P.

Reflex Bradycardia ← Intact baroreceptor Mechn

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

ATRIAL STRETCH RECEPTOR RESPONSE

- Volume Receptors
- ⊕ in Low pressure Zones (Atria & Pulmonary vessels)
- 2 type of Atrial Stretch Receptor

TYPE A

Discharge in Atrial systole

TYPE B

Discharge in Late atrial diastole

↑ Blood volume

↓

Stimulate Atrial stretch Receptor

- ↑ ANP
  - Afferent Arteriol dilatation
  - Mesangial cell Relaxation
  - ↓ Na+ Reabsorption
    - Natriuresis

  ↑ GFR

- ↓ ADH
- Vasodilation
- Inhibit Vagal action on SA Node → ↑ HR

RAAS

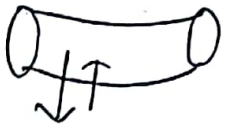
Stimuli which ↑es Renin (JG cells) ⇒

- Hypovolemia
- Hemorrhage
- Hypotension
- Dehydration
- Hyponatremia
- Excessive Use of Diuretics
- ↓ Renal afferent arteriole Pressure
- Renal Artery Stenosis
- ↑ Sympathetic
- Prolonged Standing
- Cirrhosis / CCF → Edema ++, ↓ circulating blood volume, ↑ Renin → 2° HYPERALDOSTERONISM.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* CAPILLARY FLUID SHIFT ⇒

↑ MAP
↓
↑ Capillary Pressure
↓
↑ Tissue fluid formation



QQ

MARRY'S LAW

Heart Rate ∝ 1 / Blood Pressure

Physiological basis
⇓
BaroReceptor Response

B.P. ∝ 1 / H.R

BAINBRIDGE REFLEX ★★

Sudden ↑ in blood volume → ↑ Heart Rate
↳ d/t Atrial Stretch ↑Receptor pressure
↳ Direct Stretch of SA Node

BEZOLD-JARISH REFLEX (CORONORY CHEMOREFLEX)

- Injection of - Serotonin
Capsaicin
Veratridine
Phenylguanides
} Into Carotid Arteries

⇓

Causes Apnea followed by Rapid shallow ventilation

⇓

Hypotension
Bradycardia

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

RENAL PHYSIOLOGY

Excretion ⇒ Filtration − Reabsorption + Secretion

Glomerular filtration Membrane ⇒

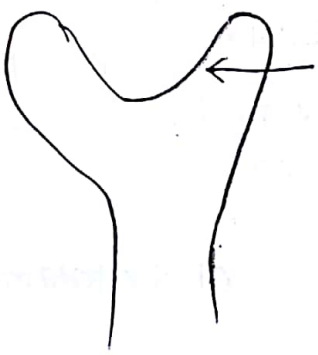
(i) Glomerular capillary Endothelium
- → Fenestrated
- → Large pores ⊕
- → 70–80 nm

(ii) Basement Membrane (Limiting factor for filtration)
- → No Pores
- → Permeability is equivalent to pore size of 8nm
- → Proteoglycans | sialoproteins ⊕

⇓

gives ⊖ve charge to basement Membrane

(iii)



visceral Layer of Bowman's capsule

⇓

Modified to form Podocytes

Filtration slits ⊕
- → 25–30 nm

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Neutral Substance > 8nm ⇒ Not filtered at all.

QQ Least Permeability of size & charge of

7nm ⊖ ⇒ size of Albumin

7nm ⊕

4nm ⊖

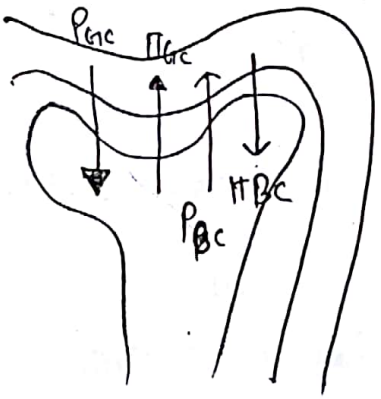
4nm ⊕ve

⇓

1st protein to appear in Urine when basement Memb. loses its ⊖ve charge.

HCO_3^- free filtered b/c of its small size

* Pressure Responsible for FILTERATION :-



Net filtration pressure ⇒

$\Rightarrow P_{GC} - \pi_{GC} - P_{BC} + \pi_{BC}$

$= 45 - 20 - 10 + 0$

$= 15 mmHg$ (=)

$(10 mmHg)$ (=)

* GFR $\propto$ Net filtration pressure

$\propto (P_{GC} - \pi_{GC} - P_{BC} + \pi_{BC})$

$= K_f (P_{GC} - \pi_{GC} - P_{BC} + \pi_{BC})$

③ ④ ⑤ ⑥

K_f = Permeability (①) × Surface Area (②)

all six parameter affects GFR

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* ↑ Sympathetic Stimulation

⇓

i) Afferent arteriole Constriction

ii) Mesangial cell contraction

↳ "KINKING" of Glomerular capillary

⇓

↓ Surface area

iii) Renin

↓ S.A
↓ GFR

* On Afferent Arteriole Dilatation

⇓

↑ P_{GC}

⇓

↑ GFR

* On Ureteric Stone OR Benign Hyperplasia of Prostate

⇓

↑ P_{BC}

⇓

↓ GFR

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

QQ. Blood Flows from afferent to efferent arteriole;

Which Yes ?

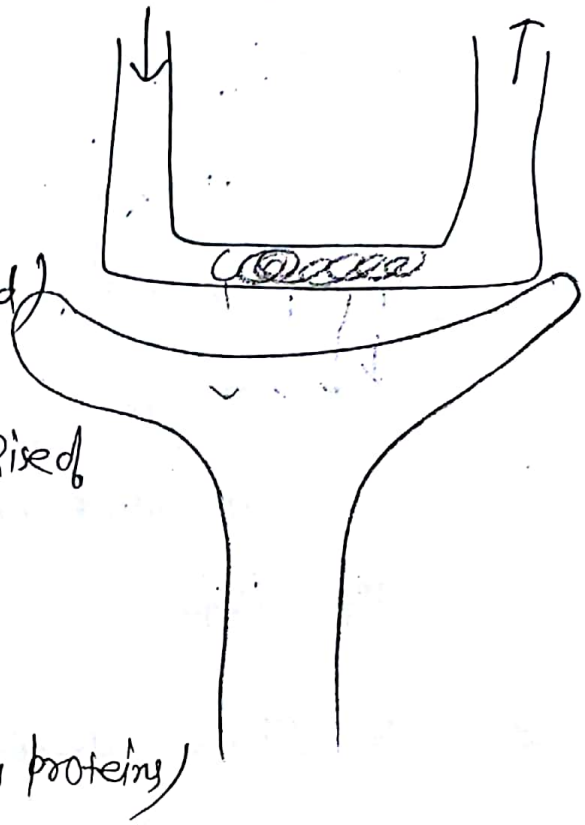
i) P_{GC}

ii) Π_{GC}

iii) P_{BC} (Remain Unchanged)

iv) Net filtration pressure

↳ Yes b/c of Rised Π_{GC}



Glomerular filtrate

↳ Ultrafiltrate of plasma

↳ (Plasma - Plasma proteins)

* Sometimes filtration @ the efferent arteriole = 0 (Zero)

⇒ Renal blood flow ⇒ 1100 - 1200 mL/min (22-23% of cardiac output)

Renal plasma flow ⇒ 625 - 650 mL/min

GFR ⇒ 125 mL/min

Glomerular filtrate ⇒ Ultrafiltrate of Plasma

Filtration fraction ⇒ $\frac{GFR}{RPF} = \frac{125 ml/min}{625 ml/min} = 0.16 - 0.20$

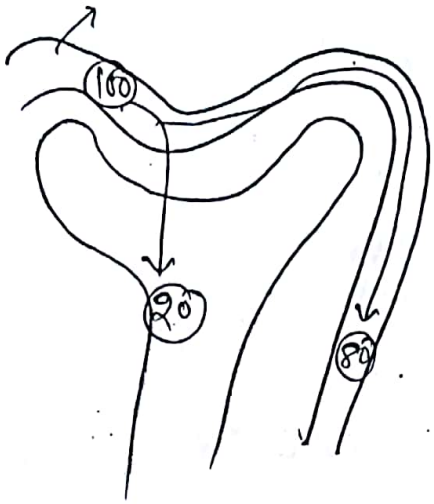
$= 16 - 20\%$

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Freely filtered ⇒ It doesn't Mean 100% filtered

⇓

Maximum 20% filtered in single circulation.



① ↑ GFR

~~a> Afferent Arteriolar dilatation~~

b> Efferent Arteriolar constrication

⇓

dual effect on GFR

Mild to Moderate efferent arteriole constrication ⇒ ↑ P_{GC}, ↑ GFR

↓ also ↑ Filtration fraction → ↑ Π_{GC} (also)

At one point ↑↑ Π_{GC} More than P_{GC} (↑) ; So GFR ↓↓

(In Severe efferent arteriolar constriction)

⇓

efferent arteriolar diameter is 1/2 - 1/3 of afferent arteriolar diameter

(↓↓ GFR)

② ↑ Filtration fraction

a> afferent arteriolar dilatation

~~b> Efferent arteriolar constricatk~~

$FF = \frac{GFR\uparrow}{RPF\uparrow} = Same$

$FF = \frac{GFR\uparrow}{RPF\downarrow}$

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

QQ Effect of Efferent arteriolar constriction on GFR ?

a) ~~Initially~~ ↑es then ↓es ;

b) ↑es ;

c) ↓es ;

d) No change.

EFFECT OF ANGIOTENSIN & SYMPATHETIC ON GFR

A attacks E

E attacks A

Angio-tensin - II ⇒ Efferent arteriole constriction

Sympathetic (epinephrine ⇒ Afferent arteriole constriction (↓GFR)

**

Angio II

→ Low conc^n (Physiological cond^n & Renal A. Stenosis) ⇒ Efferent arteriole constriction (↑GFR)

→ High conc^n (Hypovolemia Hemorrhage) ⇒ Both afferent & efferent arteriole constriction (↓GFR)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

B/L Renal A Stenosis ⇒

↑ Renin
↑ Angiotensin II (Low conc^n)
⇓
Maintains GFR

Pt. comes ☹ Hypertension

↳ if we give ACE Inhibitor
⇓
it causes to block in Angiotensin II
⇓
Result in "Renal Shutdown"

So; in this patient ACE Inhibitor all Contraindicated.

Renal Handling of different Substances

- Not Filtered / ~~Reabsorbed~~ @ all = Proteins (Albumin)

- Freely filtered; Not Reabsorb; Not secreted ⇒ Inulin

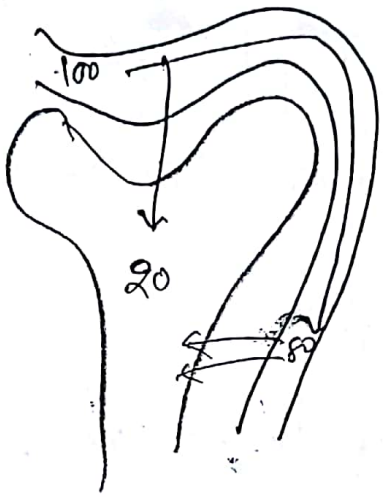
$$Cl_{in} = GFR$$

iii) Freely filtered; Completly Reabsorb ⇒

Glucose

Amino acid

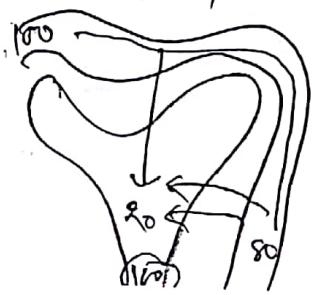
HCO_3^- (if HCO_3^- < 24meq/Litre)



iv) Freely Filtered ; Partly Reabsorb ⇒

- H_2O ⇒ GFR ⇒ 180 Litres/day
  - Urine ⇒ 1 - 1.5 Litre/day
- Electrolytes
- Urea (50%)

v) Freely filtered; completly secreted ⇒



Para amino hippuric acid

↓↓

Renal plasma flow

C_{PAH} (Excretion)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

vi) Freely filtered; Partially secreted :-

- PAH (High conc^n)
- Creatinine

* How to calculate the filtration Rate & Excretion Rate :-

Filtration Rate

⇓

GFR × P_x

$\frac{mL}{min} \times \frac{mg}{mL}$

$= \frac{mg}{min}$

Excretion Rate

⇓

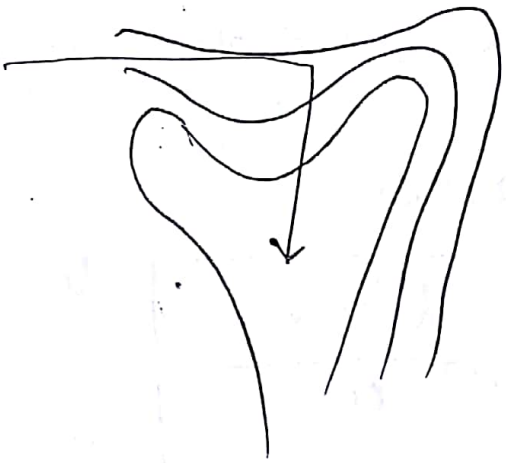
$U_x \times V$ → Rate of urine flow

⇓

Urine conc^n of "x"

$= \frac{mg}{mL} \times \frac{mL}{min}$

$= \frac{mg}{min}$



QQ - Blood glucose = 100 mg/dl = 1 mg/mL

GFR = 100 mL/min

1 mg/min

10 mg/min

~~100 mg/min~~

100,00 mg/min

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

QQ $Na^+ = 140$ mEq/L

GFR = 180 L/Day

filtration Rate / day =

$= 180 \times 140 = 25,200$ meq/day

CLEARANCE **

- Volume of plasma cleared of that Substance / free of that Substance in Unit time → Clearance of Substance

- Unit ⇒ mL/min.

- $$Cl_X = \frac{U_x \times V}{P_X}$$

U_X = Urinary concn of Substance "X" (mg/mL)

V = Rate of Urine flow (mL/min)

P_X = Plasma concn of "X" (mg/mL)

** $[Cl_X] = \frac{\frac{mg}{mL} \times \frac{mL}{min}}{\frac{mg}{mL}} = \frac{mL}{min}$

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

$Cl_{Inulin} = GFR$

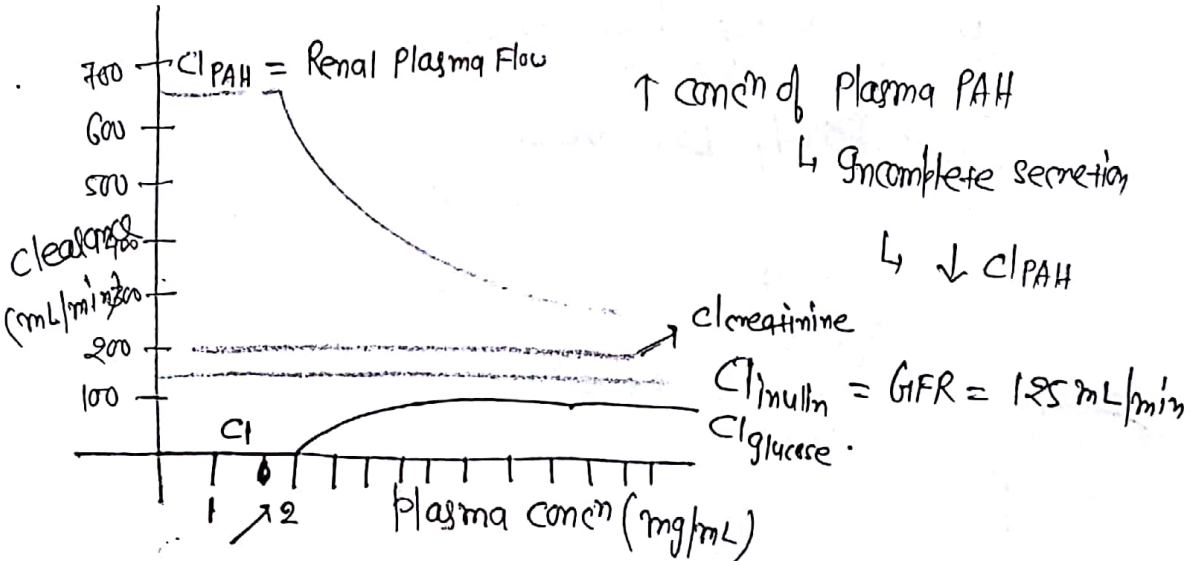
Cl_{PAH} (in Low conc^n) = Renal Plasma flow

For Inulin ⇒ Filtration Rate = Excretion Rate

$\Rightarrow GFR \times P_{in} = U_{in} \times V$

$\Rightarrow GFR = \frac{U_{in} \times V}{P_{in}}$

$\Rightarrow GFR = Cl_{inulin}$ *



↑ conc^n of Plasma PAH
↳ Incomplete secretion
↳ ↓ Cl_{PAH}

Renal threshold (180-200 mg/dl) OR 2mg/mL

below 2mg/ml $Cl_{glucose} = 0$; b/c Urinary conc^n of glucose is zero below 2mg/ml.

QQ Which of the following has highest clearance?

a) Inulin;

b) Glucose;

c) Urea;

d) Creatinine

QQ. Cl_{PAH} is used for Measurement of Renal Plasma flow

Technician by Mistake; gives 3 times Recommended dose of PAH

(a) (N) value

(b) Falsely high value

(c) Falsely Low value

FREE H_2O CLEARANCE

Cl_{H_2O} = Rate of Urine flow ($\dot{V}$) − clearance of osmoles

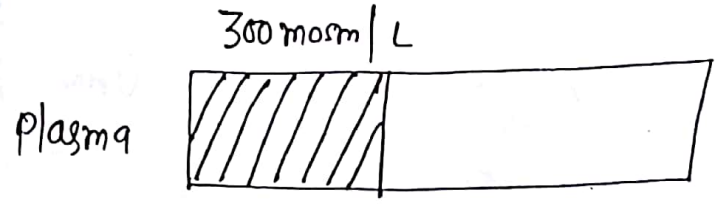
$$Cl_{H_2O} = V - \left[\frac{U_{osm} \times \dot{V}}{P_{osm}}\right]$$

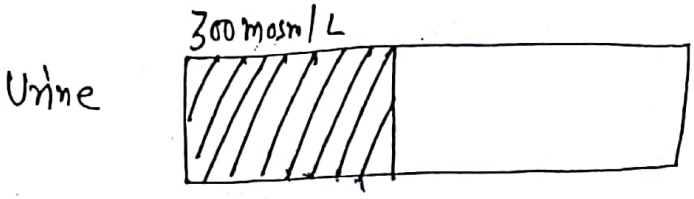
* If Urine is isotonic w.r.t plasma ⇒

$$Cl_{H_2O} = \dot{V} - \left[\frac{U_{osm} \times \dot{V}}{P_{osm}}\right]$$

$= \dot{V} - \dot{V}$

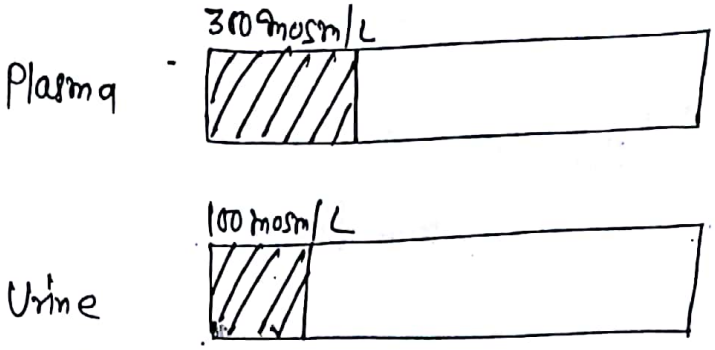
$=$ Zero





C_{H_2O} = Zero

* if Urine is Hypotonic :⇒



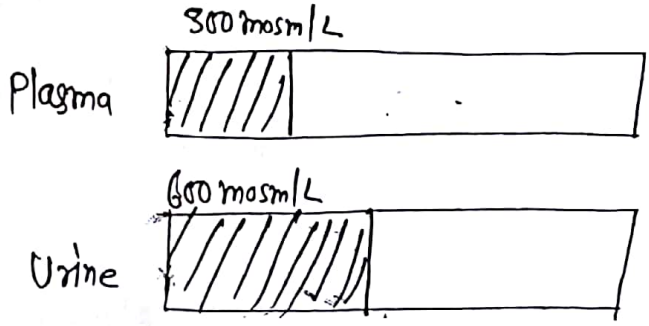
$C_{H_2O} = \dot{V} - \frac{100 \times \dot{V}}{300}$

$= \dot{V} - \frac{1}{3}\dot{V}$

$= \frac{2}{3}\dot{V}$

C_{H_2O} = ⊕ve

* if Urine is hypertonic | concentrated :⇒



$C_{H_2O} =$

$\dot{V} - \left(\frac{600^{2} \times \dot{V}}{300}\right)$

$= \dot{V} - 2\dot{V} = \ominus\dot{V}$

C_{H_2O} = ⊖ve

Q. $C_{H_2O} = -1.2$ ml/min

Urine is

(a) Isotonic

(b) Hypotonic

(c) Hypertonic

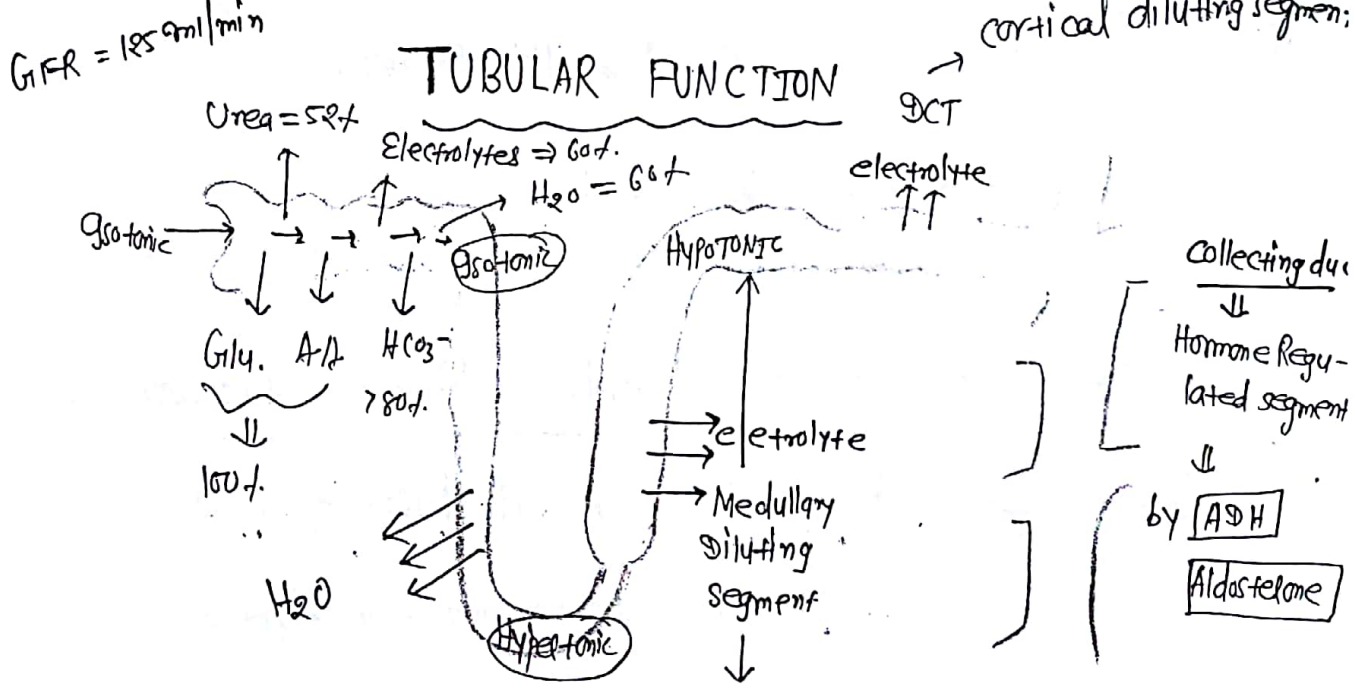
Q In Diabetes Insipidus; $C_{H_2O} = ?$

+ve; Yes

Q. Marathon Runner ; Sweating ++

Maxim Antidiuresis ; $C_{H_2O} = ?$

(a) +ve; (b) -ve



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

PCT ⇒ Angiotensin II ⇒ ↑ Na^+ Reabsorption

PTH ⟶ ↓ Phosphorus Reabsorption
(Phosphaturic Action of PTH)

TAL → Thick ascending Limb ⇒ Angiotensin II ⟶ ↑ Na^+ Reabsorption

DCT ⇒ PTH ⇒ ↑ Ca^{2+} Reabsorption

CD ⇒ ADH ⇒ Yes H_2O Reabsorption

Aldosterone ⇒ Yes Na^+ Reabsorption
Yes K^+ Secretion
Yes H^+ Secretion

ANP ⇒ ↓ Yes Na^+ Reabsorption

* How does kidney handle different Substances :-

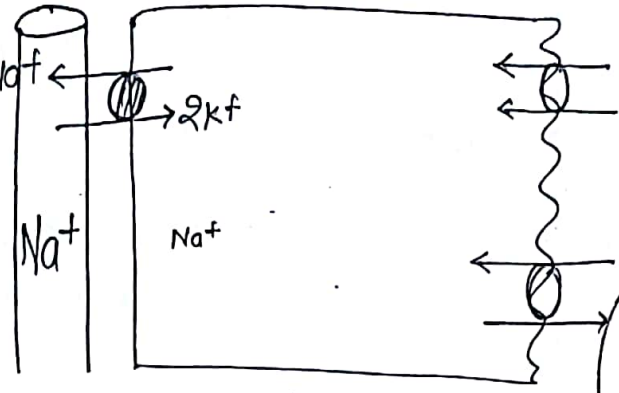
SODIUM ⇒ Reabsorbed in all parts of Nephron
except ⇒ Descending thin segment

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

PCT :→ Basolateral side of PCT has Na^+-K^+ Pump.

⇓

60 % Na^+ Reabsorb



2° Active co-transport
(Na^+-Glucose
Na^+- Amino acid)
(Na^+- Pi)

2° Active counter-transport
(Na^+-H^+)

→ Inhibited by Parathormone.

On PCT; (Na^+ - Pi IIa protein)

Na^+ - Pi IIc protein

→ This protein is Inhibited by PTH

⇓

↑ Urinary loss of Inorganic Phosphorus

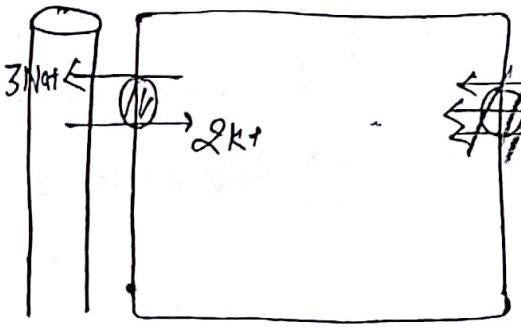
(Phosphaturic action of PTH)

Descending thin segment ⇒ No Reabsorption of Na^+

Thick Ascending Limb ⇒

⇓

30% Na^+ Reabsorb



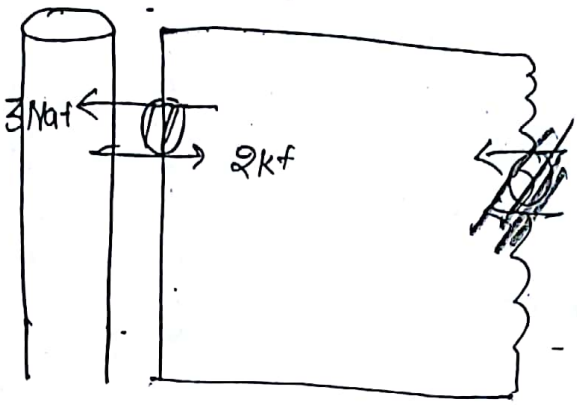
Lasix (Furesomide) works here

$Na^+-K^+-2Cl^-$ Co-transport

(2° active cotransport)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

DCT ⇒ 7% Na^+ Reabsorbed

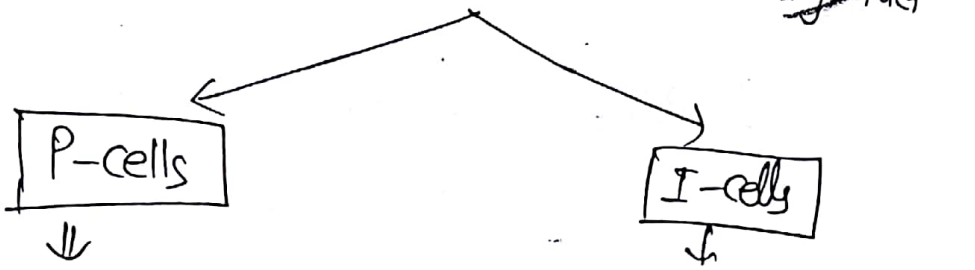


Thiazides acts here

Na^+–Cl^- co-transport

→ Secreted by Zona glomerulosa of Adrenal cortex.

Aldosterone acts on Late DCT & collecting duct

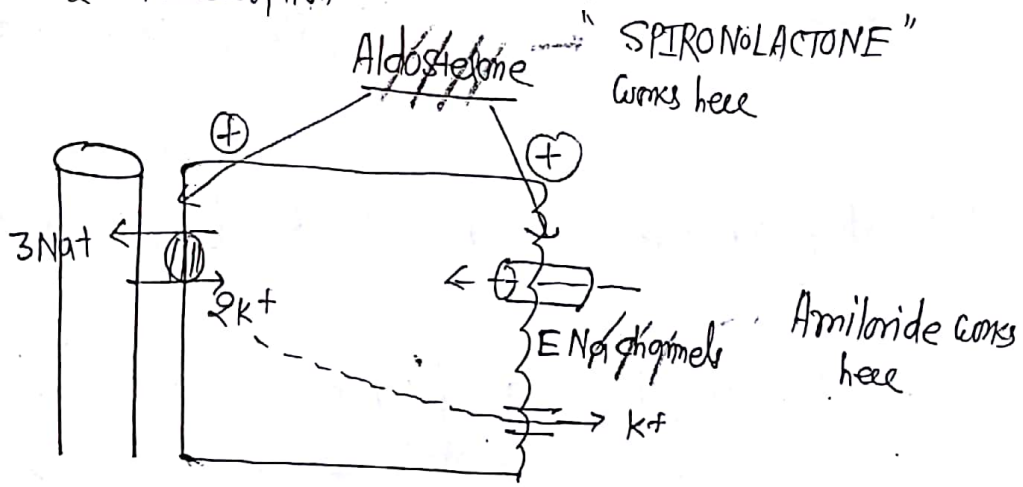


Principal cell

- → Na^+ Reabsorption
- → K^+ secretion
- → H_2O Reabsorption

Intercalated cells

L H^+ secretion



RAAS ⟶ Aldosterone ⇒ ↑ Na^+ Reabsorption

↑ K^+ secretion

↑ H^+ secretion (by "I-cells")

QQ Which gives directly Stimulation to Aldosterone ??

(a) ↑ Na^+ ;-

(b) ↓ Na^+ ; (it works via RAAS)

(c) ↑ K^+ ;

(d) ↓ K^+

QQ Hyperaldosteronism can Never cause ??

Likely to cause

~~(a)~~ Acidosis ;

(b) Alkalosis ;

+

Hypokalemia

QQ

POTASSIUM ⇒ It is both Reabsorbed & Secreted.

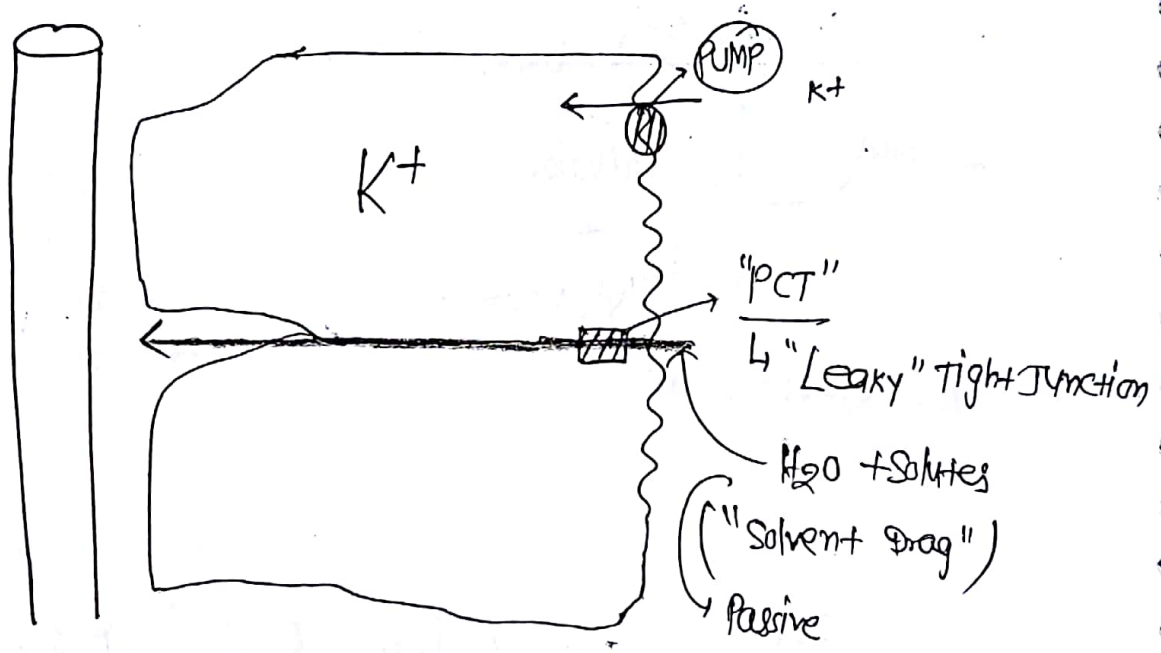
Reabsorption ⇒

- PCT
  - Passive ("Solvent Drag")
  - Active (we don't know about Pump)
- TAL ⇒ Na^+–K^+ – $2Cl^-$ co-transport (2° Active co-transport)

Secretion

↳ Collecting duct & Late DCT
(by Aldosterone)

SOLVENT DRAG ⇒



CALCIUM ⇒ Freely filtered & Almost Completly Reabsorbed (99+)

- Mechⁿ of Ca^{+2} Reabsorption
  ↳ Similar to Na^+
- Maxᵐ Ca^{+2} Reabsorption ⇒ PCT

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* PTH ↑ Ca^{2+} Reabsorption in "DCT"

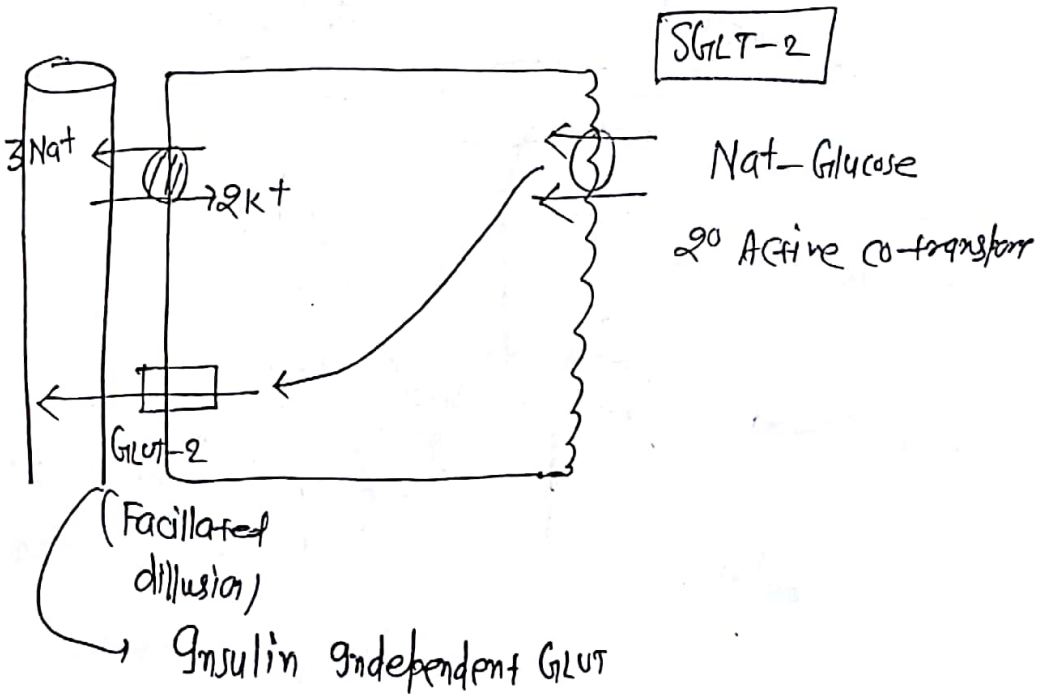
MAGNESIUM ⇒ Max^{im} Mg^{2+} Reabsorption in "Thick Ascending Limb"

- Lasix ⟶ ↑ Urine loss of — Na^+
  Cl^-
  K^+
  Ca^{++}
  Mg^{++}

GLUCOSE

Site = PCT ; 100% Reabsorption

Mechanism :-



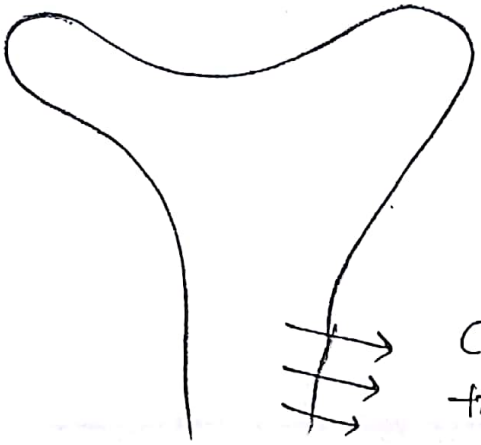
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

RENAL THRESHOLD ⇒ Plasma conc^{n} beyond which glucose appears in urine

↳ 180 – 200 mg/dl

OR

2 mg/mL



Carrier Mediated transport

⇓

T_mG ⇒ ♂ = 375 mg/min

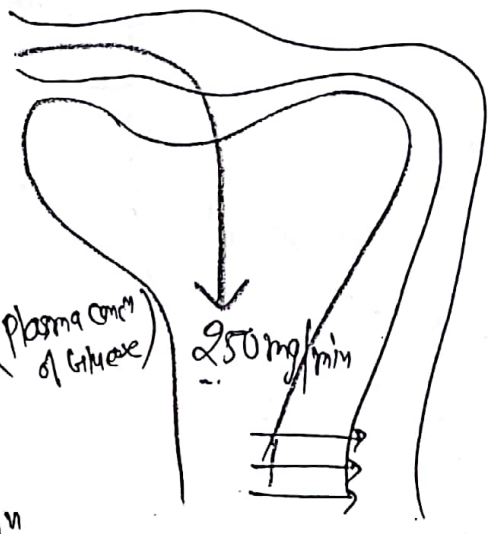
♀ = 300 mg/min

⇓

Transport Maxima of Glucose

T_mG ← Glucose Rate

*



Renal threshold

⇓

2 mg/mL

Filtration Rate

⇓

GFR X $P_{Glucose}$ (Plasma conc^{n} of Glucose)

= 125 X 2

= 250 mg/min

250 mg/min

T_mG = 375 mg/min (♂)

= 300 mg/min (♀)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Ideally @ this condⁿ total glucose Reabsorbed & (88)
Not appear in Urine ; but b/c of

"NEPHRON HETEROGENEITY"

↳ All Nephron's Not Works Simultaneously and Not ē Same capacity.

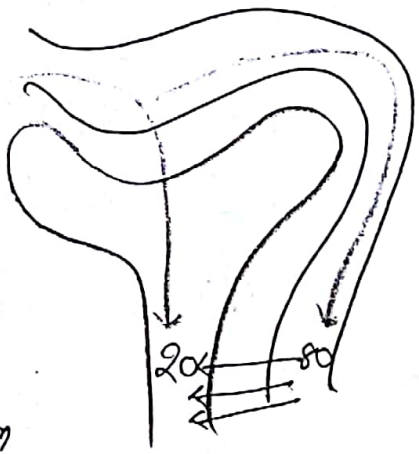
↳ At Plasma glucose of 2mg/mL
↳ Filtration Rate of glucose is 250 mg/min ; which is less-than T_{MG} ; but at P_{GLU} of 2mg/mL → Glucose begins to appear in urine

PAH

- Freely filtered & completely secreted (In Low concⁿ)

PAH (Low concⁿ) ⇒
<20 mg/dl

if ↑ Plasma concⁿ of PAH
↓
Incomplete secretion
↳ clearance PAH ↓



Secretion of PAH
↳ PCT
↳ Carrier Mediated secretion
↳ Tm ⊕

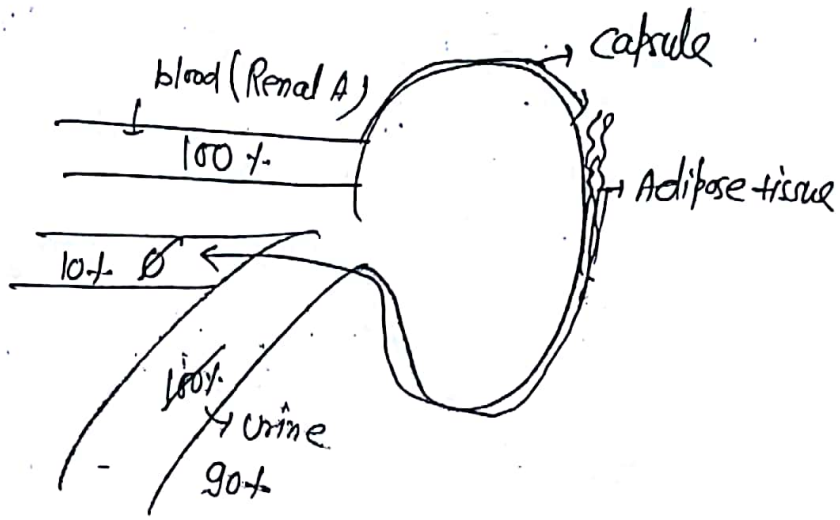
$(T_m)_{PAH}$ = 80 mg/min

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

QQ PAH (Low conc^n)

⇓

So; PAH has an Extraction Ratio



$$\text{Extraction Ratio} = \frac{\text{Arterial conc}^n - \text{Venous conc}^n}{\text{Arterial conc}^n}$$

$$= \frac{100-10}{100} = \frac{90}{100} = 0.9 \text{ OR } 90\%$$

Why there is an Extraction Ration of PAH??

b/c complete Renal Artery blood doesn't participate in filtration (Small amount goes into Renal capsule & Adipose tissue & directly goes into Renal vein; Not participate in filtration).

QQ. Cl$_{PAH}$ (Low conc^n) ⓐ Actual Renal blood flow

ⓑ Effective Renal blood flow

ⓒ Actual Renal Plasma flow (ARPF)

ⓓ Effective Renal Plasma flow (ERPF)

$$ARPF = \frac{ERPF}{0.9}$$

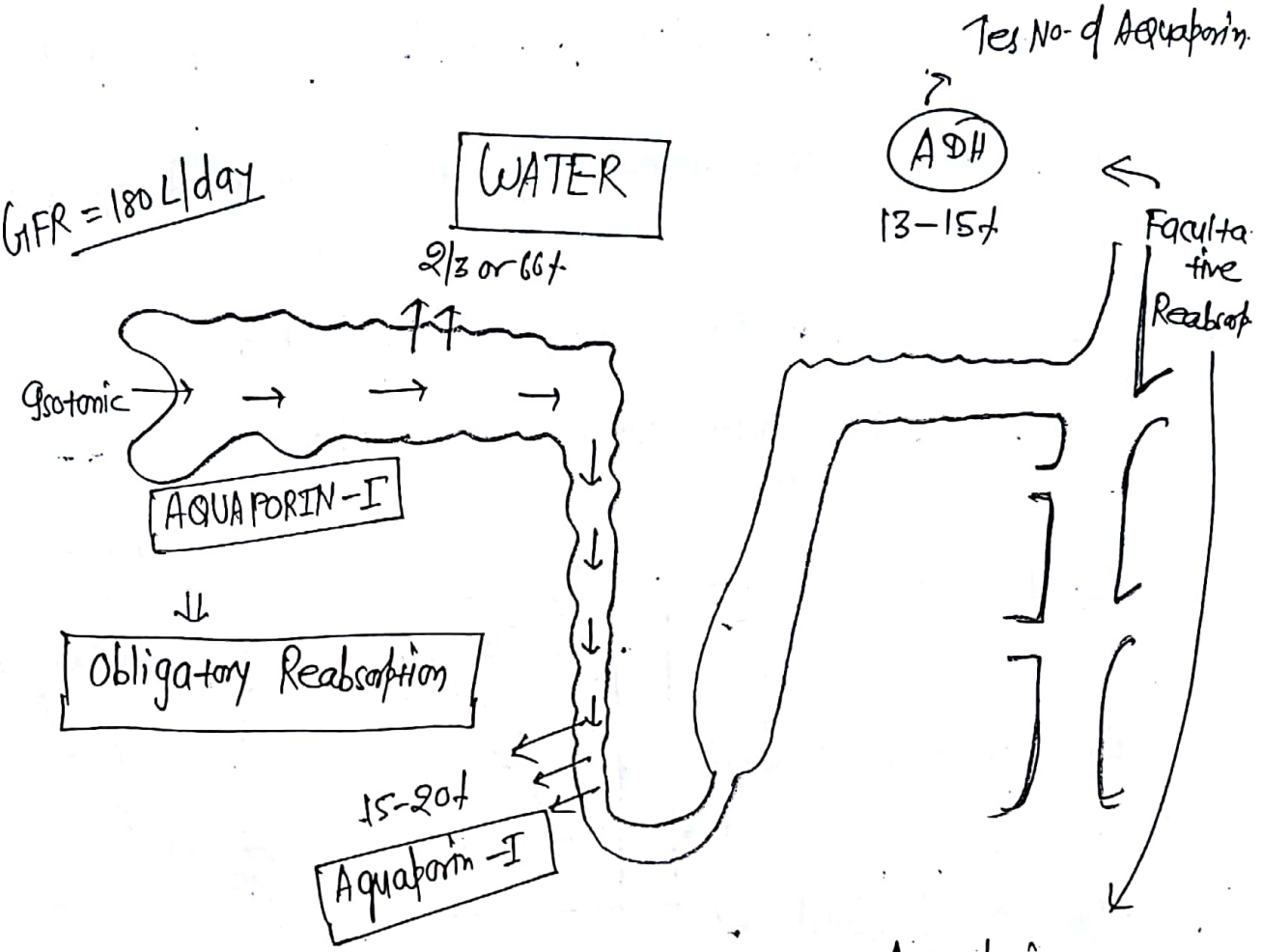
QQ ERPE = 630 ml/min

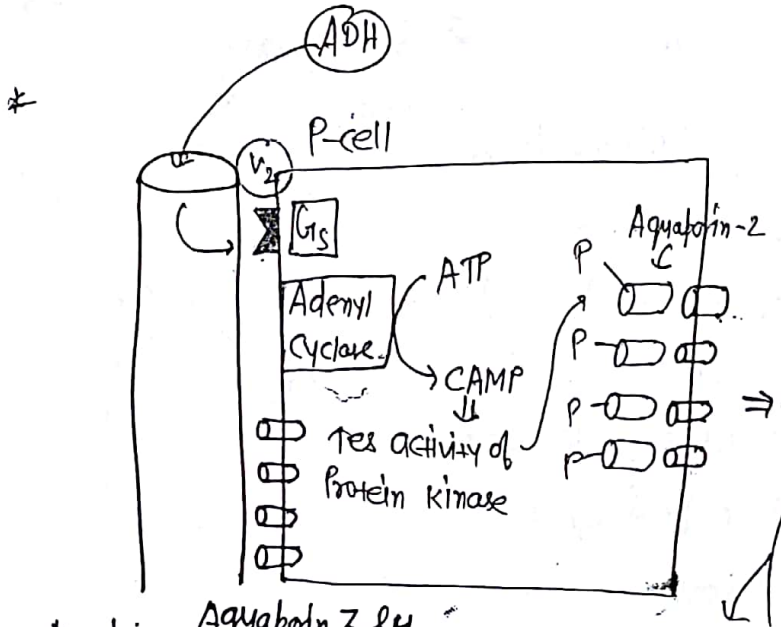
ARPF = 91

ARPF = 700 ml/min

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

** Renal blood flow = $\frac{100}{100 - \text{Hematocrit}} \times$ Renal Plasma flow





Aquaporin-2 on Luminal side & Aquaporin-3 & 4 on Basolateral Membrane

⇒ ↑ Insertion of Aquaporin-2 on Luminal Membrane

⇓

↑ H_2O Reabsorption by ADH

↳ concentrated urine

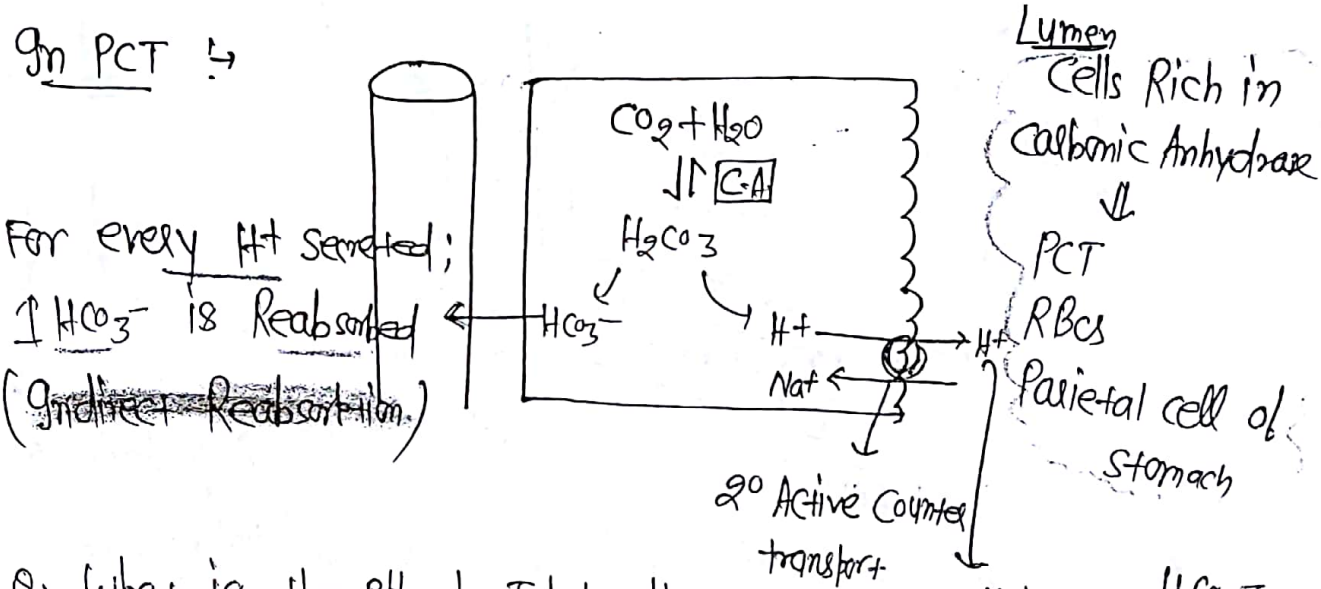
H^+

Filtration ⟶ Not possible
↳ b/c No free form ⊕.

↳ but urine is acidic ; b/c of secretion of H+

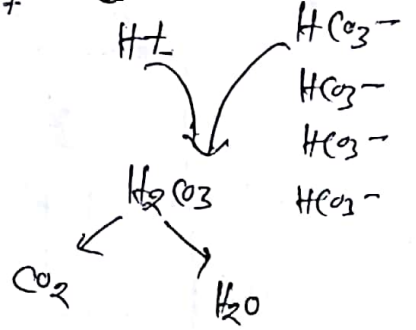
Q. Maxm H+ is secreted by -
(a) ~~PCT~~ (4200 mmol/day)
(b) CD (<80 mmol/day)

Q. Urinary Acidification occurs by -
(a) PCT
(b) ~~CD~~



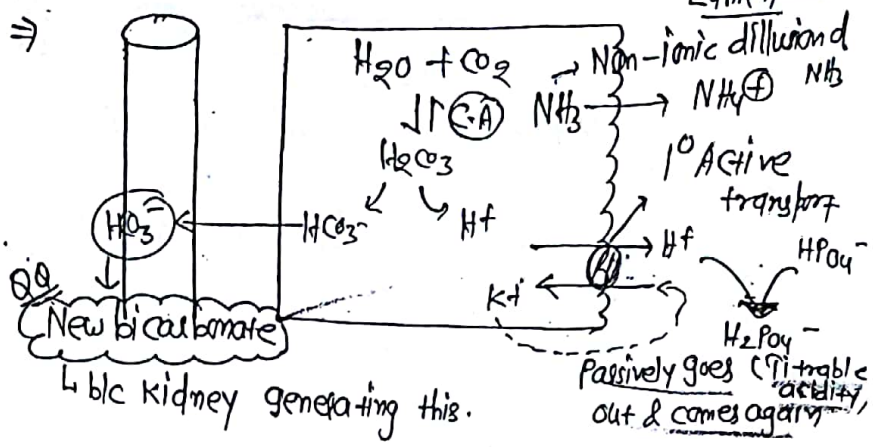
Q: What is the pH of Tubular fluid
@ the end of PCT;
(a) ~~7.3~~ (No change in pH)
(b) 6.3
(c) 5.3
(d) 4.3

⇓
b/c whatever H+ secreted is buffered by HCO_3^-



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

In collecting duct ⇒ (I-cells)



↳ b/c kidney generating this.

$HCO_3^{\ominus}$

- → 80% Reabsorb in PCT
- → TAL, DCT] 20% Reabsorb

Mech^{n} ⇒ Same as in PCT

So; as we enter collecti. duct; No $HCO_3^{\ominus}$ is there So; New $H^{\oplus}$ buffered by HPO_4^{-}

Urinary buffers ⇒ ① $HCO_3^{\ominus}$ (bicarbonate)

② HPO_4^{-2} (Phosphate)

③ NH_3 (Inducible Urinary buffer) QQ

⇓

b/c in Acidosis ⇒ ↑ NH_3 production.

Limiting pH of Urine ⇒ pH = 4.5

Factors which affect H+ secretion ⇒ ① P_{CO_2}

② Aldosterone → ↑ H+ secretion in collecting duct

③ Carbonate Anhydrase Inhibitor

↳ ↓ H+ secretion

↳ ↑ Urinary loss of

↳ • Na^{+}

• HCO_3^{-}

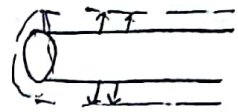
• H_2O (So works as diuretics)

↙ Causes Acidosis ⇓ eg: Acetazolamide

REGULATION OF SODIUM EXCRETION & GFR

① Myogenic Mechⁿ of Autoregulation of GFR :→

B/w MAP of 90 & 200 mm Hg ⇒ GFR is constant.

* ↑ Renal blood flow ⟶ 

↑ Stretch

↓

QQ opening of Mechano-Sensitive Ca^{2+} channel

↓

Ca^{2+} influx

↓

Vascular Smooth Muscle contraction

⊖

** So, GFR constant

So, GFR constant

② Tubuloglomerular feedback (TGF) :⇒

eg of Negative Feedback

↑ GFR ⊖ ⟵ Vasoconstriction of Afferent Arteriole

site of action

↓

↑ Na^+, Cl^- Load in Tubular Fluid

↓

Macula Densa

acts as sensor QQ

Macula Densa

↓

↑ Na^+, Cl^- Reabsorption by Macula densa cells

Increase Na^+, Cl^- reabsorption by Macula densa cells

↑

↑ Activity of Na^+ K^+ ATPase Pump

Increase activity of N^+ K^+ ATPase pump

↑

↑ ATP hydrolysis

↑

↑ Adenosine QQ

Increase adenosine

Ca^{2+} influx

A_1 Receptor

prt. in vascular Smooth Muscle

Juxta Glomerular Apparatus ⇒

① JG Cells
- Renin Secreting cells
- In tunica media of afferent arteriole >> efferent arteriole

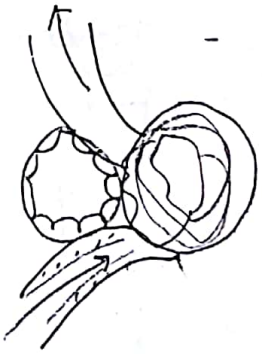
② Macula densa cell ⇒ prt @ Begining of DCT / prt @ the end of Loop of henle
- Modified Tubular Epithelial cells
- It is "SENSOR"
- Detect Nat & Cl⁻ Load in Tubular fluid

Begining of DCT

the end of loop of henle

③ Laci's cells
- Extraglomerular Mesangial cells
- We don't know about exact Role
- It take up immune complexes in certain type of Glomerular Nephritis

ectraglomerular mesangial cells

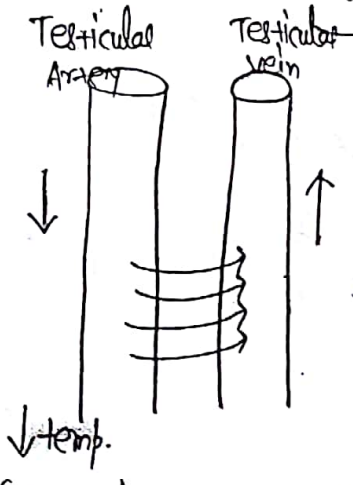


* ↓GFR
↓
Nitric oxide Release
↓
Afferent arteriole Dilatation
⊕

③ Glomerulo-tubular Balance (GTB)

↳ It is Kas "3rd Factor"
↳ Act when 1st two Mechanism fail
↳ More GFR ⇒ More Reabsorption
↳ Site of Action ⇒ PCT

COUNTER-CURRENT MECHANISM



(Heat is translocated from Artery to vein)

2 vessels
↳ close to each other
Parallel to each other
with flow in opposite direction,

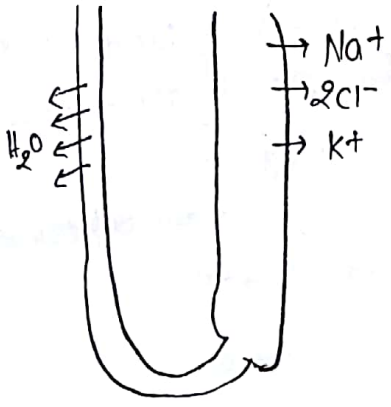
Kas "counter-current"

prt. in
- Kidney — Kidney
- Testicular vessels — Testicular vessels
- Intestinal villis — Intestinal villis
- Venae comitantes — Venae comitantes
  - Pair of veins a/q certain arteries — Pair of veins a/q certain arteries
  - help to conserve heat — Help to conserve heat

Counter current — countercurrent

Counter current multiplier — Countercurrent multiplies
↓
Loop of Henle — Loop of henle
↓
Creates Medullary Interstitium Hyperosmolality — creates medullary intestitium hyoerosmolality

Counter current exchanger — countercurrent exchange
↓
Vasa Recta — vasa recta
↓
Maintains Medullary Interstitium Hyperosmolality — maintains medullary Intestitium hyperormolality



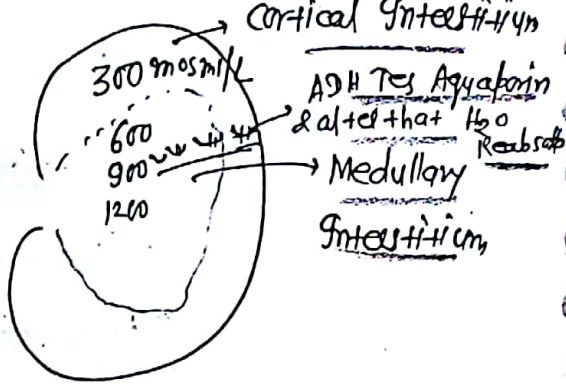
2 Limbs of Loop of Henle
↳ differential Permeability — Differential permeability

.to produce a conc^{n} Urine; we Need

⇓

① ADH

② Medullary Interstitial hyperosmolality



both are Must for Conc^{n} Urine;

if Any one absent; No Conc^{n} Urine formed

QQ Max^{m} Urine Osmolality ⇒ 1200 mosm/L

QQ Possible Range of Urinary osmolality ⇒

50 — 1200 mosm/L

ADH — Max^{m} ADH

QQ Usual Range of Urinary osmolality ⇒

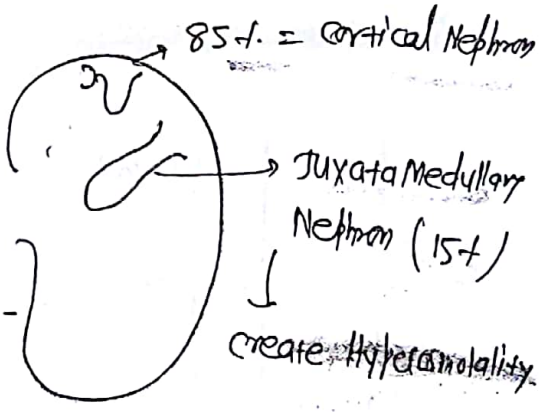
300 — 1200 mOsmol/L

Isotonic — Hypertonic

* Solutes Responsible for Medullary Interstitium Hyperosmolality :-

Major ⇐ { Na+, K+, Cl− } TAL

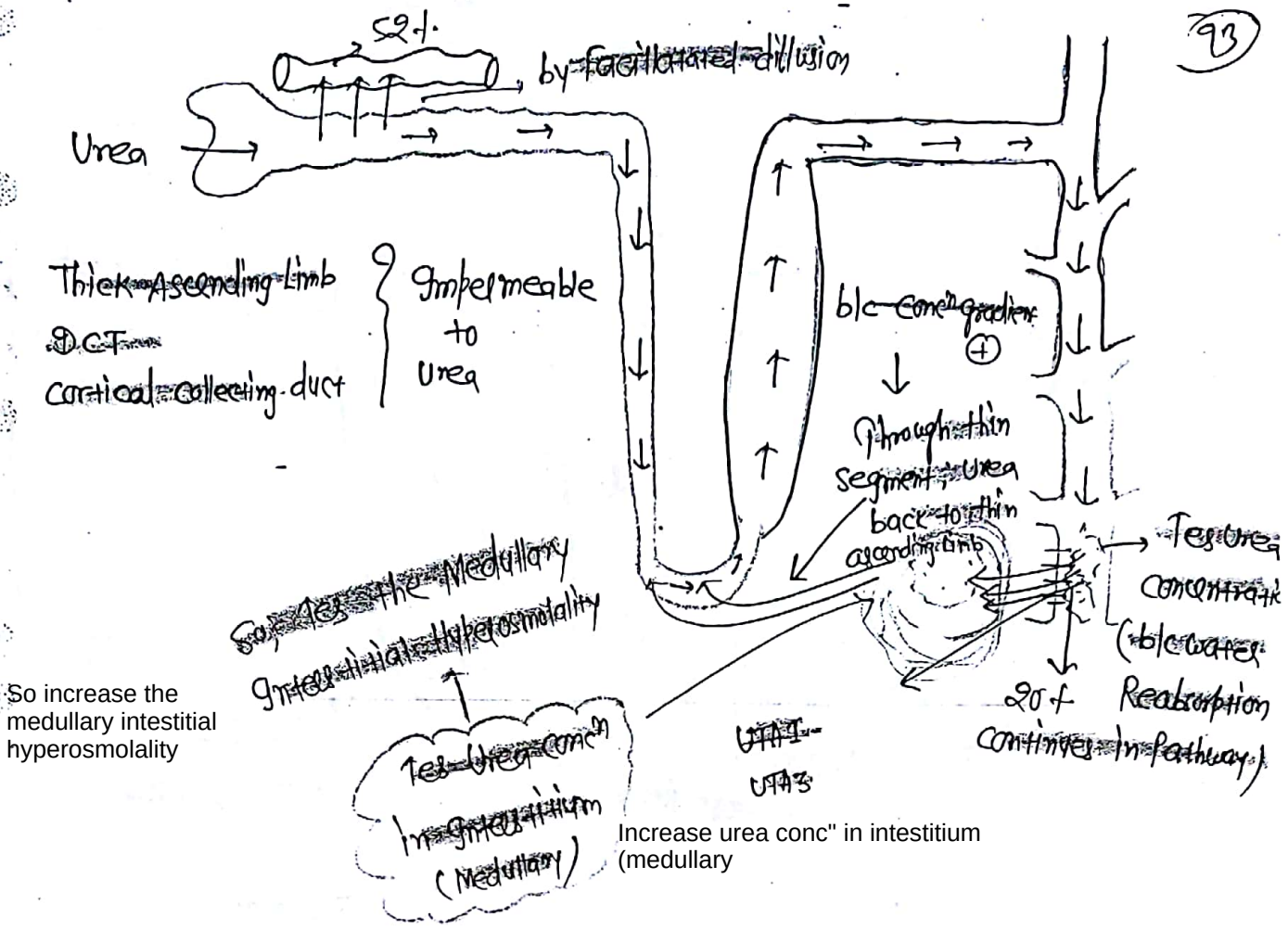
Minor ⇐ Urea from Medullary collecting duct



* Urea is Reabsorb ⓐ ⇒ PCT ; but comes to Medullary Interstitium & Some time Contribute 50% of Medullary Interstitium Hyperosmolality

Urea us reabsorb

PCT but comes to medullary intestitium and sometime contribute 50% of medullary intestitium hyperosmolality



So increase the medullary intestitial hyperosmolality

Increase urea conc" in intestitium (medullary

Urea cycling

Urea cycling

VASA RECTA

- 2 limbs of Vasa Recta all Counter current to each other and with Loop of Henle

2 limbs of vasa recta all counter current with each others and with loop of henle

- Both limbs of Vasa Recta all freely permeable to Salutes & water.

both limbs of vasa recta all freely permeable to salutes and water

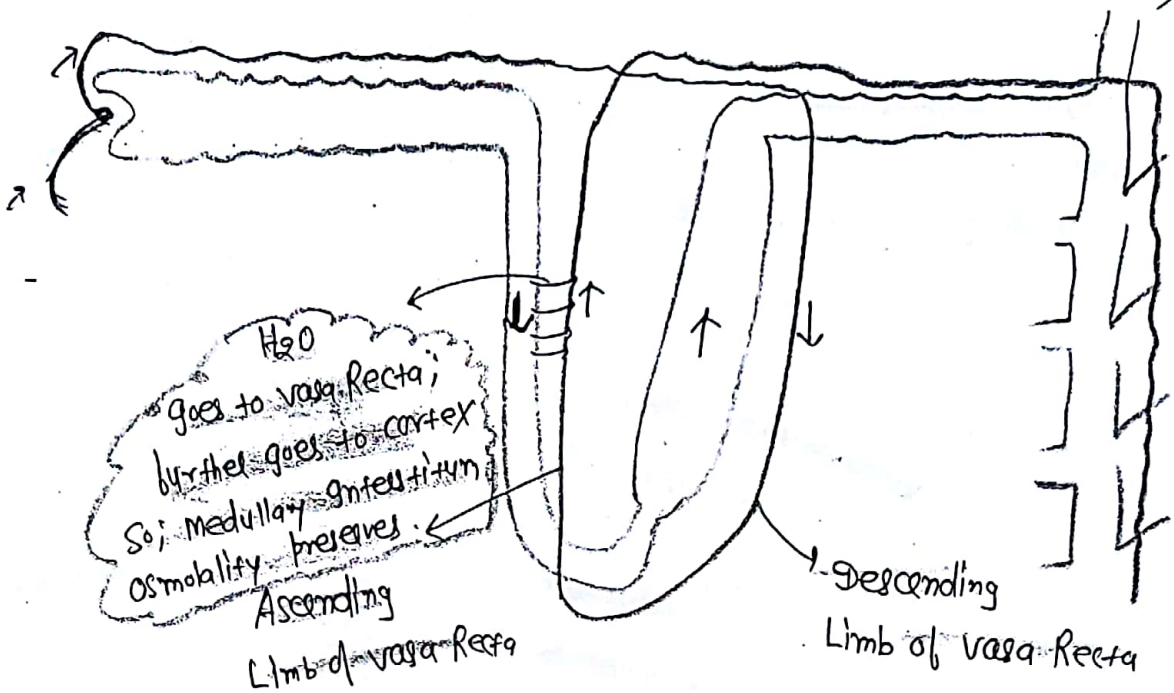
- It has very very very slow Rate of blood flow

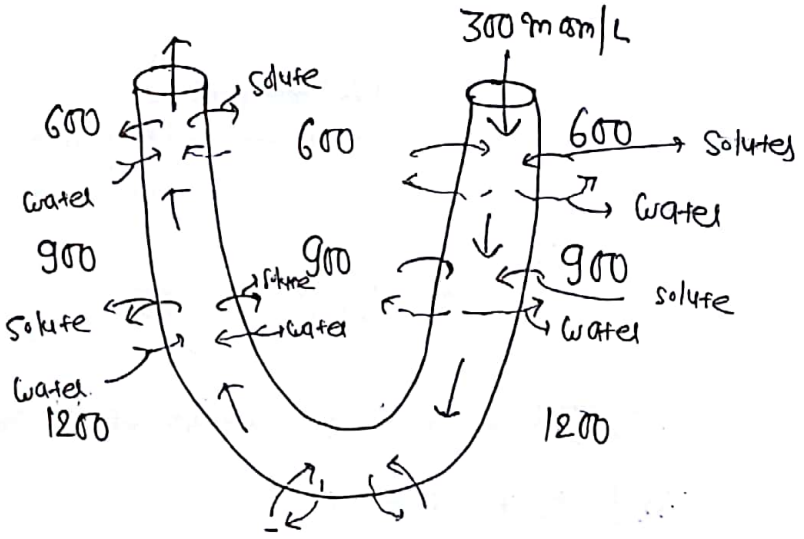
It has very very very slow rate of blood flow

- Vasa Recta => 5% of Renal blood flow.

vasa recta => 5 + of renal blood flow

* 1st part of kidney affected by Anoxia ⇒ Medulla
(b/c of preserved Loop of Henle)





http://mbbshelp.com WhatsApp: +1 (402) 235-1397

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

RESPIRATORY SYSTEM

BRONCHODILATION

* ~~Sympathetic stimulation~~ sympathetic stimuation
* ~~Adrenergic agents~~ Adrenergic agents
* Adrenaline
* VIP (By NANC ↳ Nerves)
  - ↓ Bronchial Smooth Muscle Relaxant
  - → Non-Adrenergic Non-Cholinergic

BRCHOCONSTRICTION

* ~~Parasympathetic circulation~~ Parasympt. stimulation
* Ach
* ~~cholinergic Agents~~
* ~~Leuko-trienes~~
* Substance P
* Adenosine
* Cool Air

* Total Pulmonary ventilation ⇒ R.R. (Respiratory Rate) × T.V (Tidal volume)

Alveolar ventilation ⇒ R.R × (T.V − D.S.)

DEAD SPACE (D.S)

Volume of Air which doesn't participate in Respiratory Exchange

* In Infants ⇒ 3.3 ml/kg body weight = 15-30 ml
  In Adults = 2 ml/kg body weight = 140-150 ml

Physiological or Total Dead Space = Anatomical dead space + Wasted Ventillation

WhatsApp: +1 (402) 235-1397

* Wasted ventilation ⇒ $\frac{V}{Q} > 1$

↳ i.e ventilation is in excess of Perfusion; & this ventilation is going to be wasted.

→ Overventilated alveoli

→ Underperfused alveoli

* V/Q > 1:0

⇓ ventilation wasted

⇓

Tes Physiological Dead space

eg ⇒ Thrombus in vessels

V/Q < 1.0

⇓

Wasted Perfusion

⇓

Incomplete oxygenation of blood

⇓

K/as "Shunting of blood".

eg ⇒ Foreign body

* In (N) individual ; wasted ventilation ⇒ 0

⇓

So; in (N) individual ; Physiological D.S = Anatomical D.S

Measure by "BOHR's Equation" Q

⇓

Partial Pressure of CO_2 in Expired Air (P_ECO_2)

Partial Pressure of CO_2 in Arterial blood ($PaCO_2$)

Tidal volume (V_T)

Measure by FOWLER'S TECHNIQUE Q

⇓

Measured N_2 analysis in expired Air after single deep breath of 100% O_2

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Bohr's Eqn ⇒ $P_ECO_2 \times V_T = PaCO_2 \times (V_T - V_D)$

V_D = dead space volume.

QQ P_ECO_2 = given

$PaCO_2$ = given

$\frac{V_D}{V_T}$ Ratio

$$P_ECO_2 \times V_T = PaCO_2 \times (V_T - V_D)$$

$$\Rightarrow \frac{P_ECO_2}{PaCO_2} = \frac{V_T - V_D}{V_T}$$

$$= \frac{P_ECO_2}{PaCO_2} = 1 - \frac{V_D}{V_T}$$

$$\Rightarrow \frac{V_D}{V_T} = 1 - \frac{P_ECO_2}{PaCO_2} \Rightarrow \frac{PaCO_2 - P_ECO_2}{PaCO_2}$$

(N) Ratio is upto 0.4

SPIROMETRY

LUNG VOLUMES & CAPACITY

TIDAL VOLUME ⇒ Volume of Air Inspired OR expired during a Normal quiet Respiration.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

- only volume which is same in Male & females
- 500mL.

INSPIRATORY RESERVE VOLUME ⇒ Volume of Air Inspired Forcefully ; over & above a tidal Inspiration ; with Maxm effort.

3300 ml = ♂
1900 ml = ♀

Expiratory Reserve volume ⇒ Volume of Air expired forcefully ; over & above a tidal expiration ; with Maxm effort.

- 1000ml = ♂
700ml = ♀

Residual volume ⇒ Volume of Air ; which Remains in Lung at the end of Maxm expiration

- 1200ml = ♂
- 1100ml = ♀

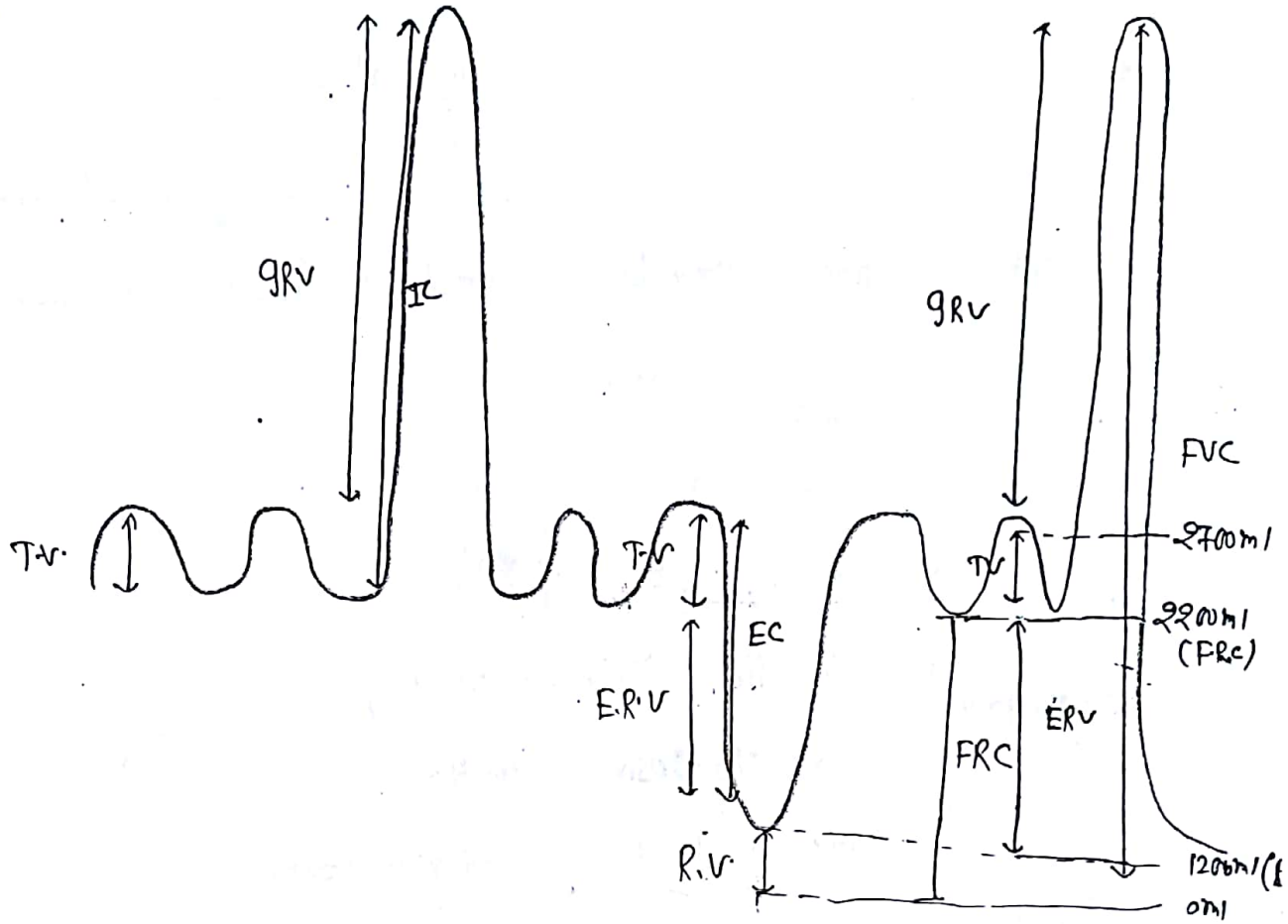
Inspiratory capacity ⇒ IRV + TV

Expiratory capacity ⇒ ERV + TV

Functional Residual capacity ⇒ Volume of Air in Lung at the end of (N) expiration

↳ ERV + RV ; (N) value = 2200ml ♂ ; 1800ml ♀

http://mbbshelp.com WhatsApp: +1 (402) 235-1397



Forced vital capacity ⇒ Volume of Air expired forcefully after a forcefully inspiration.

↳ ERV + TV + gRV

Total Lung capacity = ~~6000ml~~ ♂, 4200 ♀

↳ gRV + TV + ERV + RV

* Lung volume @ the end of Normal expiration ⇒ Functional Residual capacity (FRC)

* Lung volume @ the end of Forceful expiration ⇒ Residual volume (RV)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Lung volume At the end of Forceful Inspiration
↳ Total Lung capacity.

* Volume of Air expired forcefully after a forcefull Inspiration
↳ Forced vital capacity

* Which volume can't be Measured by Routine Spirometry

RV
FRC } (X)
TLC

- For FRC ⇒ ERV + RV.
⇓ Measurement
i) He Dilution technique
ii) N_2 Washout Method
iii) Whole body plethysmography
↳ Most accurate
↳ also Measure volume of air trapped in Bullae

- For R.V. ⇒ RV = FRC − ERV
↳ Measure by Routine Spirometry

Q N_2 Can be used in Measurement of
a) Anatomical dead space – Single Breath N_2 Analysis
b) FRC – by N_2 washout Method
c) Both

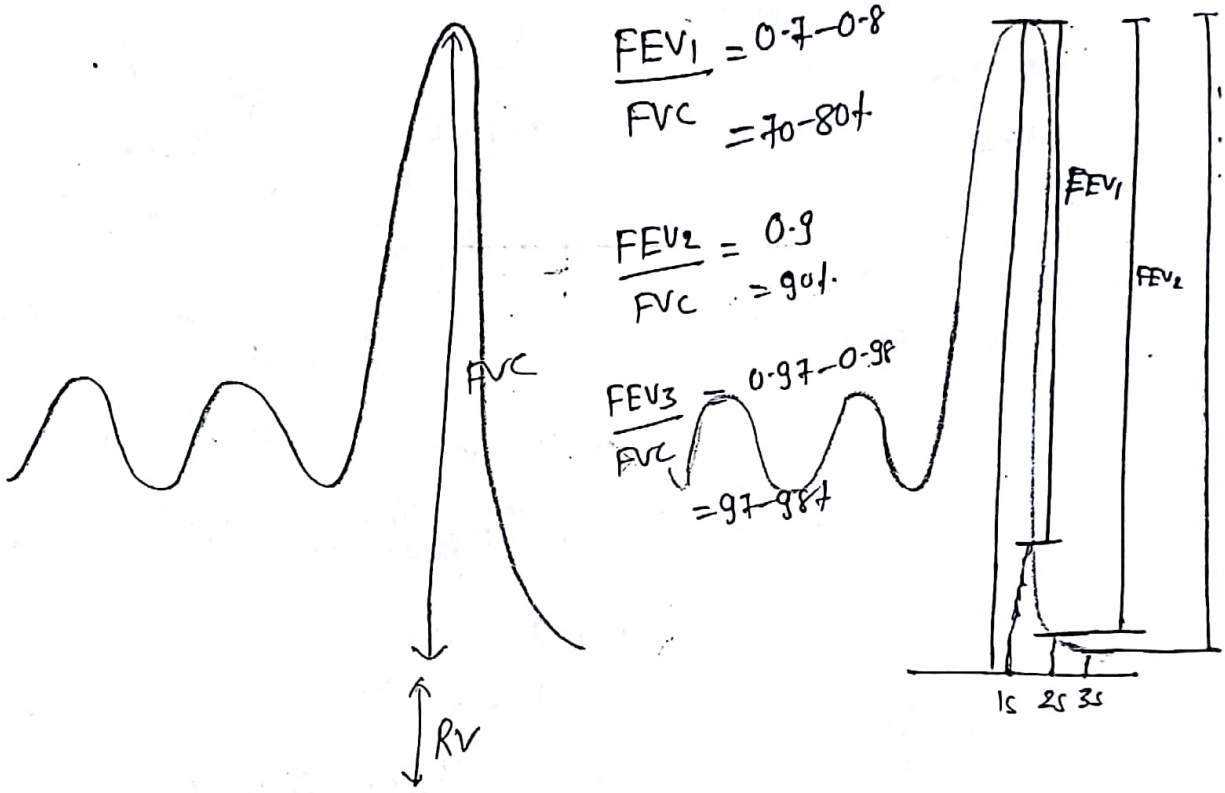
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

TIMED VITAL CAPACITY

FEV_1 — Forcefully expired volume of Air @ the end of 1 sec

FEV_2 @ 2sec

FEV_3 @ 3sec



$\frac{FEV_1}{FVC} = 0.7-0.8 = 70-80\%$

$\frac{FEV_2}{FVC} = 0.9 = 90\%$

$\frac{FEV_3}{FVC} = 0.97-0.98 = 97-98\%$

Obstructive Lung Disease

$\frac{FEV_1 \downarrow\downarrow}{FVC \downarrow}$ $\downarrow$

Restrictive Lung Disease

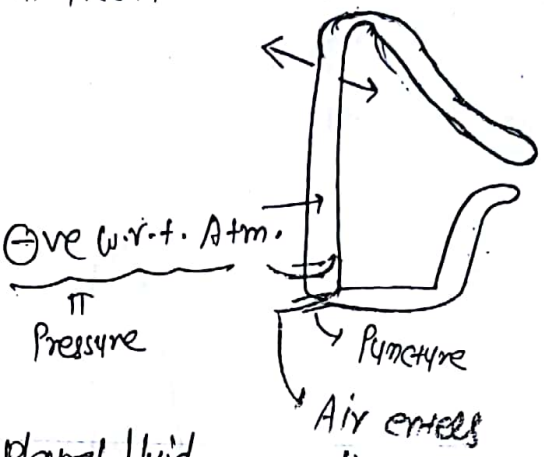
$\frac{\downarrow FEV_1}{\downarrow\downarrow FVC}$ (N) or $\uparrow$

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

VENTILATION

1. INTRAPLEURAL PRESSURE / PLEURAL PRESSURE / INTRATHORACIC PRESSURE / ESOPHAGEAL PRESSURE :-

i) Lung Recoil & chest wall Recoil
⇓
Two opposing forces
↳ 'g' creates
⊖ve pressure in pleural space



⇓
Zero Pressure w.r.t. Atm.

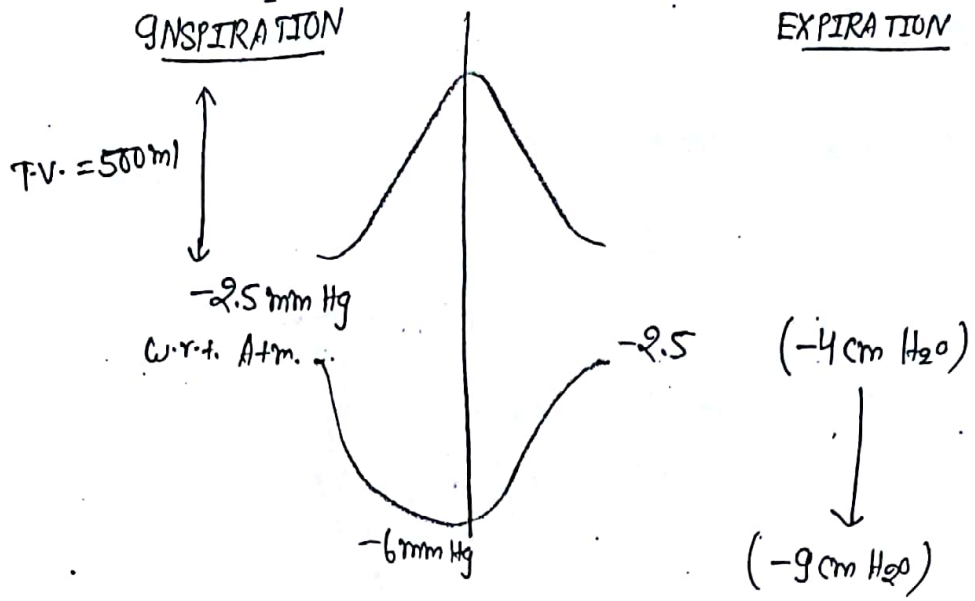
ii) continuous drainage of pleural fluid into the Lymphatics.

In Emphysema
↳ ↑ chest Recoil force (Lung Recoil force ↓ b/c of destruction of elastic fibres of Lungs)
⇓
Barrel shaped

At FRC
↳ Lung Recoil = Chest wall Recoil
↳ So; it is K/as "Relaxation volume of Lungs"

* What happen to Intrapleural pressure ∈ Respiration :-

http://mbbshelp.com WhatsApp: +1 (402) 235-1397



Pleural pressure May ⊕ve during "VALSALVA" → also during Labour

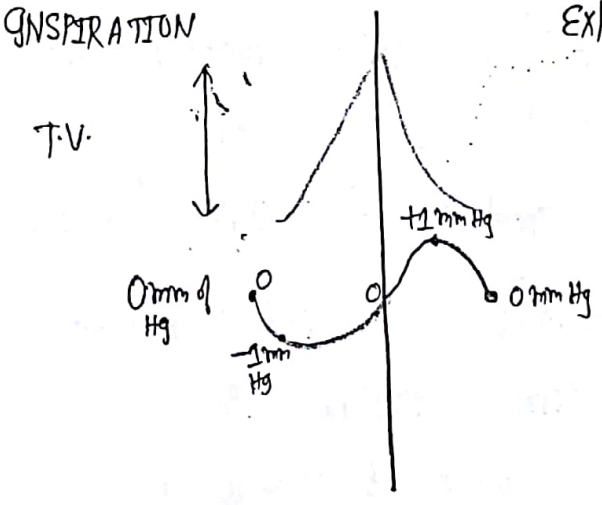
⇓

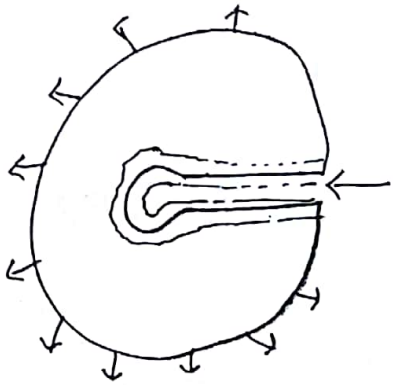
Straining
⇓
Any kind is valsalva
(Forcep expiration against Closed Glottis.)

In Forcefully expiration
↳ Pressure goes to -10 mm Hg

* During valsalva ⇒ ↓ venous Return
↓ Blood Pressure
↓ cardiac output

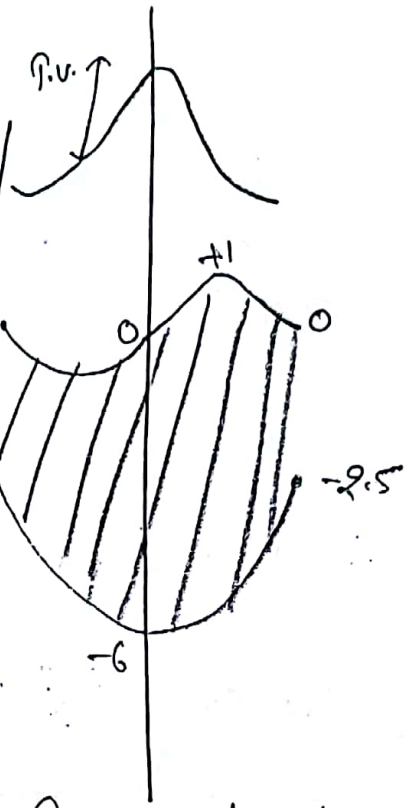
II. INTRAPULMONARY PRESSURE / AIRWAY PRESSURE / ALVEOLAR PRESSURE →





http://mbbshelp.com WhatsApp: +1 (402) 235-1397

NET Pressure :-



Also " Transpulmonary Pressure / Transmural Pressure / Distending Pressure "

⇒ Intrapulmonary - Intrapleural
(P) (P)

QQ Transpulmonary Pressure @ start of Inspiration

↳ $0 - (-2.5) = +2.5$ mm of Hg

QQ Transpulmonary Pressure @ end of Inspiration

↳ $0 - (-6) = +6$ mm of Hg

LUNG COMPLIANCE

Compliance ⇒ Distensibility

⇒ $$\text{"C"} = \frac{\Delta V}{\Delta P}$$

ΔV = change in volume

ΔP = change in transpulmonary Pressure

(N) value of Lung compliance ⇒ 0.2L / cm H_2O.

Lung + chest wall compliance ⇒ 0.1L / cm H_2O

Q. Change in Lung volume = 600ml ; esophageal Pressure changes from -4 cm of H_2O @ start of Inspiration & -8 cm H_2O @ end of Inspiration ;

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Lung compliance = ??

Transpulmonary Pressure ⇒ 0 − (−4) ⇒ +4 ⇒ (+4) change

↓ ⇒ ↓

0 − (−8) +8

$$C = \frac{\Delta V}{\Delta P} = \frac{600mL}{4 cm H_2O} = 150 mL/cm H_2O.$$

SPECIFIC COMPLIANCE

$$\frac{\text{Compliance}}{\text{FRC}} = \text{Specific compliance}$$

In Emphysema → ↑ compliance (Lung)

↑↑ FRC

↳ So; Specific compliance ↓.

QQ Condⁿ in which compliance ↑ & Specific compliance ↓

↳ Emphysema

* Compliance $\propto \frac{1}{\text{Surface tension}}$; Surface tension $\propto \frac{1}{\text{Surfactant}}$

** Compliance $\propto$ Surfactant

SURFACTANT :→ Secreted by Type-II Pneumocytes

↳ Dipalmitoyl Phosphatidyl Choline

Q. Which is More Numerous :→

Type-I → 40%.

Type-II → 60%.

Q. Which are having More alveolar surface Area :→

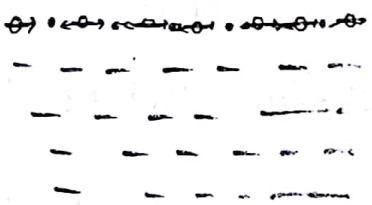
Type-I → 95%.

Type-II

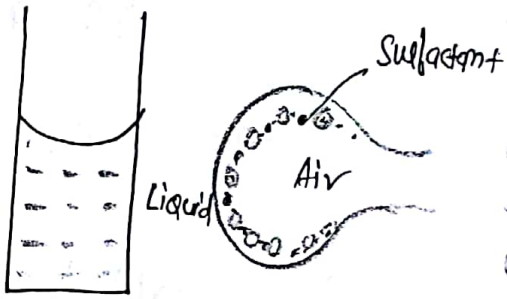
Type-I

* Surface tension → @ Air-Liquid Interface

Air



Liquid



With expiration

↓

Tes conc^{n} of Surfactant Molecules per Unit Area

⇓

↓↓ Surface tension

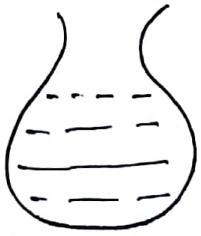
⇓

Helps to Maintain alveolar Stability. QQ

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(99)

Saline ventilated Lung



No Air-Liquid Interface

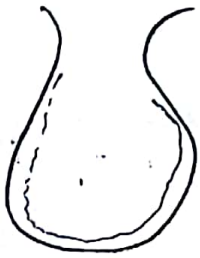
⇓

Surface tension = 0

⇓

↑ compliance (Better compliance)

Air ventilated Lung



Air-Liquid Interface

⇓

Surface tension ⇒ ⊕

⇓

↓ compliance as compare to Saline ventilated Lung.

* Hormones which affect Surfactant ⇒

i) Thyroid ⇒ ↑ type II Pneumocyte activity

So; In Hypothyroidism ⇒ RDS May seen in Newborn

ii) Insulin ⇒ ↓ type II Pneumocyte activity

↳ So; Babies born to Diabetic Mother → More Likely to Suffer from RDS.

iii) Glucocorticoids ⇒ ↑ type II Pneumocyte Maturation

↳ In preterm babies ⇒ give Steroids

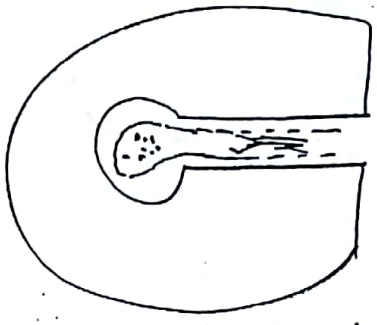
DYNAMIC COMPRESSION OF AIRWAYS

During Forcefully expiration

⇓

Tendency of Airways to collapse

↳ K/as "dynamic compression of Airways".



In Early Bronchial Asthma ⇒ Expiratory wheeze ⊕

At end of Forceful Expiration

⇓

Airway collapse is complete

⇓

Air is trapped in Alveoli

↳ This Air is K/as "Residual volume"

⇓

this is d/t "Dynamic compression of Airways"

WORK DONE IN QUIET BREATHING

⇒ 0.3 – 0.8 kg-m/min

65% (2/3rd) — 35%

Against elastic forces

- 43% → against surface tension elasticity
- 22% → against tissue elasticity

Against Resistant forces

- 28% → against Airway Resistance
- 7% → against viscous Resistance

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

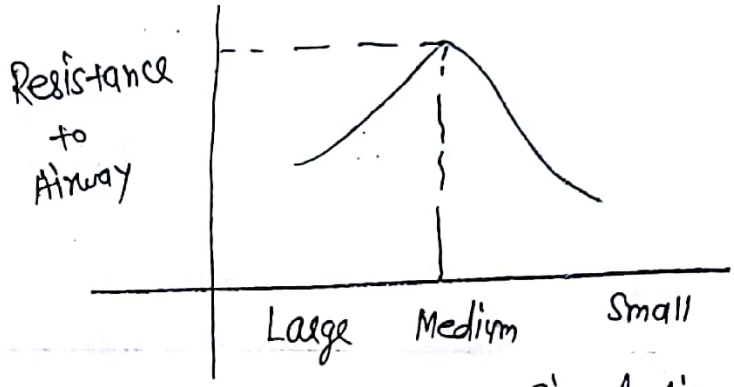
Q: Which Airways have Maxm Resistance to Airflow ?→

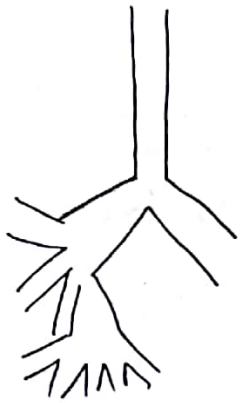
ⓐ Large sized Airways

~~ⓑ Medium sized Airways~~

ⓒ Small " "

$R \propto \frac{1}{r^4}$





WEIBEL'S CLASSIFICATION OF TRACHEOBRONCHIAL TREE :→

* 23 Generation
* Trachea ⇒ Generation Zero
* 1-16 ⇒ Conducting Zone
* 17-23 ⇒ Respiratory Zone

Medium size Airways = 3rd - 5th Generation

	Medium size Airways	Small size Airways
Total cross Sectional Area	↓	↑
velocity of Airflow	↑	↓
Reynold's No. $\left(R_2 \frac{\rho V D}{\eta}\right)$	↑	↓

Turbulant Airflow ⊕
↳ dil + i+ Resistance of Airflow Tes in it.

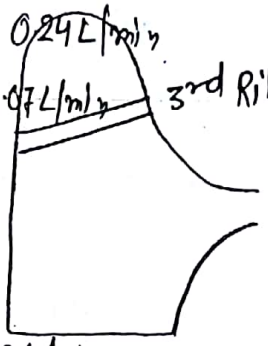
VENTILATION PERFUSION GRADIENT IN ERECT POSTURE

BAD → Base to Apex there is Decrese in
- → Intrapleural pressure
- → Ventilation
- → Perfusion

But $\frac{V}{Q}$ Ratio ⇒ Less from Base to Apex.

$\frac{V}{Q} = 3.3$

Ventilation = 0.24 L/min
Perfusion = 0.07 L/min
3rd Rib ⇒ $\frac{V}{Q} = 1$



$\frac{V}{Q} = 0.63$

Ventilation = 0.82 L/min
Perfusion = 1.29 L/min

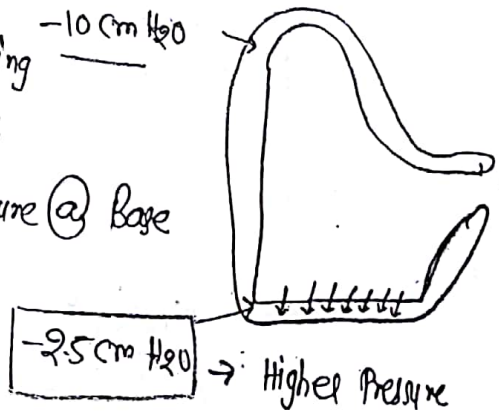
Avg. V/Q Ratio @ Lung ⇒ 0.8

QQ. Pa_{O_2} is Maxim at ⇒ a) Base; ⇒ $\frac{V}{Q} < 1.0$
~~b) Apex.~~

↳ Incomplete oxygenation

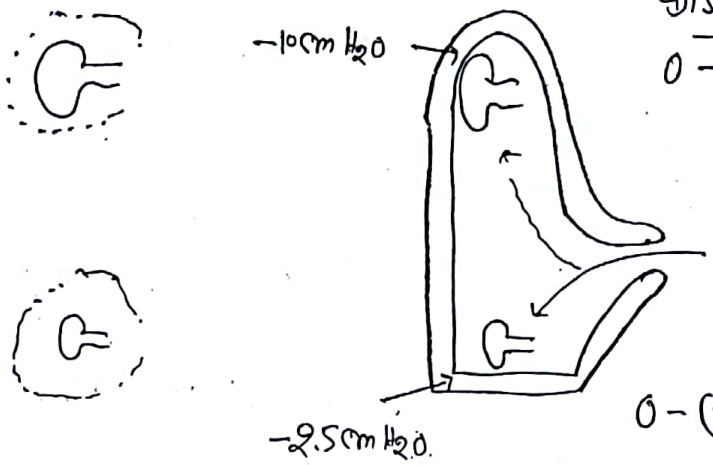
* Base to apex Intrapleural Pressure less ⇒

Probable Reason ⇒ During Standing
Weight of Lungs acts as Base
↳ Less Pleural pressure @ Base



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Base to Apex Ves in Ventilation :⇒



Distending Pressure

0 − (−10) = +10 cm H2O

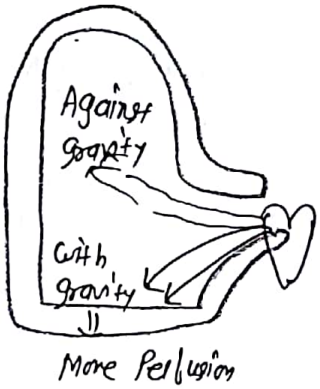
0 − (−2.5) = +2.5 cm H2O

QQ. Ventilation is More in alveoli @ Base ??

a) Alveoli @ Base have More Surfactant;

b) Alveoli @ Base are More compliant

* Base to Apex Ves in Perfusion :⇒



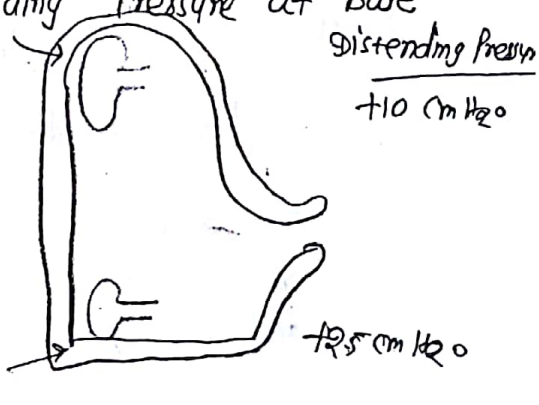
CLOSING VOLUME

- It is the Lung volume at which Airways at base begins to collapse; b/c of Lessed distending Pressure at base

Distending Pressure is less at base

⇓

therefore; Airway & Alveolar diameter is less at base



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Closing volume > Residual volume

↳ b/c it is Not expired volume; it is Lung volume

** FRC > Closing volume > Residual volume

FRC > Closing volume > Residual volume

* Elastic fibers ⇒ Exert Radial traction on Airways

↓

Keep the Airways Patent

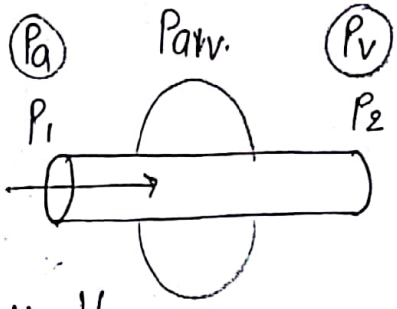
* With Age ⇒ ↓es Lung elastic fibers

Mid 70's ⇒ Huge Reduction(↓) Lung elastic fibers

↳ ↓es tendency of Airways to collapse

↳ closing volume approaches FRC.

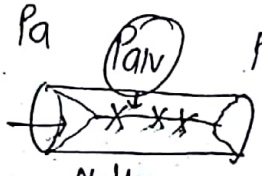
ZONES IN LUNG IN ERECT POSTURE



ZONE 1 ⇒ Zone of No flow

↳ Palveolar > Pa > Pv

↳ No Zone 1 in (N) Lung



Zone 1 prt. at Apex in Hypertension; Hemorrhage; ⊕ve Pressure ventilation

Zone 2 ⇒ Zone of Intermittent Flow / Pulsatile flow. → Klas "Waterfall effect"

- During Systole ⇒ $P_a > P_v > P_{AIV}$ ⇒ Flow (+)
- During Diastole ⇒ $P_a > P_{AIV} > P_v$ ⇒ Flows stop
  - ↳ Prt. at Apex.

Zone 3 ⇒ Zone of continous flow

$P_a > P_v > P_{AIV}$ Pa> Pv > Paiv

- (+) @ Base of Lung

@ Base of lung

PARTIAL PRESSURES

	INSPIRATION	EXPIRATION
% of O_2 ⇒	21%	16%

QQ Mouth – to – Mouth Respiration

At Sea level ; Atm. Pressure = 760 mm of Hg

$$P_{O_2} = \frac{21}{100} \times P_B = \frac{21}{100} \times 760 = 160 \text{ mm of Hg}$$

QQ At High Altitude :- ~~(a) ↓ P_B (Barometric Pressure)~~

$P_{O_2} = \frac{21}{100} \times 500$ (if veg to 500 (atm. Pressure))

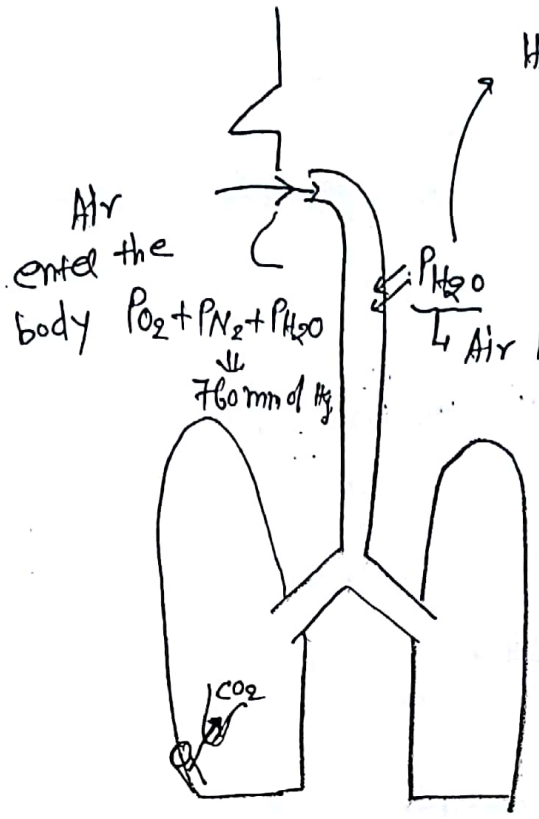
= 105 mm of Hg.

(b) ↓ % of O_2

(c) Both

(d) None

$P_{O_2} + P_{N_2} = 760$ mm of Hg



H_2O vapour comes from epithelial cells.

P_{H_2O} = 47 mm of Hg (Irrespective to altitude & Environmental temp.)

↳ Air humidifies

Alveolar Partial Pressure of oxygen (P_AO_2)

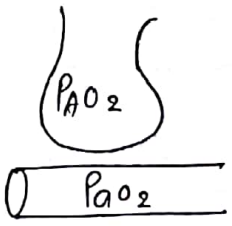
⇒ By Alveolar Gas equation

Alveolar O_2 ⇒

Provided

↳ i) $\frac{V}{Q} \geq 1.0$

ii) Respiratory Memb. ⇒ (N)



HENRY'S LAW

↳ Partial Pressure in the solution is equal to Partial Pressure above the solution.

* Alveolar Gas equation ⇒

$$P_AO_2 = \underbrace{\left[(P_B - P_{H_2O}) \times \text{fraction conc}^n \text{ of } O_2 \right]}_{P_IO_2} - \frac{P_ACO_2}{R}$$

R = Respiratory Quotient

$$R.Q. = \frac{\text{Volume of } CO_2 \text{ Produced}}{\text{Volume of } O_2 \text{ Consumed}}$$

for Carbohydrate = 1

for Mixed diet = 0.8

$$P_AO_2 = \left[(P_B - P_{H_2O}) \times \text{bractional conc}^n \text{ of } O_2 \right] - \frac{P_ACO_2}{R}$$

At Sea level

$$P_AO_2 = \left[(760 - 47) \times \frac{21}{100} \right] - \frac{40}{0.8}$$

$$\Rightarrow \{P_AO_2 = 105 \text{ mm Hg}\}$$

QQ. How Much is P_AO_2 if he Receives 4 times Atmospheric pressure & 100% O_2.

4 times Atmospheric ⇓ Hyperbaric O_2 chamber ⇓ $4 \times 760 = 3040$

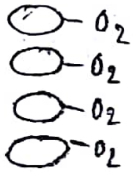
$$P_AO_2 = (3040 - 47) \times \frac{100}{100} - \frac{40}{0.8}$$

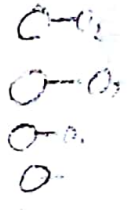
$\simeq$ 3,000 mm Hg.

given in Gram ⊖ve septicemia CO_2 poisoning

RESPIRATORY EXCHANGE

	Arterial Blood	Venous Blood
Total O_2 (ml/dL)	19 ml/dL	14 ml/dL
P_{O_2} (mm of Hg) (dissolved O_2)	95 mm of Hg	40 mm of Hg
S_{O_2} (%)	97-98%	75%





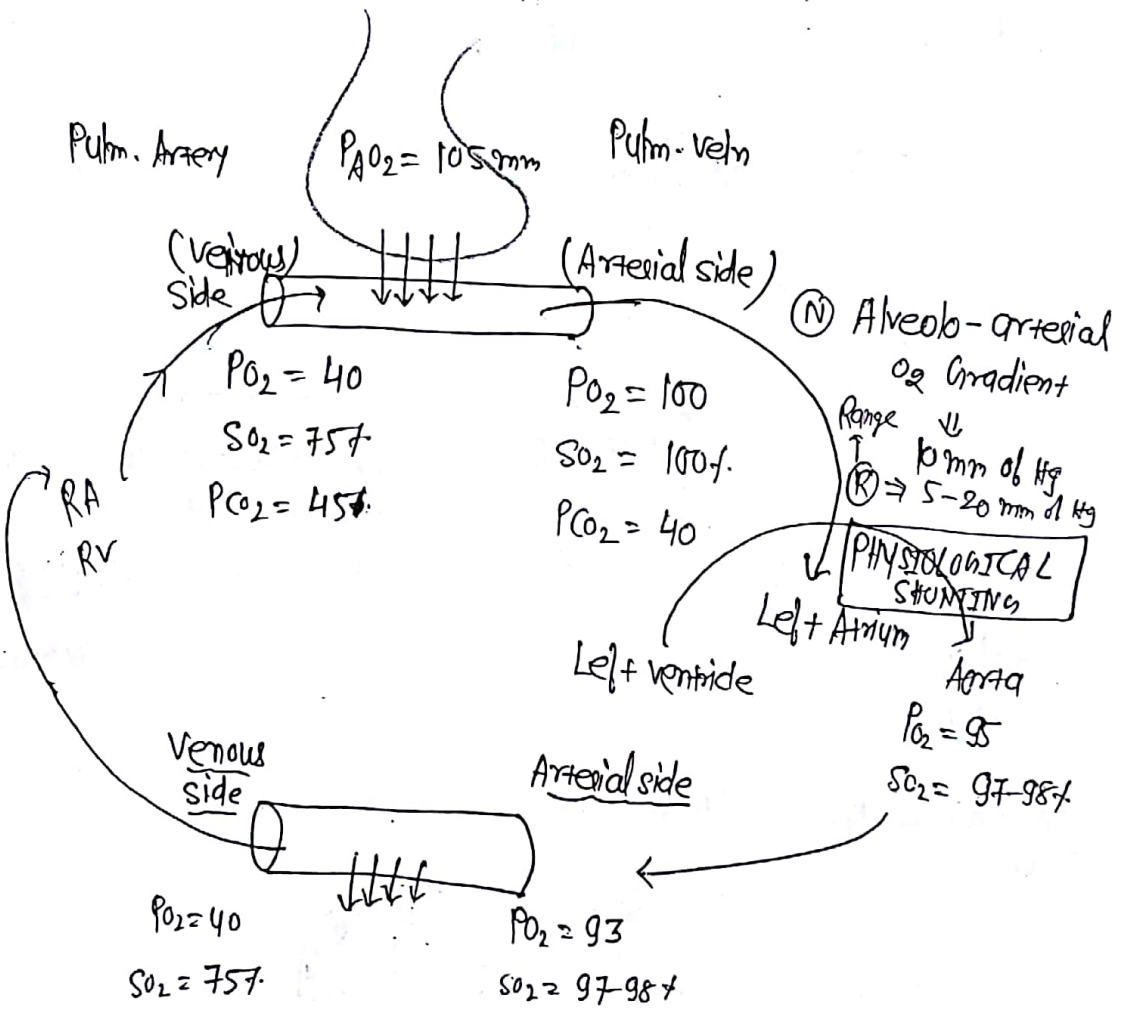
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

	Arterial Blood	Venous blood
Total CO_2 (mL/dL)	49 mL/dL	53 mL/dL
P_{CO_2} (mm Hg)	40	45

O_2 consumption at Rest ⇒ 250 mL/min

CO_2 production at Rest ⇒ 200 mL/min

$$R.Q = \frac{CO_2 \text{ Produced}}{O_2 \text{ consumed}} = \frac{200 \text{ mL/min}}{250 \text{ mL/min}} = 0.8$$



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Q) Alveolo-arterial gradient is Yes in all except ⇒

(a) Rt → Lt. Shunt;

(b) Pulmonary fibrosis

(c) Pulmonary edema;

(d) ~~High~~ altitude ⇒ b/c exchange is Not affected;

↳ as much as Alveolar P_AO_2 ↓es ; arterial PaO_2 also ↓es; so; gradient same.

Pulmonary capillary Transient time (Blood stay in Pulmonary capillaries)

↳ 0.75 – 0.85 sec

Tissue capillary Transient time (Blood stay in Tissue capillaries)

↳ 1-2 sec

QQ Large changage in P_{O_2} ⇒ ~~a) Pulmonary capillaries~~

b) Tissue capillaries

QQ Largest Arterio-venous O_2 difference

↳ Heart

	PaO_2	PvO_2
Normal ⇒	95	~~40~~ ↓
(a) Coronary	95	20

QQ. Min^m Arterio-venous O_2 difference

↳ Kidney

	PaO_2	PvO_2
	95	~~40~~
Kidney	95	70

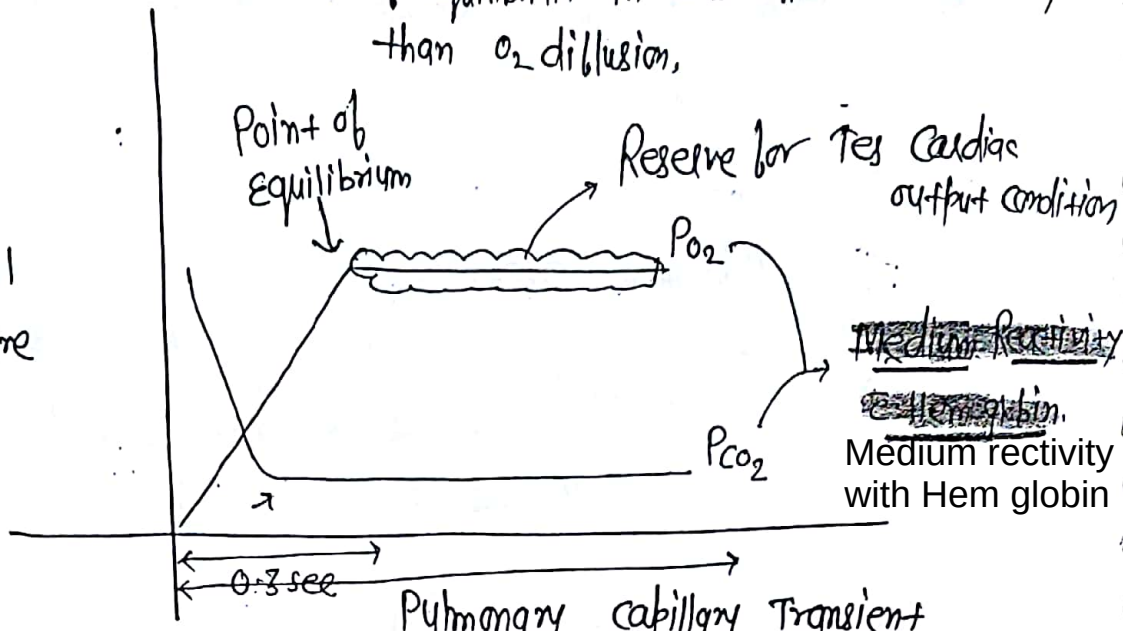
Renal blood flow = 1100 - 1200 ml/min

↳ 22-23% of C.O.

Blood supply to the kidney is in excess of its Metabolic Need.

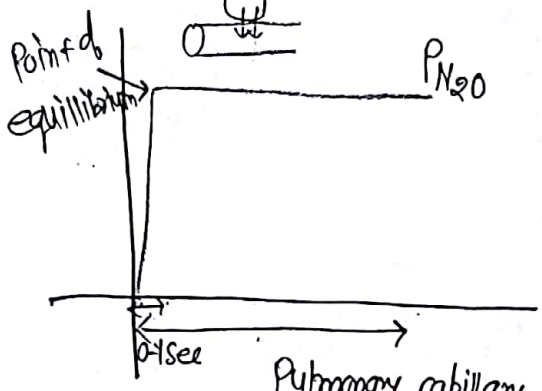
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Point of equilibrium in CO_2 diffusion comes early than O_2 diffusion.



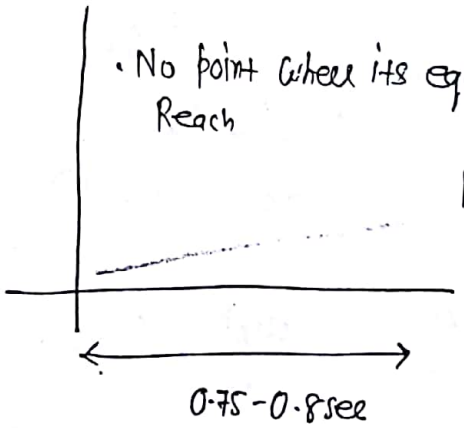
* PERFUSION OF FLOW LIMITED GASES

- N_2O
- Gas which completes diffusion within Pulmonary capillary transit time
- Nil transit time Reactivity with Hb



PERFUSION OF DIFFUSION LIMITED GASES

- CO
- Gas which doesn't equilibrate within Pulmonary capillary transit time
- CO has very very high Reactivity to Hb.
- No point where its equillibrium Reach



(Q9) Which of the following is Diffusion Limited gas ??

(a) N_2O
(b) O_2
(c) CO_2
(d) ~~CO~~

⇒ Perfusion or Flow Limited gas

OXYGEN TRANSPORT

		Arterial blood	Venous blood
(1)	With Hb (As OxyHemoglobin)	18.71 mL/dL	13.88 mL/dL
(2)	As dissolved O_2	(95 X 0.003) 0.29 mL/dL	(40 X 0.003) 0.12 mL/dL
	Total O_2 =	19 mL/dL	14 mL/dL

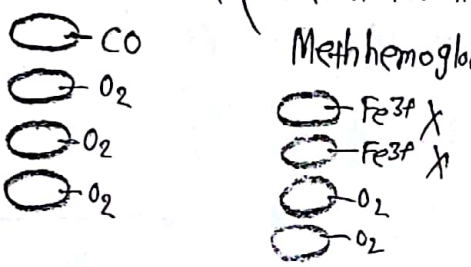
* O_2 content (mL/dL) = (O_2 in combination ≅ Hb) + (Dissolved oxygen)

= (Hb(gm/dl) X 1.34 + % Saturation) + (Dissolved oxygen (P_{O_2} X 0.003) mL/dl

(1 gm of Hb can transport 1.34 ml of O_2)

In Anemia ⇒ a) ↓ Hemoglobin (Fe deficiency Anemia, Hemolytic Anemia)

b) ↓ Saturation of O_2 (Carbon Monoxide Poisoning, Methemoglobinemia)



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

DISSOLVED OXYGEN ⇒ P_{O_2} (mm of Hg)

↓

?? mL/dL

Solubility of O_2 ⇒ 0.003 mL/dL/mm of Hg

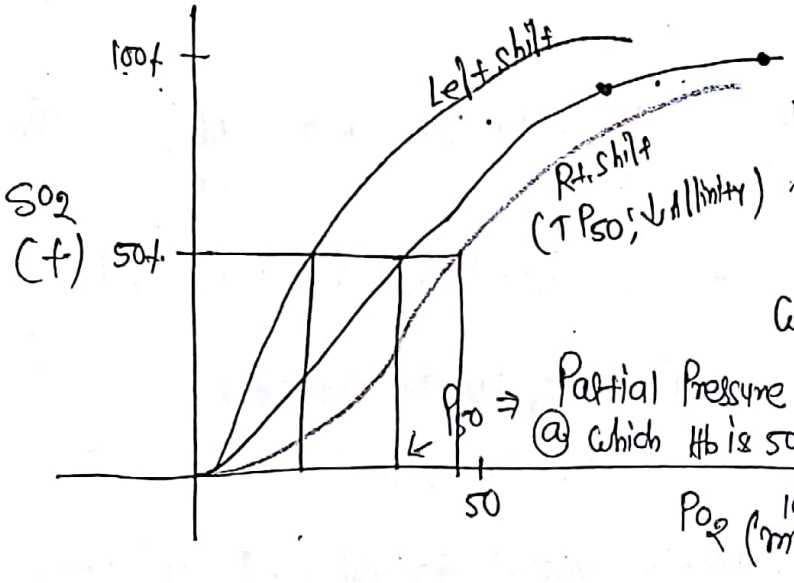
↳ if P_{O_2} is 1 mm of Hg ⇒ Dissolved O_2 is 0.003 mL/dL

So; if P_{O_2} is 100 mm of Hg ⇒ Dissolved O_2 is 0.3 mL/dL

if P_{O_2} is 90 mm of Hg ⇒ Dissolved O_2 is 0.27 mL/dL

if P_{O_2} is 80 mm of Hg ⇒ Dissolved O_2 is 0.24 mL/dL

* Oxygen Hb Dissociation curve ⇒



Sigmoid shaped

↳ "Positive co-operativity" will leads to Sigmoid shaped.

P_{O_2}	Saturation of O_2
95 mm of Hg	97–98%
Hypoxia → 60 mm of Hg	89%
if P_{O_2} is less than 60 mm of Hg. 40 mm of Hg	75%

Deoxy Hb ⟶ Oxy Hb

(Tense configuration) (Relaxed configuration)

T ⟶ R conversion

T ----------> R conversion

P_{50} ⇒ Normally 25–27 mm of Hg
= 3.6 kPa

[1 kPa = 7.5 mm of Hg]

Right Shift of curve ⇒ ↑ P_{50} ↓ Affinity (Favours delivery shift to Right)

Condn ⇒ ↑ PCO_2
↑ H+
↓ pH
↑ 2,3-DPG
↑ temp.
HbS

caused by →
G → Growth Hormone
E → Exercise (Untrained Individual)
T → Thyroid (excess)
A → Anemia
Altitude (high)
Androgen

4 moles of O_2 binds with 1 mole of Hb; but 1 moles of O_2 binds with 1 mole of Hb; but both binds at same place

Left Shift of curve ⇒ ↓ P_{50} ↑ Affinity (Favours affinity shift to Left)

Condn ⇒ ↓ PCO_2
↓ H⊕
↑ pH
↓ 2,3 DPG
↓ temp.
HbF

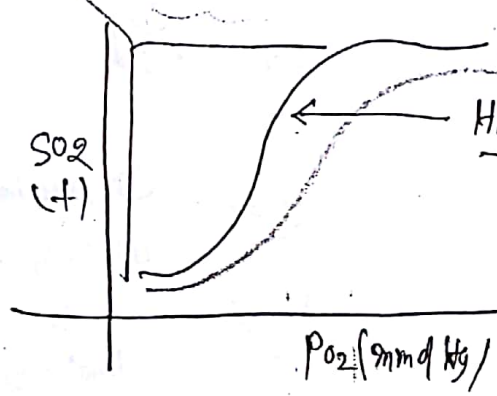
1 mol of Myoglobin binds with 1 mol of O_2

Myoglobin O_2 dissociation curve
⇓
Rectangular hyperbola
(P_{50} = 5 mm of Hg)

HbF ⇒

Myoglobin ⇒ Store house of oxygen in Muscles

Banked blood → Glycolysis
↓ 2,3-DPG



γ chain of HbF has Lower affinity for 2,3-DPG ∴ Higher affinity for O_2

REGULATION OF RESPIRATION

- NEURAL CONTROL
- CHEMICAL CONTROL (Chemoreceptors)

MEDULLA

↳ Pacemaker → PRE BOTTZINGER COMPLEX

DRG

- Dorsal Respiratory group
- "I" cells
- Function in (N); Quiet Respiration

DRG ("i" Neurons) X
⊕↓
Phrenic N. Nucleus X
(cervical spinous cord)
↓

VRG

- Ventral Respiratory group
- "I" & "E" cells
- Functions whenever Requirement req (eg⇒ Exercise)

DRG ("i") X
⊕↓ X
⊕↓

Contraction of diaphragm ⇊ Inspiration

Relaxation of Diaphragm ⇊ Expiration

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

DRG → Inspiratory signal..

Receptor for Tidal Receptor ⇒ Muscle spindle of diaphragm & ~~External~~ Internal costal Muscle

PONTINE CENTERS → Smooth transition b/w Inspiration & expiration

PONTINE CENTERS → control depth of Inspiration

PNEUMOTAXIC CENTER (P.C.)

APNEUSTIC CENTER → (++) → INSPIRATION (DEPTH)

P.C ⊖ → INSPIRATION

Vagus ⊖ → INSPIRATION

Pulmonary Stretch Receptor → Vagus

HIGHER CENTERS

- → Limbic System ⇒ Emotion & Respiration
- → Cerebral Cortex ⇒ Voluntary control of Respiratory

(a) Vagal Stimulation

↳ ↓ Depth

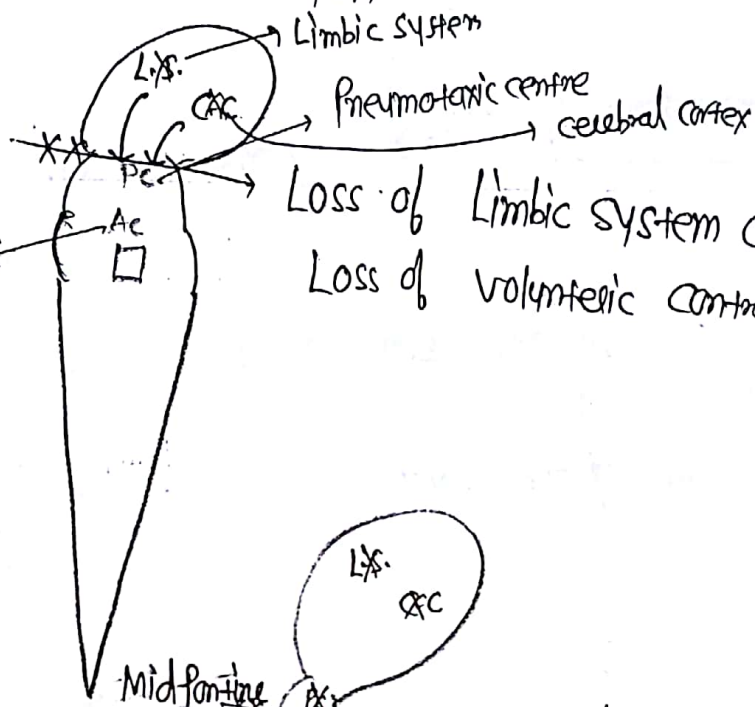
(a) Strong vagal Stimulation

↳ Apnea

(a) B/L Vagotomy

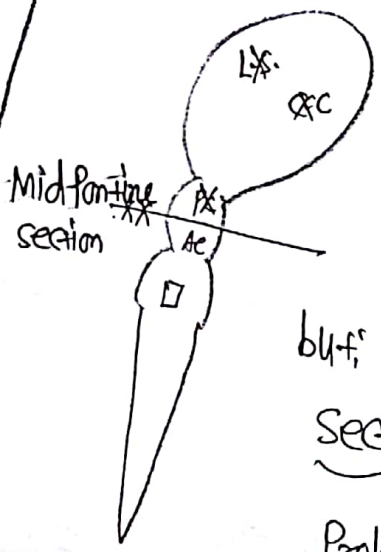
↳ ↑ Depth

(a) Cut upper Level of Pons



Loss of Limbic system control & Loss of volunteric control

(a)



↑ Depth

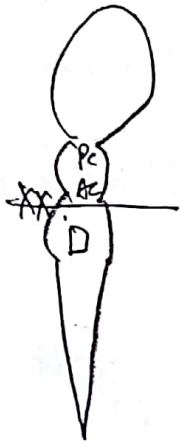
but if we do Mid pontine Section + B/L vagotomy both

↓

Prolonged Inspiratory Spasm

Known as APNEUSES OR APNEUSTIC BREATHING

(a)



Section @ upper border of Medulla.

Highly Irregular & Grasping type of breathing

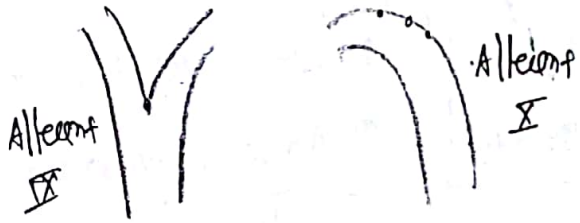
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Q. Apnea will seen if section is at :→
(a) Upper Pons; (b) Lower Pons; (c) Upper Medulla;
(d) ~~Lower~~ Medulla

CHEMICAL CONTROL
↓
By ChemoReceptors

Peripheral chemoReceptor
↓
Carotid & Aortic bodies*

Central chemoReceptors
↓
on the surface of Medulla



Stimuli for Peripheral chemoReceptors ⇒

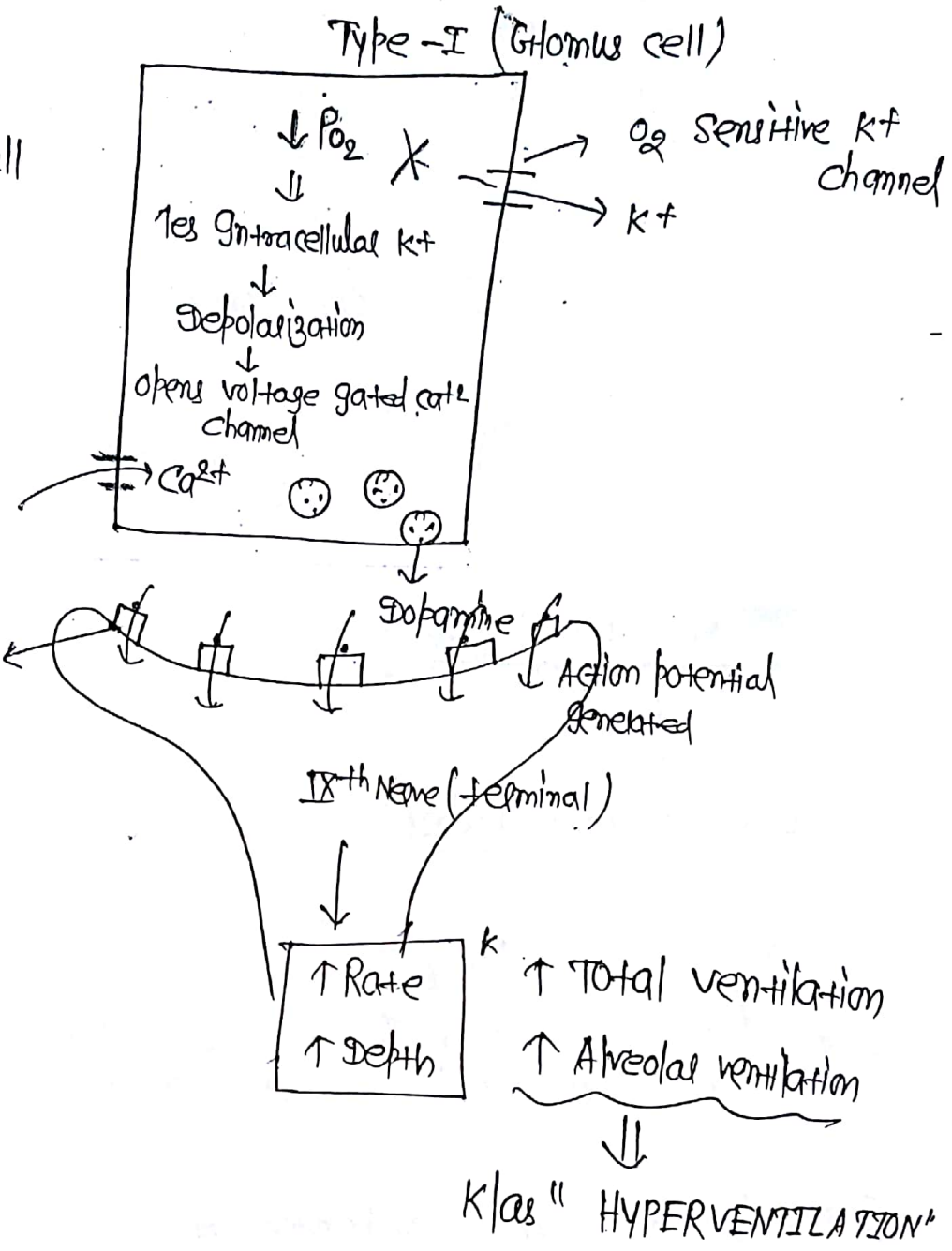
i) ↓Po_2 ← Most potent stimuli for Peripheral chemo Receptors
ii) ↑Pco_2
iii) ↑H+
iv) ↓PH
v) ↑Lactic acid
vi) ↑K+ (severe exercise)
vii) ~~Sev~~ cyanide

(a) Peripheral chemo Receptors stimulated by
(a) ↑Po_2
(b) ↓Pco_2
(c) ↑PH
(d) ~~Cyanide~~ Cyanide poisoning

CAROTID BODY

Type-II
⇩
Supporting cell

Type-I (Glomus cell)



CENTRAL / MEDULLARY CHEMORECEPTORS (C.C.R)

(Q) Most potent & direct stimulation for C.C.R

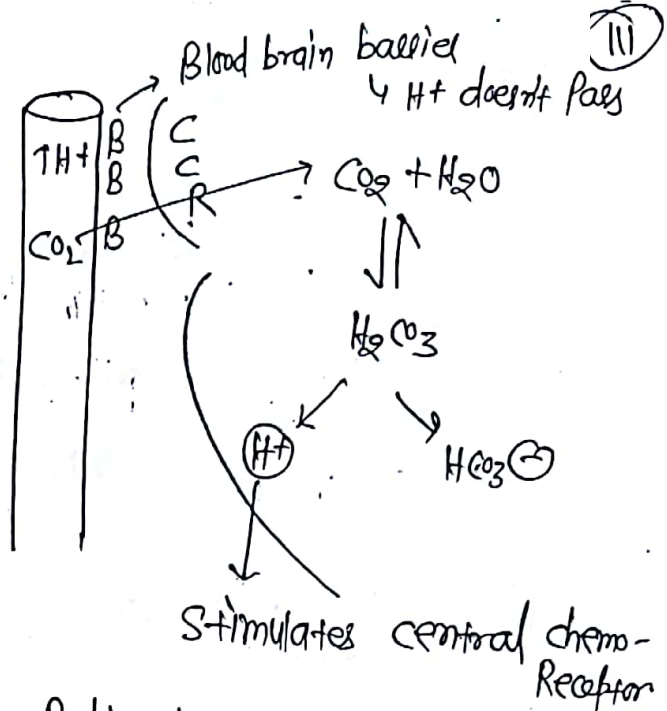
⇩

$H^{\oplus}$

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Q. Most potent Stimulus for C.C.R in blood ⇒

(a) ↑TH⊕ ; (b) ~~↑Pco_2~~



Q. Most potent Stimulus for C.C.R in CSF ⇒

(a) ~~↑TH⊕~~ ; (b) ↑Pco_2

Q. Most potent Stimulus for Respiration

(a) ↓Po_2 ; ~~(b) ↑Pco_2~~ → Stimulate both

⊕ ⊕ ⊕

30% 70%

Only Peripheral Chemo Receptors

Central Chemo Receptors

RESPIRATORY REFLEXES

(1) HERING BREUR INFLATION REFLEX ⇒

If Lung Inflation ≥ 1–1.5L ⇒ Stimulate Pulmonary stretch Receptors (⊕ @ Tracheo-bronchial tree)

vagus

↓ Depth & ↑ Expiration time.

② HERING BREUR DEFLATION REFLEX :→

↓

↑ Depth of Inspiration
&
↓ Expiration time

It prevents " Atelectasis of Lungs "**

③ HEAD'S PARADOXICAL REFLEX :→

Inflation causes further inflation of Lungs.

Significance ⇒ Newborn's → 1st breath is d/t it.

④ J-RECEPTOR REFLEX :→ J ⇒ Juxtacapillary

↓

by Dr. A.S. PAINTAL

⊕ in Alveolo capillary junction

Stimuli for J-Receptor ⇒ Hyper Inflation
Pulmonary congestion
Pulmonary Edema
Pulmonary Embolism

Responses ⇒ Apnea (Transient) – Rapid Shallow ventillation QQ
– Hypotension
– Bradycardia.

Q) In Exercise → ↑ Rate; ↑ Depth

Which Resptor Stimulate ⇒ In exercise (Mild to Moderate)

Po2, Pco2, H+ } ≤ in (N) Limits ← a) Pulmonary Stretch Receptor
b) J-Receptor
c) chemoReceptor
~~d) Joint~~ Proprio Receptors

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Joint:- Proprio ceptors

(+) → Vaso Motor centre

(+) → Respiratory centre

* but; In Severe exercise ; ↓ P_{O_2}, ↑ P_{CO_2}, ↑ H+, ↓ K+ ⇒ Joint Proprioceptors + Chemo Receptors both works

CYANOSIS – Bluish discolouration of skin & Mucosa

. Deoxy Hb ≥ 4.0 gm/dL

So; Severe Anemia will Not prt. with cyanosis

While; In Polycythemia patient present ∈ cyanosis (May be)

. Meth Hb ≥ 1.5 gm/dL

. Sulph Hb ≥ 0.5 gm/dL

HYPOXIA ⇒ **** O_2 deficiency at tissue Level

1. HYPOXIC HYPOXIA ⇒ P_{O_2} < 60mm of Hg

S_{O_2} < 89%

"M/c type of Hypoxia"

Cyanosis (+)

M/c type of Hypoxia
Cyanosis (+)

Causes ⇒ High Altitude

High Altitude

Hypoventilation

Hypoventilation

Gulleian - Baare syndrome

Gulleian - Baare synd

Bubal infact

Bubal infact

Peripheral chemoReceptor ⇒ (+)

Peripheral chemo-receptor stimulation

stimulation

2. ANEMIC HYPOXIA ⇒ either Hb ↓ or Saturation of O2 ↓

Anemic Hyoxia

either Hb Decrease or satuation of O2 decrease

Cynosis = (-)

Cynosis - (-)

Hb → ↓

SO_2 → ↓

P_{O_2} → (N) (bc there is No problem Regarding the exchange of O_2 here)

PeriPheral chemoReceptor ⇒ (-)

stimulation

eg ⇒ Met Hb

CO Poisoning

3. STAGNANT HYPOXIA ⇒ ↑ Arterio-Venous O_2 difference

also "Hypoperfusion hypoxia"

Stagnant hypoxia

Cyanosis (+)

bc of Sluggish blood Flow

eg: CHF or circulatory shock.

Peripheral chemo-Receptor ⇒ Very very very high Rate of blood flow

(2-3 gm)

⇒ 2000 ml/min/100gm

gm Brain ⇒ 52 ml/min/100 gm

if there is ↓ in blood flow Rate

↳ ↓ Total Volume of blood & therefore O_2 delivered to Peripheral chem Receptors in cardiac arrest

④ **HISTOTOXIC HYPOXIA** ⇒ ↓ Arterio-Venous O_2 difference

eg ⇒ ~~Cyanide Poisoning~~ Cyanide Posining

Peripheral chemoReceptor → ⊕ Stimulation

ACCLIMATIZATION ⌐ Minm time Required * ∟ 2-3 days

- ~~Development of compensatory Mechanism to ward off ill effects of Low Barometric pressure.~~
- i) ↑ Renal excretion of bicarbonates → Leads to Polyuria (More loss of water) b/c Solutes comes ↓ ↑↑ Solvent.
  ↓
  pH tends to Normalize (So, Respiratory Alkalosis ; further Nf Inhibit the Peripheral chemo-RR Receptor)
  ↓
  ↓P_{O_2} → Les Respiratory Drive
- ii) ↓P_{O_2} → ↑ Erythropoietin → comes from kidney → ↑ Red cell Mass (Polycythemia)
- iii) Shifts oxygen-Hb dissociation curves to Right (Least helpful) ⇒ ∴ ↑ Les O_2 delivery to tissue
  ∟ ∴ ↑ Les in 2,3-DPG

* In Natives of High Altitude ⇒ iv) ↑ Capillary density at tissue Level
v) ↑ Mitochondria ; ↑ Cytochrome enzyme

HIGH ALTITUDE PHYSIOLOGY

(↓P_{O_2}) Hypoxic Hypoxia → Stimulate Peripheral chemo Receptor → ↑ Rate of ventilation
↑ Depth of ventilation

$P_{CO_2} \propto \frac{1}{V_A}$ ⊖ "CO_2 washout" ⇐ Hyperventilation

∟ Respiratory Alkalosis

* ↓P_{O_2}
↓
Peripheral chemo (R)

VMC → Sympathetic Discharge → CVS changage 1st to Normalize in Acclimatization

Respiratory centre → ↑ Rate of Ventilation, ↑ Depth of ventilation → CVS changage 1st to Normalize in Acclimatization

* Physical activity during Acclimatization → Rate of Ascent → ACUTE MOUNTAIN SICKNESS ⇒ Individual Susceptibility
⇒ after 1st 24 hrs. (1-3 days)
⇒ In few clin Few hours

Mild Altitude Sickness ⇒ Headache; Sleep disturbance; Irritability.

HACE ⇒ High altitude Cerebral edema

↓ P_{O_2}

↓

Cerebral vasodilation

↓

↑ P_c

↓

↑ Tissue fluid formation

R_x ⇒ give O_2 & evacuate

Prevention ⇒ Acetazolamide

↳ Produces Metabolic acidosis & Acidosis's Res. Respiratory drive

HAPE ⇒ High altitude Pulmonary edema

↓ P_{O_2}

↓

Pulmonary vasoconstriction

(Patchy vasoconstriction) ← Not Uniform vasoconstriction

↑ Flow in those Areas where there is little or No vasoconstriction.

↓

↑ P_c

↓

↑ Tissue Fluid formation

CHRONIC MOUNTAIN SICKNESS

↳ MONGE'S DISEASE

↳ occur in Fully Acclimatized patient

↓ P_{O_2}

↓

Pulm. vasoconstriction

↓

Pulm. Hypertension

↓ P_{O_2}

↓

↑ Red cell Mass

↓

↑ Blood viscosity

↓

↑ Resistance to flow

Right heart Failure

⇓

Congestive Cardic Failure

↳ Pulmonary edema

GIT

Smooth Muscle

- Unstriated
- Involuntary
- Actin
  Myosin
  Tropomyosin
  Troponin
- Ca++ binding Protein
  - Calmodulin

QQ- Gatekeeper in the GIT
⇓
Epithelial calcium channel.

RMP of Smooth Muscle
⇓
-60 mv to -30 mv

Ca++ binding protein

Calmodulin

Smooth Muscle

Single Unit
Single unit
Gap Junctions (+)
- Walls of Hollow viscera
  (GI tract
  Ureter
  Urinary bladder
  Uterus)

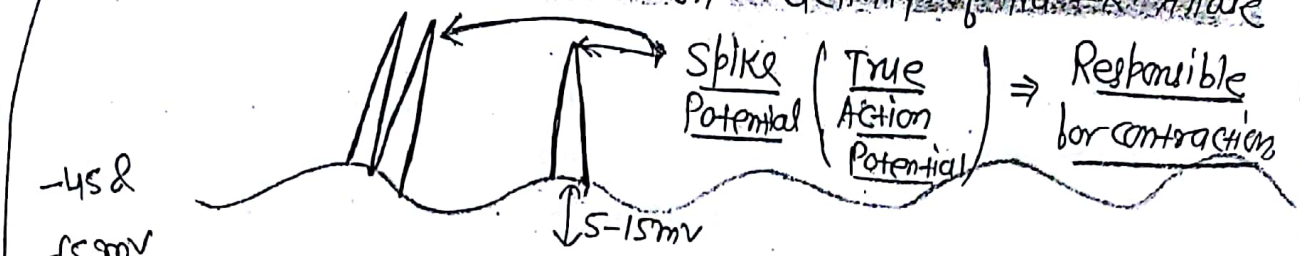
Multi-Unit
Multi- Unit
No Gap junction
- Iris
  - constrictor pupillae
  - dilator pupillae
- Ciliaris

* Vasaylal Smooth Muscle ⇒ has both single & multi-unit type of Smooth Muscle

* Electrical activity
⇓
PaceMaker ⇒ Interstitial cells of CAJAL
⇓
BER (Basal electrical Rhythm)

* Basal electrical Rhythm

↳ Variation of Membrane potential ⇒ d/t oscillation in activity of Na+-K+ ATPase



Frequency → Variable

Maxm → ~~Duodenum~~ – ~~12/min~~ 12/min

Duodenum

Minm → ~~Cecum~~ – ~~2/min~~ 2/min

cecum

↳ It is Not Responsible for contraction,

Depolarization ⇒ Ca^{+2} influx (Not Na+ influx)

Q: ↑ frequency of Spike potential in All except ⇒

↳ ↑ Contractile Activity

(a) Parasympathetic

(b) Ach

(c) Stretch → Opening of Mechano-Sensitive Ca^{+2} channel.

(d) ~~Adrenaline~~

Mech^{n} of Smooth Muscle contraction ⇒

Increase In Sarcoplasmic ca+2

↑ In Sarcoplasmic Ca^{2+}

↓

Ca^{2+} binds ē Calmodulin

↓

Ca^{2+} – Calmodulin complex

↓

Activates "MLCK" (Myosin light chain kinase)

↓

Phosphorylates Myosin Light chains in Myosin head

↓

Activates Myosin ATPase

↓

Actin – Myosin cross-bridge "formation"

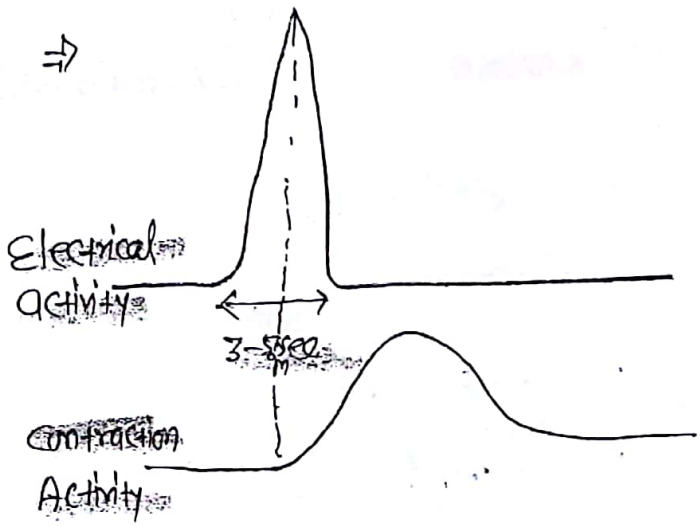
↓

Actin – Myosin – cross – bridge "cycling"

Relaxation by ⇩ Phosphatase

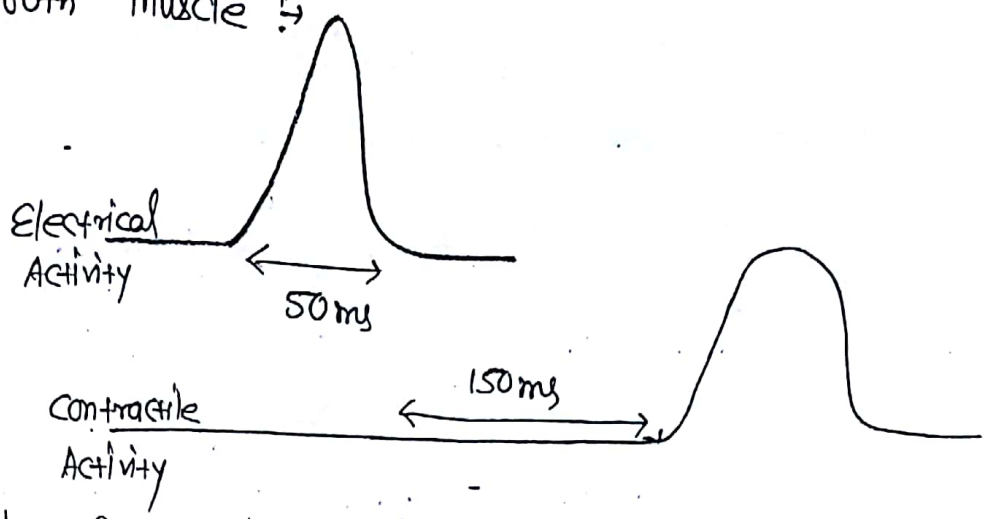
LATCH MECHANISM ⇒ Slower Actin-Myosin cross bridge cycling.

In Skeletal Muscle ⇒



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* In Smooth Muscle :-



* GI Transplant done Rarely; b/c Intestine is Rich in Lymphoid tissue; so! chance of its Rejection is very high.

CONTROL OF SMOOTH MUSCLE (GI Tract)

- NEURAL CONTROL (Neural control)
  - Enteric Nervous System (Enteric Nervous system)
    - Intrinsic nervous system
      - INTRINSIC NERVOUS SYSTEM
        - Found in b/w the Longitudinal & circular Muscle Layers
          - MYENTRIC OR AUERBACH'S PLEXUS
            - ↓ Controls Gut Motility
          - SUB MUCOSAL OR MEISSNER'S PLEXUS
            - ↓ Controls
              - Secretory Activities
              - Blood supply
    - Extrinsic nervous system
      - EXTRINSIC Nervous System
        - Modify the activity of Intrinsic
          - Sympathetic
            - ↓ Contraction of Sphincter
            - ↓ the Contractile activity
            - ↓ Secretory activities
          - Parasympathetic
            - ↑ Contractile activity of gut
            - Relaxation of Sphincter
            - ↑ Secretory activities
- HORMONAL CONTROL (Hormonal control)

HORMONAL CONTROL OF GI Tract

STOMACH

↳ G-cells (Antrum) → Gastrin → ↑ HCl secretion

G cells (Antrum) — Gastrin — Increase HCl secretion

- Distension
- Parasympathetic - Stimulation
- Ach
- Ca++ (Intraluminal & Blood borne)
- ↑↑ Adrenaline

Ach
Para-Sympathetic
GRP
Gastrin
↳ ↑ HCl secretion

Gastrin Releasing Peptide G-cells (Pyloric Antrum)

Parasympathetic stimuli
↳ Release Ach
↳ Acts on (R) of G-cell
↓
GRP Release → Gastrin secretion.

↳ D_1 cells (FUNDUS) → GHRELIN → also by Epsilon cells of Pancreas

c"C cell" of pancrease

GHRELIN

- Orexigenic (↑↑ Appetite)
- Mobilizes fats & ↑↑ Fat deposition

Mobilizes fats & increase fat deposition

- Modifies choice of Food

Modifies choice of food

- Enhances Memory
- Sleep deprivation (↑ Ghrelin secretion
- Anorexia ⇒ (N) OR High Ghrelin
- ↑ Growth hormone secretion.

Small intestine

SMALL INTESTINE

↳ "I" cells ⇒ CCK

- ↑ Gall bladder contraction
- ↑ Pancreatic Enzyme Secretion
- Potentiates action of secretin

QQ Most imp. Stimulation for Secretion of CCK ?

(A) Fatty acids; (B) Products of Protein Digestion

CHOLERETICS Choleretics

↑es synthesis of Bile salts

Increase synthesis of bile salts

↓

∴ ↑ Secretion of Bile

Increase secretion of Bile

Eg ⇒ Bile salts

Biles salts

CHOLEGOGUES Cholegogues

↑ Gall bladder contraction

Increase Gall Bladder contraction

↓

∴ ↑ Secretion of bile

Increase secretion of Bile

CCK

CCK

"S" cells of Small Intestine ⇒ SECRETIN

"S" cells of small intestine

↳ ↑ HCO_3^- Content of bile & Pancreatic Juice

Increase HCO- content of bile & pancreatic juice

↳ delays gastric emptying

delays gastric emptying

QQ Most alkaline Secretion ?

Saliva → 6.0 - 8.0 (7-8 usually)

Bile → 7.0 - 8.0

Pancreatic Juice → upto 8.8

Brunner's gland → upto 9.3

Secretion ↳ ⊕ in duodenum

"K" cells of Small Intestine ⇒ GIP ⇒ Glucose dependent Insulinotropic peptide

k cells of small intestine

Glucose dependent Insulinotropic peptide

Incretin

Incretin

↑ Insulins

Increase Insulins

"L" cells of Small Intestine → GLP-1 ⇒ Glucagon like peptide-2

"L" cells of small intestine

GLP - 1

Glucagon like peptide

GIP - 1 ⇒ ↑ Insulin

⇒ Also known as Physiologic β-cell stimulating hormone of GI tract

Physiology Beta- cell stimulating hormone of GI tract

S cells of Small Intestine — Somatostatin

Somatostatin

- ↓ Gastric Motility & secretion
- ↓ Intestinal ||

Decrease - Motility & Secretion

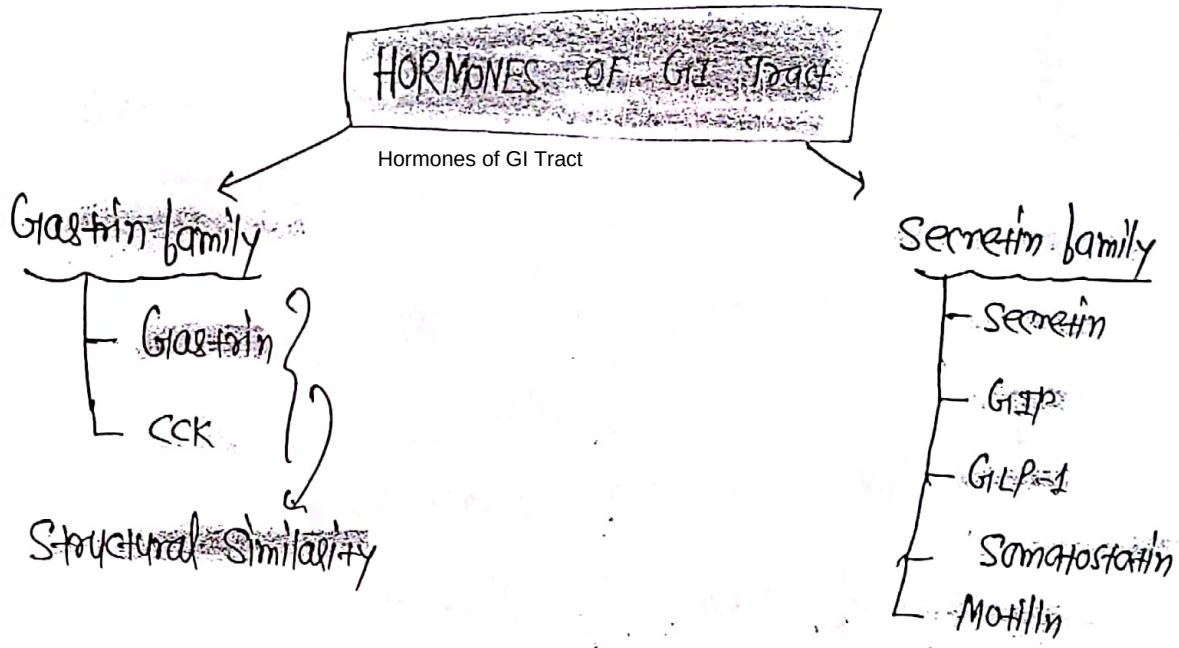
Decrease Intestinal motility & secretion

M cells of Small Intestine — Motilin

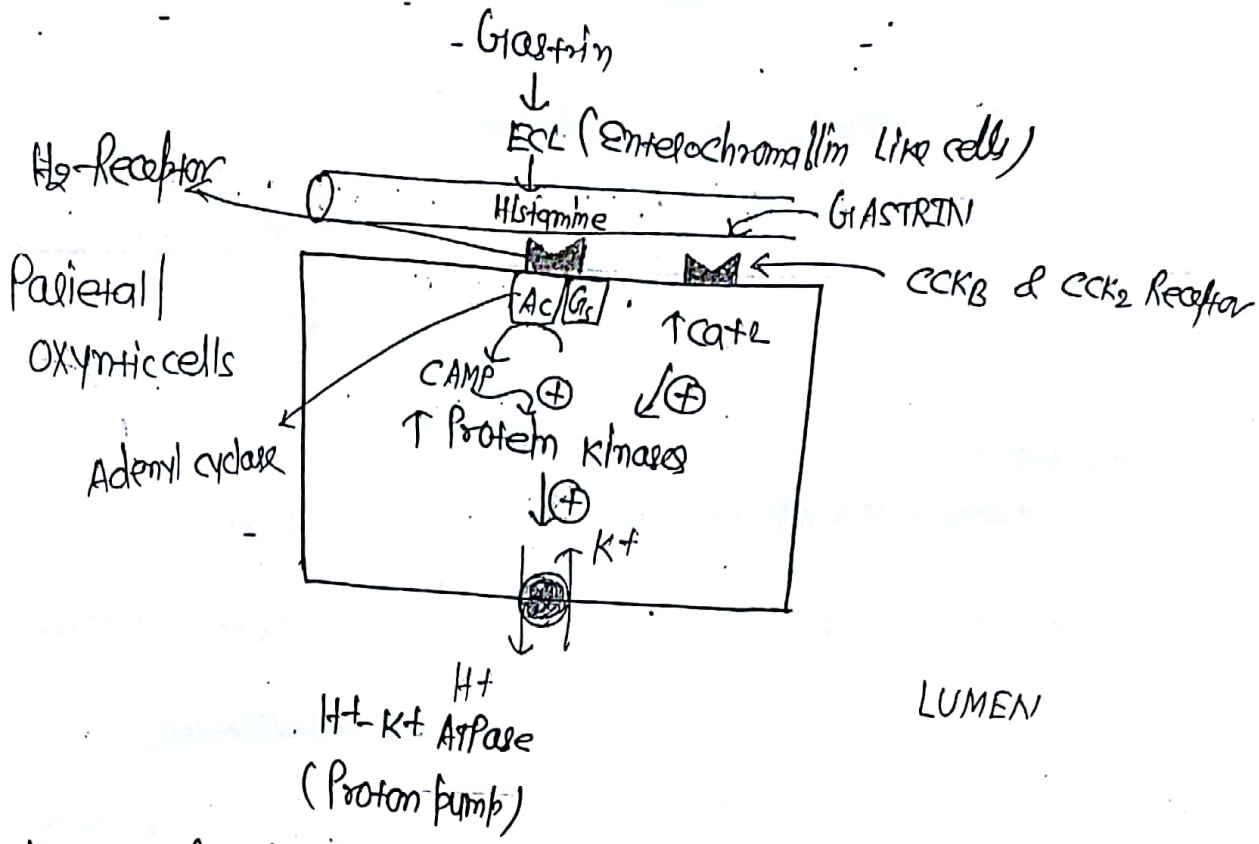
↑ When a Meal is ingested, secretion of Motilin is suppressed until digestion & Absorption are complete

- Migratory Motor Complexes
- ↑ GUT Motility (99)

Erythromycin combines Motilin



Hormones of GI Tract



* Gastrin acts on entero-chromaffin cells
↓
Histamine secretion
↓
Acts on H_2 Receptor
↳ acts on G_s Protein
↳ Activates Adenyl cyclase
↳ ↑ cAMP & ↑ Protein kinase

Increase cAMP &
Increase Protein kinase

SECRETION OF GI TRACT

SALIVA ⇒ 800 - 1200 ml/Day

pH = 6.0 - 8.0 (usually 7.0 - 8.0)

- 3 Pairs of Major salivary gland
  - → Parotid → Largest gland
  - → Submandibular + Max^{m} contribution to
  - → Sublingual Saliva

3 Phases

↳ CEPHALIC ⇒ Most Important ; b/c Thought; Sight
ORAL → by Sour Maxim , Smell
GASRTIC activated

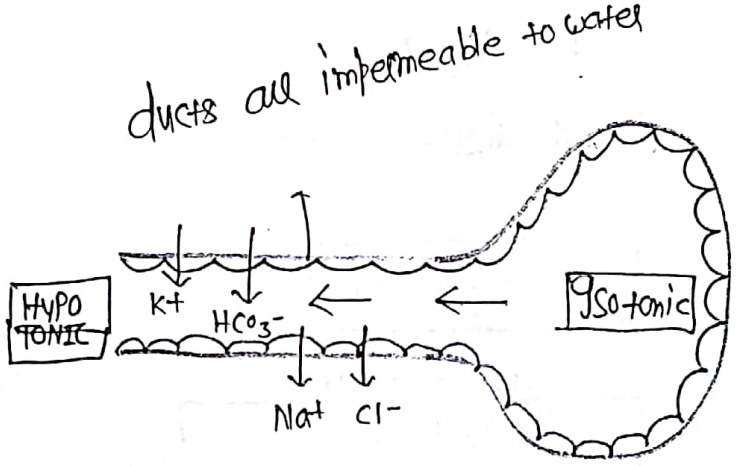
3 Enzymes

↳ S. Amylase

Lysozyme

Lingual Lipase ⇒ Secreted by 'EBNER's GLANDS ON DORSUM OF GLAND.

→ Chloride ion (Cl^-) Require to activation of S. Amylase
↳ Not H^+; HCO_3^-



Na^+, Cl^- Reabsorption > K^+, HCO_3^- Secretion into saliva

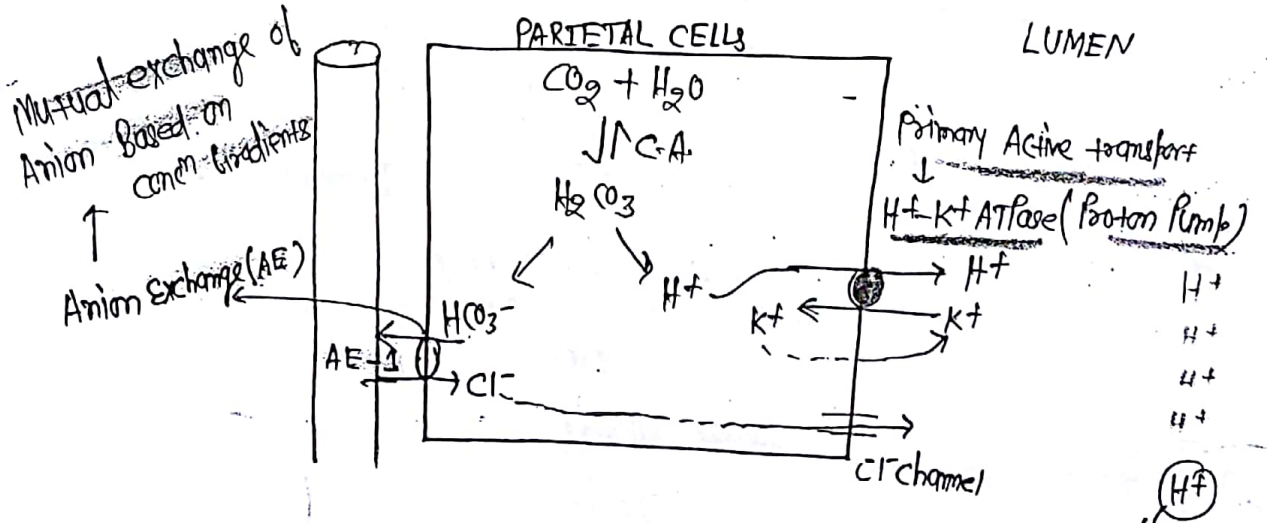
* Aldosterone Receptors are present here

↳ In Collecting duct
Salivary glands
Sweat glands
Colon
Hippocampus

GASTRIC SECRETION ⇒

- 2,000 / 2,500 mL / Day ← Maximum
- pH = 2-3
- 3 Phases
  - Cephalic
  - **Gastric** ← Neural + Hormonal ⇓ by Gastrin
  - Intestinal
- Oxyntic / Parietal cells
  - Secreted HCl
  - Intrinsic Factor
- Chief / Peptic cells
  - Pepsin
  - Gastric Lipase

HCl Secretion



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Function of Hcl ⇒ i) Bactericidal Agent

pH of Pure Hcl ⇒ 1-2.

ii) Solubilizes the Iron salts

Fe^{+3} —vit c→ Fe^{2+}

↳ only absorbable form of Iron

iii) Activation of Pepsinogen to form Pepsin.

PANCREATIC SECRETION ⇒ 1500 mL/Day

↳ pH = upto 8-8

↳ Very Rich in enzyme

↳
- Pancreatic Amylase
- Trypsin
- Chymotrypsin
- Carboxypeptidase
- Elastase
- Nucleotidase
- Lipases
  - ↳ Colipase Dependent Pancreatic Lipases
  - ↳ Bile Salt activated Pancreatic Lipases

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

INTESTINAL SECRETION ⇒ 1500 mL/Day

- pH = 7.0–8.0
- Secrete Enzymes

⇓

- Enterokinases

Trypsinogen → Trypsin

⇓

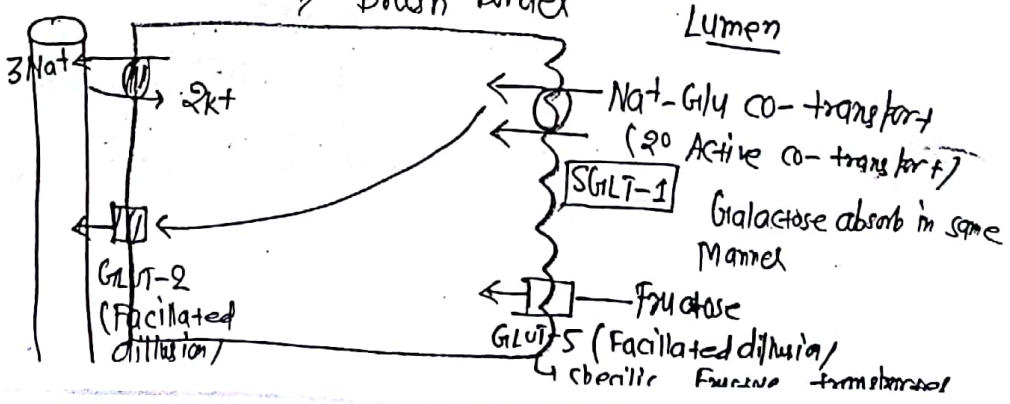
Activates all other Pancreatic enzyme to their active forms

- Disaccharidases
  - Lactases
  - Sucrases
  - Maltases
- Di & Tri-peptidases

DIGESTION & ABSORPTION

(A) CARBOHYDRATE → Luminal

→ Brush border



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

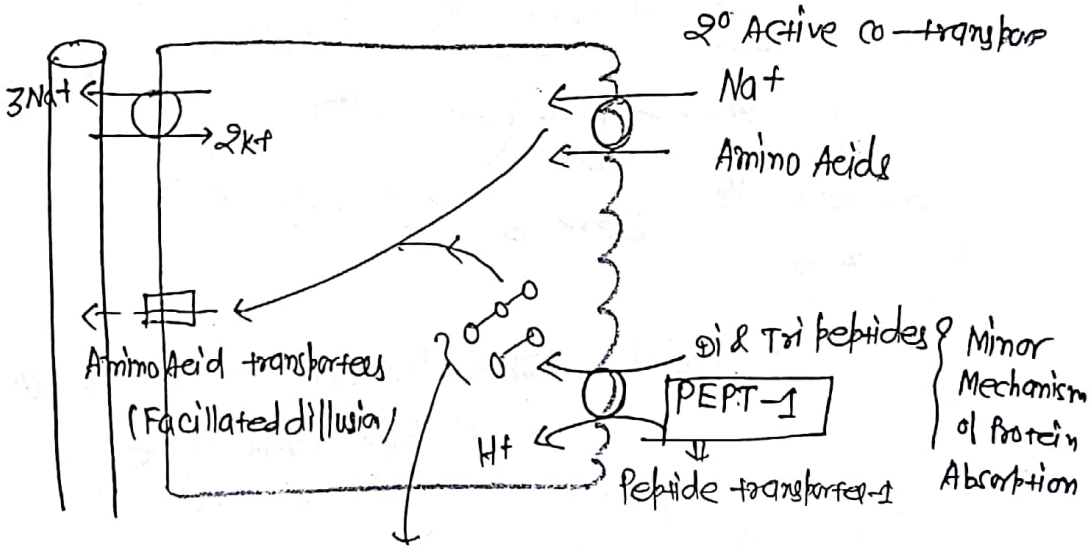
Glucose is absorbed by :-

a) ~~Facillated~~ diffusion ; b) ~~2°~~ Active co-transport

(B) PROTEINS DIGESTION :-

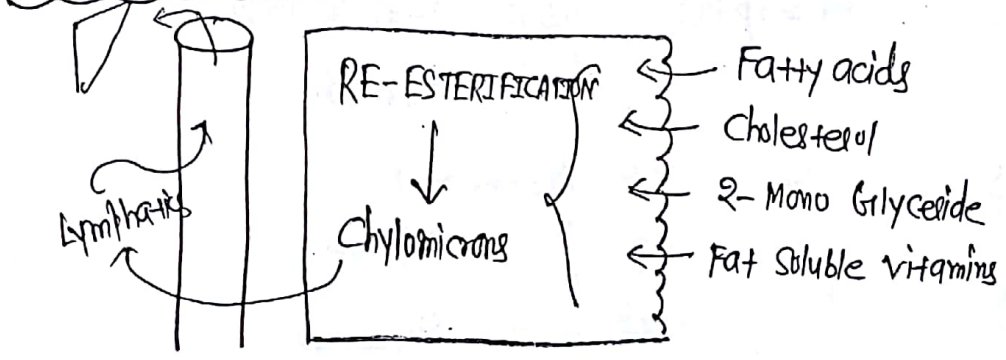
- Luminal digestion
- Brush border digestion
- Intracytoplasmic Digestion (Di & Tri peptidase (+))

Absorption ⇒



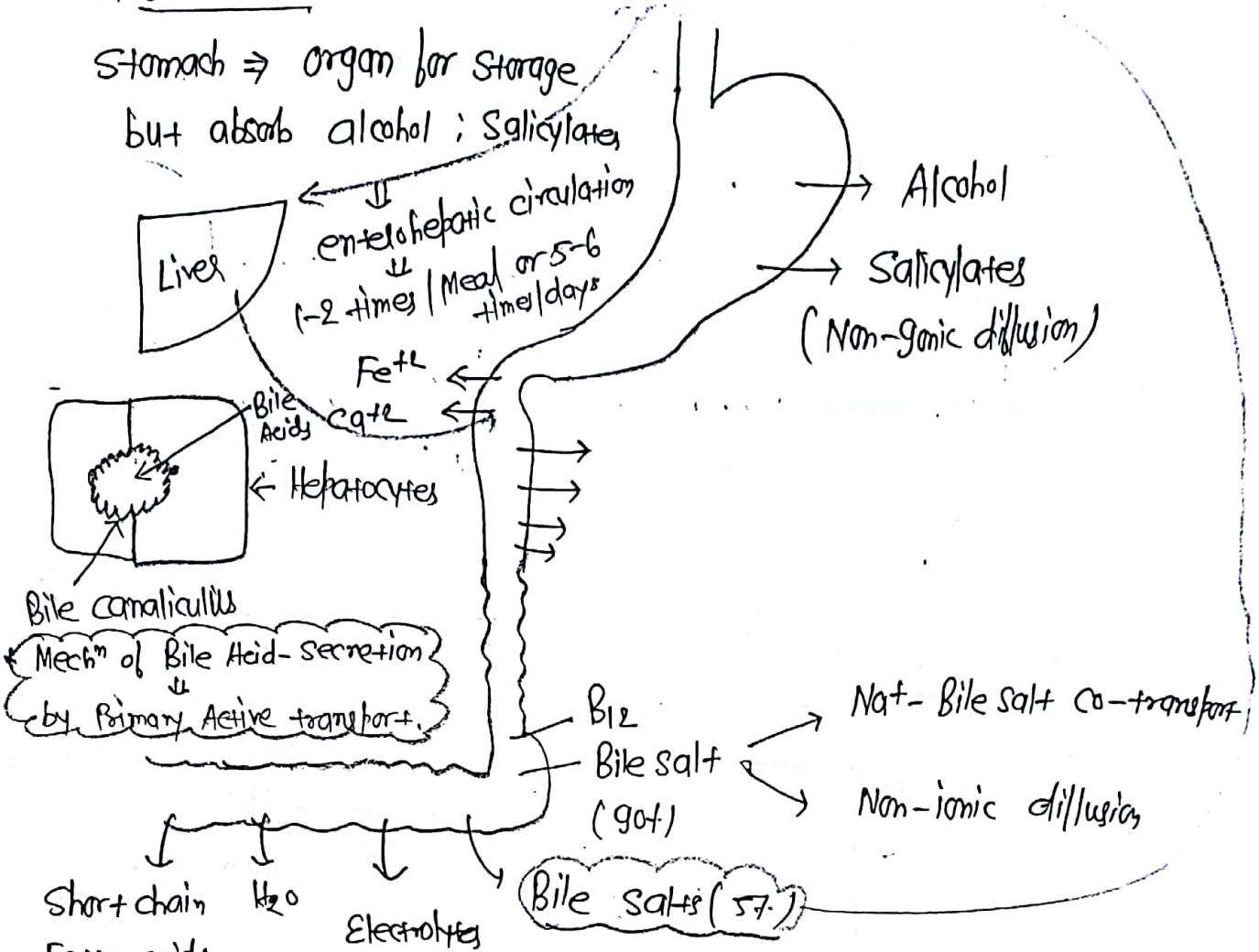
done by Intracytoplasmic Di & Tri peptidases

(C) FATS ABSORPTION :-



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* ABSORPTION :-



↳ Produced by colonic bacteria by Action on dietary fibers; complex carbohydrate

eg ⇒ Acetate 60%
Propionate 25%
Butyrate 15%

QQ: Absorption alcohol starts in ??
↳ Stomach

QQ Maxm Alcohol Absorption ??
↳ Jejunum

QQ Fe^{+2} absorption ⇒ Duodenum

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Q. Maxm Ca^{2+} ⇒ Jejunum

Q. B12 ⇒ Distal ileum

Q. Fatty acids ⇒ Jejunum

Q. Bile ~~Acids~~ Salts ⇒ Distal ileum

Q. Short chain fatty acids ⇒ Colon

Q. Long chain fatty acids ⇒ Jejunum

Q. Maxm water absorption ⇒ 9000 ml enters in ~~Gastric~~ Small Intestine.

Jejunum	⟶	5500 mL (Maxm)
Ileum	⟶	2000 mL
Colon	⟶	1300 mL
Feces	⟶	200 mL

Q. Maxm Na+ absorption ⇒ Jejunum

Q. Maxm K+ is secreted by :- Salivary glands

Q. Maxm K+ conc^{n} is in ⇒ Colonic fluid

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

SDA (Specific Dynamic Action of Food) ⇒

↳ Obligatory Expenditure of Energy for Digestion & Absorption of Food

eg ⇒	Proteins	Carbohydrate	Fats
	↓↓ ⊗ amount	↓↓ ⊗ amount	↓↓ ⊗ amount
	100 Kcal energy generated	100 Kcal energy generated	100 Kcal energy Generated
To digest & assimilate ⇒	30 Kcal expend	6 Kcal	5 Kcal

QQ SDA is Maxm for ⇒ Proteins

BASAL METABOLIC RATE

depends on ⇒ ~~Body~~ Surface Area

~~Lean~~ Body Mass

MOVEMENTS OF GI TRACT

,Movements of GI Tract

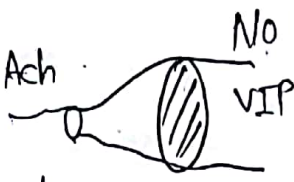
* When food prt. in Small Intestine

↳ first Movement ⇒ i) Segmentation Contraction ⇒

- Mixing contraction
- Alternate contraction & Relaxation in the segment of Intestine

ii) Peristalsis :→ Local Neural activities

↳ Mediated by Parasympathetic & Sympathetic



Ring of contraction behind Food

Relaxation in front of Food

Gn Esophageal Peristalsis

- 1° ⇓ Mediated by vagus during Swallowing
- 2° ⇓ if Primary fails to Move food forward ⇓ Secondry (2°) is Mediated by Local plexus

Gn B/L vagotomy

↳ Loss of 1° Esophageal Peristalsis

iii) Migratory Motor Complexes (MMC)

Migratory motor complexes (MMC)

↳ ⊕ Gn Gastric Digestive Period

↳ Not a Neural activity; it is Hormonal activity ⇓ by Motilin (M cells)

↳ Ring of contraction which starts from body of Stomach goes upto Distal Ileum

↳ Kl as "HOUSEKEEPING CONTRACTION"

Housekeeping contraction

, 1st MMC ⇒ 90–120 min after Last Meal

↓ then

occur in cycles of 90 mins

- Phases of MMC
  - I ⇒ Quiescent Phase
  - II ⇒ Phase of irregular electrical & Motor activity
  - III ⇒ Phase of Regular electrical & Motor activity

Total duration ⇒ 90 min

- MMC ⇒ 5 cm/min

  (Peristalsis ⇒ 5–25 cm/sec)

- GI prevents Reflux of colonic contents into ileum. and also clearing the tract.

GI REFLEXES

* Receptive Relaxation of Stomach

Receptive relaxation of stomach

- Relaxation of Fundus during Swallowing
- Mediated by vagus

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* **Gastro colic Reflex** ⇒

Food ⊕ in Stomach ⇒ Defecation

In Infants it is Prt.; Abolished in Adults.

Q. Maxm Postprandial ↑ in tone & Motility is ⊕ in which Segment of colon ?

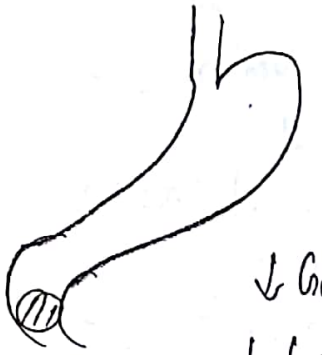
a) Ascending colon

~~b)~~ Descending colon

c) Sigmoid colon

* **ENTEROGASTRIC REFLEX** ⇒ Neural + Hormonal

↳ Mainly Somatostatin



↓ Gastric Motility

↓ Gastric secretion

Stimuli that Inhibit ⇒ ① - Distension M.Imp

Gastric Motility

② Type of Food ⊕

Fats > Proteins > Carbohydrate

③ Acidity of Gastric chyme

More Acidity of Gastric chyme

↳ greater Inhibition

④ Osmolality of Gastric chyme

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

DEFECATION REFLUX ⇒ 1st Urge ⇒ 18 mm of Hg

Evacuation ⇒ 55 mm of Hg

MICTURATION REFLUX ⇒ 1st Urge ⇒ 150 ml

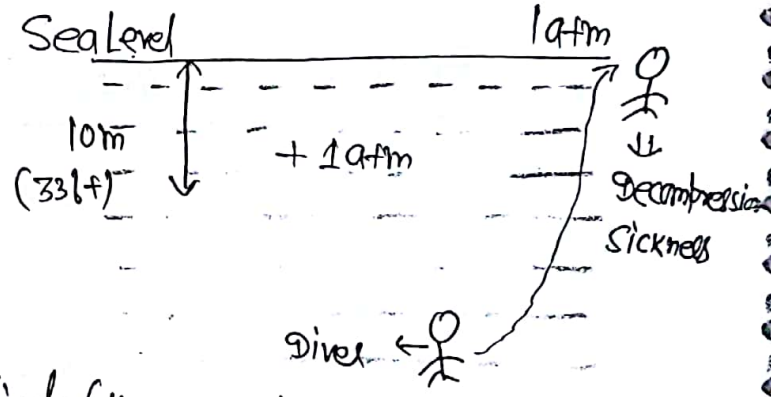
Uncontrollable ⇒ 400 ml

DEEP SEA PHYSIOLOGY

Deep Sea Physiology

(a) At 100 ft ⇒ 4 atm Pressure

At 100 m ⇒ 11 atm



Diver

↓

100% O_2 → ↑↑ Solubility of O_2

⇓

Generation of Free Radicals (H_2O_2, O_3^-)

⇓

O_2 TOXICITY – Symptoms ⇒ Choking

~~Coughing~~ coughing

So; O_2 ± Inert gas given

↳ $O_2 - N_2$

Under water ⇒ ↑↑↑ Solubility of N_2 ⇒ ↑ N_2 Dissolution in plasma, Myelin; Cell Membrane

⇓

Alters Ionic Conductivity ⇐ N_2 Narcosis → "RAPTURES OF DEPTHS". OR "MARTINI Effect".

↳ Symptoms ⇒ Similar to Alcohol Intoxication.

TO Avoid N_2 Narcosis ⇒ Oxygen – He Mixture preferred

⇓

b/c He is less soluble
less Narcotic
less dense ⇒ Breathing is easier

Decompression Sickness

DECOMPRESSION SICKNESS ⇒ K/a "Dysbarism"
Dysbarism
OR
"CAISSON'S DISEASE".
Caisson's disease

Gas embolism (+)

M/c Symptom → BENDS (Painful Joint & Muscle)

M/c Symptoms ⇒

Pulmonary symptoms

Cerebral symptoms

Coma

death

(+)ve "g" Forces

↑ Peripheral pooling of blood

⇓

"Black out"

Prevention ⇒ "Anti-g" Suits

(−)ve "g" forces

⇓ ↑ Flow towards head ends

Red out ⇒ ↑es conjunctival & scleral congestion

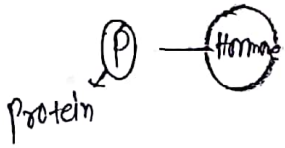
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

ENDOCRINE SYSTEM

LIPID SOLUBLE HORMONES ⇒	WATER SOLUBLE HORMONES
• Steroids • Thyroid	• Amines • Peptides
* Synthesize as & when Needed (No Storage). ↳ except ⇒ Thyroid	• Synthesize & Stored
• Transported ∈ Proteins except ⇒ DHEA Adrenal Androgen	• Transported as such except ⇒ [gGF-1] ↳ a/w growth hormone ↳ Longer half life than growth hormone
• Cytoplasmic / Nuclear Receptors	• Membrane Surface Receptor • Need 2nd Messengers (except → Insulin) ↳ b/c Insulin Receptor itself has Tyrosine kinase activity.
• Mech^n of Action ⇒ Synthesis of New proteins (enzyme)	– Act by Modifying Action of Pre-existing enzyme
• Longer half Life	• Shorter half Life

Total Hormone = Bound hormone + Free hormone



[Activity (Responsible for Activity as well as for One feedback

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Liver Induces ⇒ ↑ Hepatic output of Proteins

- Estrogen
- Barbiturates
- opioids
- Major Tranquilizers

⇓

↑ Bound hormones ; & ↓ free hormone (Transient change)

⇓

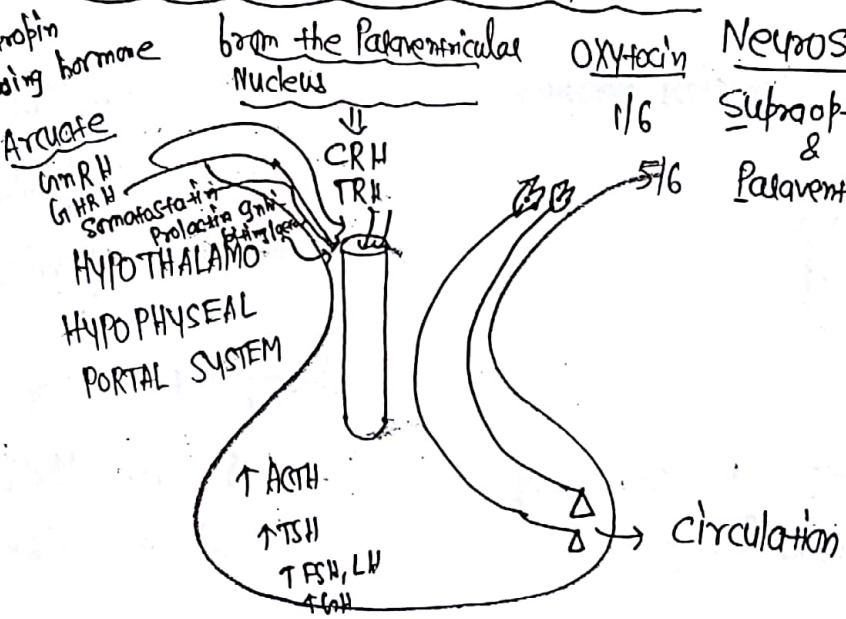
↑ total hormones ; ↑ Bound hormone ; Free hormones (N)

Q. In a heroin Addict

↳ Total thyroid ⇒ ↑
Bound thyroid ⇒ ↑
Free T_3, T_4 ⇒ (N)

HYPOTHALAMIC PITUITARY AXIS

CRH = corticotropin Releasing hormone



Oxytocin	Neurosecretion	ADH
1/6	Supraoptic	5/6
5/6	& Paraventricular	1/6

HYPOTHALAMUS		ANTERIOR PITUITARY
CRH	⊕ →	ACTH
TRH	⊕ →	TSH
GnRH	⊕ →	LH, FSH

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

HYPOTHALAMUS — ANT. PITUITARY

GHRH ⊕ → GH

Somatostatin ⊖ → GH

Prolactin inhibiting factor (Dopamine) ⊕ ⊖ → Prolactin

"STALK Effect" ⇒ ↑es in Prolactin

↳ Thrombus in Hypothalamo Hypophyseal Portal system

* All Hypothalamic hormone are secreted in Pulsatile fashion ⇒ except ⇒ TRH.

* Low frequency Pulse of GnRH ⟶ ↑ FSH.
  High frequency Pulse of GnRH ⟶ ↑ LH

QQ Continous infusion of GnRH
↳ ↓ FSH ; ↓ LH (down Regulation of GnRH happen in continous infusion)

* Pulsatile secretion prevents down Regulation of GnRH Receptor in Anterior Pituitary

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

ANTERIOR PITUITARY

Acidophils ⇒ Somato-tropes ⇒ GH
- Max^m in No.
- Lacto-tropes ⇒ Prolactin

Basophils ⇒ Cortico-tropes ⇒ ACTH
- Gonado-tropes ⇒ FSH, LH
- Thyro-tropes ⇒ TSH
  - Min^m in No.

GROWTH HORMONE

Stimuli which tes GH ⇒
- Fasting ;
- Starvation ;
- Hypoglycemia ; – Most potent stimulation
- Stress hormone
- Emotion
- Sleep (NREM III, IV)
  - [In REM sleep ⇒ ↓ Growth hormone]
- Arginine ; Leucine
- Exercise
- Ghrelin

Stress Hormone
- ↑ Energy Substrates

eg ⇒
- Catecholamines
- Growth hormones
- Glucocorticoids
- Glucagon
- ADH
- Thyroid ±

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

ACTIONS OF GROWTH HORMONE

DIRECT ACTIONS

- ↑ Blood glucose level (Anti-insulin action)
- ↑ Free Fatty acids (Lipolysis)
- ↑ Protein synthesis
- Na^+; K^+; Ca^{2+}; Phosphorus Retention

INDIRECT ACTIONS

GH → Liver → IGF-1 (Source → Liver) (Somatomedin-C)

- ↓ Blood glucose
- Lipogenesis
- Protein synthesis
- Chondrogenesis (Growth of Epiphyseal plate control)

IGF-1 Responsible for "Growth Spurt @ Puberty"

IGF-1 Secretion is Maxm in ⇒ Adolescence > Children > Adults > Elde

Growth hormone → ↑IGF-1 Receptor on Cartilage

IGF-1 Synergistic Action ≅ Growth hormone

Direct Action (Independent Action)

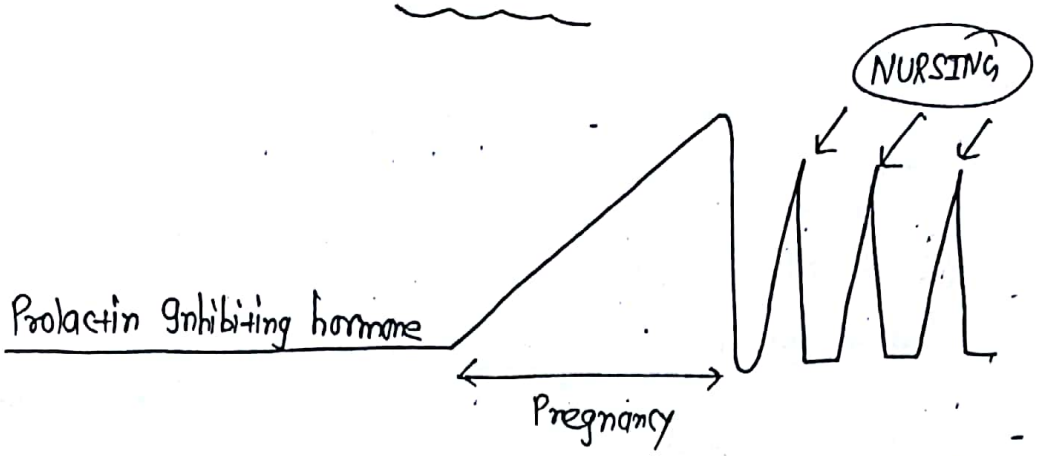
CARTILAGE

⇒ Estrogen causes fusion of growth plate.

* only IGF-1 in short stature child

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

PROLACTIN



Stimuli for Prolactin :- New PET SHOP

New ⇒ Nursing
P ⇒ Pregnancy
E ⇒ Estrogen
T ⇒ TRH (Hypothyroidism → Galactorrhea)
S ⇒ Stress
Sternous exercise
Sleep (NREM)
S ⇒ Sexual Intercourse
H ⇒ Hypothyroidism
O ⇒ Opiates
P ⇒ Phenothiazines

Stimulation Test ⇒ TRH Stimulation test ⇒ TSH, PRL
GnRH " ⇒ FSH; LH
Insulin Infusion test ⇒ GH; ACTH

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

POSTERIOR PITUTARY

ADH

* Stimuli which Tes ADH ⇒ ① ↑ Plasma Osmolality; (Tes of 5 mosm) ↑ Most potent stimulus
② ↓ Blood volume (10-15%)
③ Stress;
④ Emotions;
⑤ Pain;
⑥ Trauma;
⑦ Surgery;
⑧ Nausea;
⑨ Vomiting;
⑩ Exercise;
⑪ Prolonged standing;
⑫ Clofibrate; carbamezepine
⑬ Angiotensin II

* Stimuli which Ves ADH ⇒ ① ↓ Plasma Osmolality
② ↑ Blood volume
③ Alcohol
④ Weightlessness

* Receptors for ADH ⇒
- V_1 | V_1A Receptors
- V_2 Receptors
- V_3 | V_1B Receptors

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Secondry Messangers

$V_1 | V_{1A}$ } GPCR → IP_3 & Ca^{2+} ⇒ Vascular Smoot Muscle → Vasospasm
Liver → Glycogenolysis
Area Prostrema → ↓ Cardiacoutput.

V_2 } GPCR → cAMP ⇒ Collecting duct ⇒ ↑ Insertion of Ak-2 on Luminal Membrane

$V_3 | V_{1B}$ } IP_3 & Ca^{2+} ⇒ Ant. Pituitary ⇒ ↑ ACTH secretion

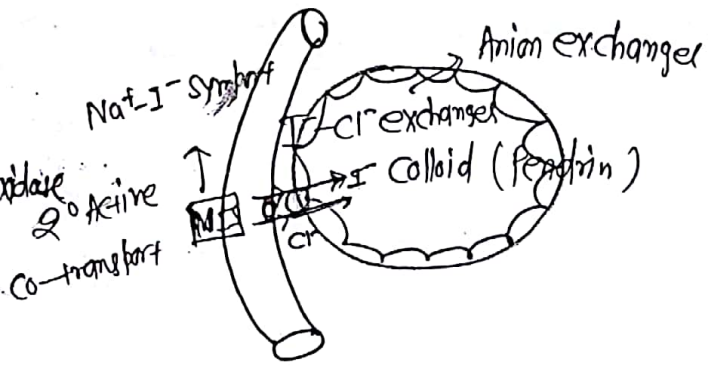
THYROID HORMONES

Hypothalamus → TRH
TRH ⊕ → TSH
TSH ⊕ → T_4, T_3
TSH ⊖ → TRH
T_4, T_3 ⊖ → TRH

Steps in Synthesis of Thyroid hormone :- ① IODIDE TRAPPING :- In Thyroid cells

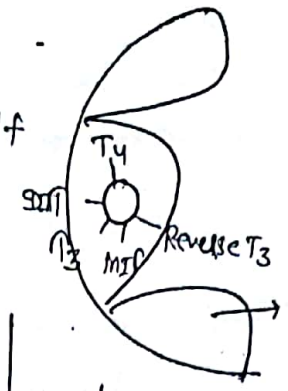
In Colloid :-

- oxidation of $I^- \xrightarrow{TPO} I_2$ — Enzyme: Thyroid Peroxidase (TPO)
- Iodination of Tyrosine
  - MIT — TPO
  - DIT — TPO
- Coupling RXn
  - DIT + DIT → T_4 — TPO
  - MIT + DIT → T_3 — TPO



- Storage :

When gland Stimulated
↳ Endocytosis of part of colloid



- Secretion of ⇒ T_4
T_3
← Reverse T_3

In traces Amount

In decreasing Concn.

Thyroid cells itself ⇓ have Microsomal deiodinase ⇓ Deiodinates the MIT, DIT ↳ Iodine is Recycled

* If Microsomal deiodinase deficiency
↳ Hypo-thyroidism symptom ⊕
↳ MIT, DIT ⊕ In Urine & plasma

T_4	T_3
Secretion by thyroid gland ⇒ ↑ (More than T_3)	
Binding ē ⇒ 99.98%	99.8%
Proteins: i) TBG, ii) Albumin, iii) Transthyretin — T_4 is Maximally bound ē TBG	T_3 is Maximally bound ē Albumin
Binding ē Receptors	↑ (binds More avidly ē Receptors)
Half-life: Longer than T_3 (6 days)	1 days

RT_3 ← 5-Deiodinase — T_4 — 5'-Deiodinase → T_3

RT_3	T_4	T_3
3, 3', 5'	3, 5, 3', 5'	3, 5, 3'
Tri Iodo thyronine	Tetra Iodo thyronine	Tri Iodo thyronine

Q. RT_3 (Reverse T_3) in circulation — Main Source

① Secretion

② ~~Peripheral~~ conversion of $T_4 \rightarrow RT_3$

Condⁿ in which $RT_3 > T_3$ (Advantage)
↳ Conserves calories

- Starvation
- Prolonged illness
- Chronic kidney disease
- Febrile Illness
- Burns
- "Se" deficiency
- Drugs which Inhibit Deiodinase

* Action of Thyroid hormone :⇒

① ↑ O_2 consumption { ↑es BMR, ↑es body temp. ; Loss of body weight }

Increase O2 consumption (Increase BMR, Increase Body Temp. ; Loss of body weight)

:⇒ except ⇒ Pituitary ;
Spleen ;
Lymph Node ;
Ovaries ;
Testis.

except

② Hypothyroid ⇒ Carotenemia ↑
Hypothytroid — Carotenemia +

b/c; Carotene → Thyroid → Vitamin A
Carotene — Thyroid — Vitamin A

③ Hypothyroid → ↑ Serum cholesterol
Hypothyroid — increase serum cholesterol

b/c; Thyroid → ↑ No. of LDL Receptor
Thyroid — Increase of LDL receptor

↳ So, ↓ Serum cholesterol
So, decrease serim cholesterol

④ Protein Metabolism → Protein Anabolic effect; but in Large dose Protein catabolic effect.

* TR_α; TR_{α_2}; TR_β; Receptors are widely distributed; TR_{β_2} is found only in the brain.

ADRENALS **

* Layers of Adrenal Cortex :⇒

		Hormone Secretion **
Zona glomerulosa	→	Aldosterone (Mineralocorticoids)
Zona Fasciculata	→	Glucocorticoids (cortisol; cortisosterone); & Some amounts of Androgen
Zona Reticularis	→	Sex steroids (Androgens); & Some amounts of Glucocorticoids

* Hormone Secreted by Adrenal Medulla :⇒ Epinephrine, Norepinephrine
(Epinephrine > Norepinephrine)
(90.1.)

* After Hypophysectomy
↳ Zona glomerulosa will be intact (RAAS); while Zona Fasciculata, Zona Reticularis → Atrophied.

* Comprises 285 A.A Residues & serve as precursor of many proteins.

← POMC (Pro-Opio Melano cortin) → Synthesize in Pituitary,

cleaved

↓ ACTH (Adrenocorticotropic Hormone)

↓ β-Lipotropin
- α-MSH
- β-MSH

↓ β-endorphin

- Cushings ⇒ Hyperpigmentation
  - ↳ ↑↑ ACTH (S. ACTH itself has Melanocyte Stimulating hormonal activity).

* Deficiency	Aldosterone	Glucocorticoids	Androgens
• 21 β hydroxylase (95% of CAH)	↓	↓	↑↑ (Virilizing symptoms)
No Mineralocorticoid Activity			
• 11 β hydroxylase (5% of CAH)	↓	↓	↑↑
• Mineralocorticoid Activity			

How to differentiate ⇒ ↑B.P. ↓K+] Seen in 11β hydroxylase deficiency } ⇒ HypoAldosteronic Hypertension

↓

* 11 Deoxy corticosterone ↑↑

↓ 11β hydroxylase (XX)

Corticosterone

↓

Aldosterone Synthase

↓

Aldosterone (X)

(Excess) 11-Deoxy corticosterone has Mineralocorticoids Activity

↓↓

↑ Na+
↑ B.P.
↓ K+

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Deficiency	Aldosterone	Glucocorticoids	Androgens
• 17,20 Lyase deficiency	↑	↓	↓
** 17,α hydroxylase deficiency	↑	↓	↓

* GLUCO-CORTICOIDS ACTION :⇒

Gluco-corticoids ↓es ⇒ B ⇒ Basophils
E ⇒ Eosinophils
L ⇒ Lymphocytes
→ By promoting their Migration from blood into tissues

Gluco-corticoids ↑es ⇒ Neutrophils
Monocyte
RBC
Platelets

Permissive Action ⇒ It enhances the action of other hormone.

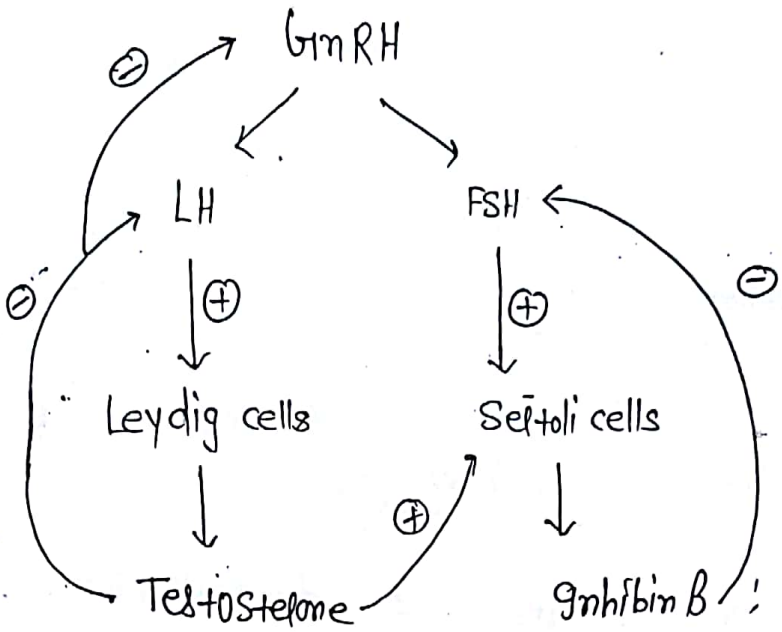
on Glucagon → • Glycogenolysis in Liver ; but Not in Muscle in general ; but when cortisol is ⊕ nt Glucagon, do glycogenolysis in Muscle too.
• Lipolysis

on catecholamine (Adrenal Medulla hormone) → Glycogenolysis;
Lipolysis;
Vasoconstriction;
Bronchodilation.

* Secretion of gluco corticoid is Regulated by ⇒ Anterior Pituitary gland through ACTH (corticotropin)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* MALE REPRODUCTIVE - HORMONE



- DHT
- DHEA (dehydro-epiandrosterone)
- Androstendione

Androgen binding Protein (ABP);
Mullerian Inhibiting Substance.

* Testosterone —5α-Reductase→ Dihydro-testosterone (DHT)

↓

Most Potent Androgen

5α-Reductase
- Type-1 → Scalp, Skin
- Type-2 → Genital skin, Prostate, other Genital tissue

* Action of different Androgens ⇒

	Testosterone	DHT
Fetal Life ⇒	Development of Male type of Internal Genitalia	• Male type of external Genitalia
	• Male type of Brain	

Testosterone

DHT

Post Puberty ⇒ Spermatogenesis;
Gonadotropin Regulation;
Tes Muscle Mass;
Development of sexual drive

2° sexual characters
Prostate growth

QQ. Before Puberty castration done ?:-
~~(a) Tall~~; (b) Dwarf; (c) Normal
↳ d/t Lack of Estrogen (No Physeal fusion).

* Function of Sertoli cells ⇒ Supportive cells;
↳ as blood testis barrier;
↳ secrete Androgen Binding Protein;
↳ also secrete Inhibin 'B'; MIS (Mullerian Inhibiting substance)
↳ contains Aromatase

Testosterone —AROMATASE→ Estrogen

* SPERMATOGENESIS ⇒

74 days

SPERMATOGONIA
↓
1° SPERMATOCYTE
↓
2° SPERMATOCYTE
↓
SPERMATIDS
↓ SPERMIOGENESIS
MATURE SPERMS (SPERMATOZOA)

Androgen Independent

? ⇒ FSH / Androgen-dependent
⇓
Testosterone Acting on sertoli cells

V.V.G. ✂

CLASSIFICATION OF HORMONE

GROUP I :- Hormones acting on Intracellular Receptor;

GROUP II :- Hormones acting on Membrane Receptor;

IIA :- Hormones acting through cAMP;

IIB :- Hormones acting through cGMP;

IIC :- " " " IP_3 - DAG Ca^{2+} system

IID :- " " " kinases (Tyrosine kinase ; JAK-STAT kinase)

* TYPE OF RECEPTORS

1) G-protein coupled Receptor (GPCR) :- Mech^m of Action :-

(a) Via Adenylyl cyclase (AC) :- Activation of Adenylyl cyclase Results in Tes synthesis & Intracellular accumulation of cAMP.

example ⇒ CRH :- Corticotropin Releasing Hormone

LH^{φ}, FSH^{φ};

TSH ;

ACTH ; (corticotropin$^{\varphi}$)

ADH ;

Vasopressin (V_2 Receptor)

Para-thormone ;

Catecholamines (β_2^{φ}, α_2) eg ⇒ Adrenaline ;

Glucagon$^{\varphi}$

hCG

calcitonin ;

Somatostatin ;

Ach (M_2) ;

Dopamine$^{\varphi\varphi}$ (D_1, D_2) ;

Angiotensin II (epithelial cells) ;

Gastrin : Histamine (H_2^{φ}).

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(b) Phospholipase IP_3 - DAG System :⇒

IP_3 → Mobilizes Ca^{2+} from Intracellular organelles → ↑ cytosolic Ca^{2+}

Ca^{2+} acts as "3rd Messanger" @ here ← "DAG" enhances protein kinase "C" activation by Ca^{+2}

* Protein kinase "C" = Phosphorylates various Intracellular proteins (Threonine, Serine or Tyrosine Residue).

Protein kinase "C" = phosphorylates various intracellular proteins

eg ⇒ GHRH (Growth hormone Releasing hormone); TRH; GnRH; ADH/ Vasopressin (V_1 Receptor); Oxytocin; Cholecystokinin; PDGF; Gastrin; Catecholamines; Angiotensin II (Vascular Smooth Muscle); Substance-P; Histamine (H_1); Muscarinic (M_1, M_3).

(c) Channel Regulation :⇒ eg ⇒ i) ↑ Ca^{+2} - β_1 - Adrenergic; ii) ↓ Ca^{+2} - Dopamine D_2; $GABA_B$; iii) ↑ K^+ - Adrenergic - α_2; Muscarinic M_2; Dopamine D_2; $GABA_B$.

2. Receptors ≡ Intrinsic Ion channels - Fastest acting Receptors; - Cell Surface Receptor/ Ligand gated Ion - channel (for Na^+; K^+; Ca^{2+}; Cl^-;

eg ⇒ Nicotinic cholinergic, $GABA_A$; $5HT_3$ (all other 5HT Receptor are GPCR).

3. Enzyme Linked Receptor - (a) Intrinsic enzyme (R) (Tyrosine kinase (R)

⇒ Insulin; Epidermal growth factor (EGF), PDGF; FGF.

(b) JAK- STAT KINASE BINDING (R) ⇒ eg ⇒ Growth hormone; Prolactin

(c) Guanylyl cyclase ⇒ Result in Intracellular accumulation of cGMP

eg ⇒ Atrial Natriuretic peptide & Nitric oxide

4. Receptors Regulating Gene expression (Transcription factors) :→
Slowest Acting.

a) Cytoplasmic Receptors → Glucocorticoids; Mineralocorticoids; Androgens; Progestins.

b) Nucleual Receptors → Estrogen, T_3, T_4, Retinoic acid; Vit D

SECOND MESSENGERS

- Molecules that Relay signals from the Membrane Receptors to Target Molecules inside the cells.

eg⇒ cAMP; cGMP; Phosphatidylinositol; Diacylglycerol (DAG); IP_3; Ca^{2+}; NO; CO; H_2S.

NEET PG ★ So, NO acts as both 1° Messenger, through cGMP; as well as secondary Messenger

So, No acts as both 1' messenger , through cGMP; as well as secondary messenger

CNS

* Receptor → Biological transducer

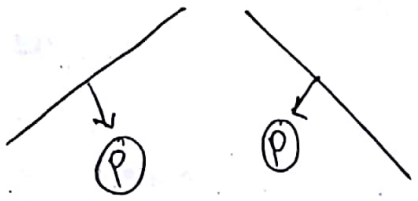
- Adequate stimulus ⇒ Stimulus to which a Receptor is Most Sensitive or to which a Receptor Respond @ Low energy Level

* Sensory coding → Receptor codes for 4 attribute of stimulus →
  i) Site / Location of stimulus ;
  ii) Modality (fine | crude) ;
  iii) Intensity ;
  iv) Duration .

* ADAPTATION → Stimulus ⊕ ; but Response ↓es over a Period of time

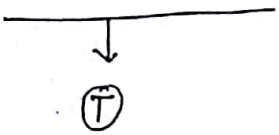
PHASIC Ⓡ
aka → "Rapidly Adapting Ⓡ"
- usually encapsulated Nerve endings
- Can detect Rate of change of Stimulus

TONIC Ⓡ
aka → "Slowly Adapting Ⓡ"
- Expanded or free Ⓝ Nerve Ending
- Can detect steady stimulus



Steady stimulus

Phasic stimulus



Tonic stimulus

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

PHASIC ®

"Aβ"

eg :→ PACINIAN CORPUSCLES :→

- Fnt in Joint capsules (128 Hz) & Deep in Muscle
  Fnt in Joint capsules (128 Hz) & Deep in muscles
- Very Rapidly Adapting Touch Reception.
  Very rapidly adapting touch receptor
- Specific to Fast Vibration (upto 800 cycles/sec)
  Specific to fast vibration
  upto 800 cycles / sec
- Deep Pressure (POKING)
  Deep pressure (Poking

"Aβ"

MEISSNER'S CORPUSCLES :→
Meissner's corpiscles

- Located at No hairy parts of skin
  Located at No hairy parts of skin
- Finger tips (++)
  Fingers tips ++
- Slow vibration upto 80 cycle/sec
  Slow vibration upto 80 cycle/sec
- Texture (Rough/Smooth)
  Texture (Rough/ smooth
- Topognosis (Topography of any Area; Localize by fingers)
  Topognosis
  topography of any area: localize by fingers
- BRAILLE (Writing System used by People, who are blind or have Low vision)
  BRAILLE (writing system used by people who all blind or have low vision

HAIR END's ORGAN :→

- Detect light Movement on the skin
  Detect light movement on the skin

TONIC ®

"Aβ"

eg :→ MERKEL's DISC :→

- Fine well Localized touch
- Location ⇒ At Finger tips.
- Texture.

RUFFINI's ENDING :→

- Fine & well Localized touch
- Prolonged Pressure
- Receptors for Sense of Position

C – MECHANO RECEPTORS :→

- Crude touch (Diffuse)
- Pressure.

JOINT CAPSULE RECEPTORS :→

- Muscle spindles
- Golgi tendon organs

} JOINT's POSITION SENSE (PROPRIOCEPTION).

BARORECEPTORS :→

- Adaptation time ⇒ 2 days

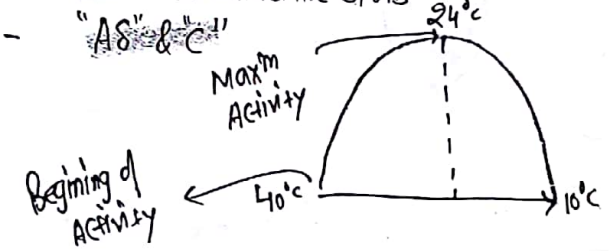
THERMORECEPTORS :→

Detection of skin temperature

S

COLD

- More Numerous
  More numerous
- More cold-sensitive spots
  More cold-sensitive spot
- "Aδ" & "C"



WARMTH
warmth

- Less in No.
  less is no.
- "C"
- Can detect temp. upto 30-46°c (>46°c ⇒ Tissue damage, Pain ® will stimulate)
  can detect temp. upto 30-46 'c (>46'c => Tissue damage pain R will stimulate

30- 40 'C

30 - 40°C → Warm Receptor Activity is More

Warm - receptor activity is more

Cold receptor activity is more

Cold Receptor Activity is More

Overlap b/w Cold & Warmth Receptors

overlap b/w cold & warmth receptors

Other eg of Tonic ® ⇒ - NOCICEPTORS

- Free Nerve endings for Pain → Mechanical, Thermal, Chemical, Polymodal
- very Poorly Adapting OR Not at all.

- CHEMO RECEPTORS

Never Adapt (b/c they give information about potentially life threatening situation)

eg ⇒ Taste buds; OSmo Receptors ; Olfactory ®: glucoReceptors.

QQ Don't Adapt at all

i) Chemo ®; ii) Noci ®

qmp

TRANSIENT RECEPTOR POTENTIAL (TRP) CHANNELS

→ These all a family of excitatory channels.

Family of excitatory channels

→ Sub family

↳ ① VANILLOID ® → Noxious Heat (Painful heat)

H+

capsaicin (Vanillin group of compounds)

Capsicin (Vanillin group of compounds

TRPV1 ⇒ H+, capsaicin

H+ capsaicin

TRPV3 ⇒ detect temp b/w 35-39°C

Detect temp b/w - 35-39'c

TRPV4 ⇒ detect temp upto 34°C

Detect temp upto 34'C

WhatsApp: +1 (402) 235-1697

② Acid sensing ion channels → detection of H^+

H^+ → TRPV1, ASIC (Acid sensing ion channels)

③ ANKYRIN ® → Also "TRPA1"
- Pain

④ PURINERGIC ® → Also "P_{2X}, P_{2Y}"
- for Pain

Pain → (ATP) → TRPA1, P_{2X}, P_{2Y}

⑤ MENTHOL ® → Also "$TRPN_3$"
- for Moderate cold
- also Also "CMR-I" Receptors
  - cold & Menthol Sensitive Receptor-1

* TRP channels →
- Temperature → Noxious heat, Moderate cold
- H^+
- Capsaicin
- Pain
- Taste

* Mechano-tropic ®

GPCR (G-Protein coupled Receptor) →
- Sweet
- Bitter
- Umami (eg ⇒ Fish; Meat; Mushroom)

* Taste Receptors
  - IONOTROPIC
    - Salt
    - Sour
  - MECHANO TROPIC GPCR
    - Sweet
    - Bitter
    - Umami → Glutamate Receptor
    - TRP Channel

NEUROTRANSMITTER

SMALL MOLECULE RAPIDLY ACTING NEUROTRANSMITTER

I → Ach

II → Amines
- Norepinephrine
- epinephrine
- Dopamine
- Serotonin
- Histamine

III → Amino Acids
- Glutamate ; Aspartate
- Glycine ; GABA

IV → Gas
- Nitric oxide (NO)

LARGE MOLECULE SLOWLY ACTING NEUROTRANSMITTER

- Pituitary Peptides
  - ADH
  - ACTH
- Hypothalamic Peptides
  - GnRH
  - CRH
- Gut Peptides
  - cholecystokinin (CCK)

* LAW OF SENSORY PHYSIOLOGY :⇒

I. Bell - Magendie Law :⇒

(Posterior) Dorsal Horn ⟶ Sensory

(Anterior) Ventral Horn ⟶ Motor

* DRG (Dorsal Root Ganglion) :⇒ Contains the cell body (Soma) of Sensory Neuron coming from Receptors.

II. Muller's Doctrine of Specific Nerve Energy :⇒

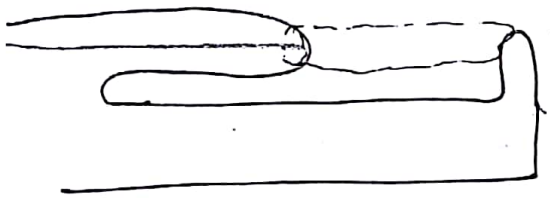
Muller's Doctrine of specific nerve energy

- Receptor
- Pathway
- Area of Brain Stimulated

} ⇒ Specific for Each Sensation.

III. Law of Projection :⇒ "PHANTOM LIMB"

- if a Nerve Pathway is stimulated Anywhere in its course; the Sensation appear arising from site of Receptor.



⇒ d/t Cortical Plasticity

Thalamus & cortex → Have ability to form New Synapses.

IV. Law for Intensity Discrimination of a Stimulus ⇒

Ⓐ WEBER FECHNER LAW ⇒ Sensation felt α Log (Intensity of Stimulus)

Sensation felt 2 log (Intensity of stimulus)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

$\Rightarrow$ $S = K \log I$

(B) STEVEN'S POWER LAW :$\Rightarrow$ Sensation felt $\propto I^a$

$S = KI^a$ (K, a $\Rightarrow$ constant).

S = KI a

TYPES OF INHIBITION

I. Direct / Post-synaptic Inhibition :$\Rightarrow$

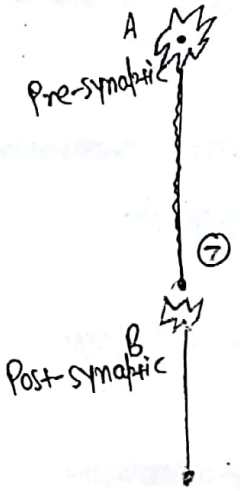
Neuron (A) $\longrightarrow$ Releases Inhibitory Neurotransmitter (Glycine)

$\downarrow$

Produce IPSP (Inhibitory Post-synaptic potentials)

$\downarrow$

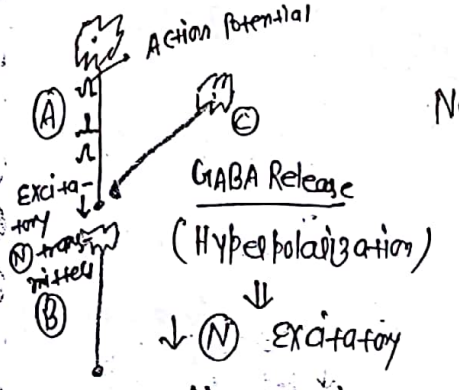
Inhibit Neuron (B)



* "Strychinine" can antagonize this type of Inhibition

II. Pre-synaptic / Indirect Inhibition :$\Rightarrow$

Neuron (A) $\longrightarrow$ (+) Neuron (B)



Neuron (C) $\rightarrow$ Inhibitory Neuron

↳ Forms Axo-Axonal Synapse c pre-synaptic Neuron (Neuron A)

GABA Release

(Hyperpolarization)

$\Downarrow$

$\downarrow$ (N) Excitatory Neurotransmitter

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* GABA Receptor on Pre-synaptic Membrane

- GONOTROPIC RECEPTOR
  - $GABA_A$
  - $GABA_C$
  - ↓ they ↑es Cl⁻ conduction
- METALLOTROPIC RECEPTOR
  - $GABA_B$
  - ↓ they ↑ K⁺ conductance

↓

Hyperpolarization of Pre-Synaptic Membrane (Neuron-A)

↓

↓es the Secretion of excitatory Neuro-transmitter

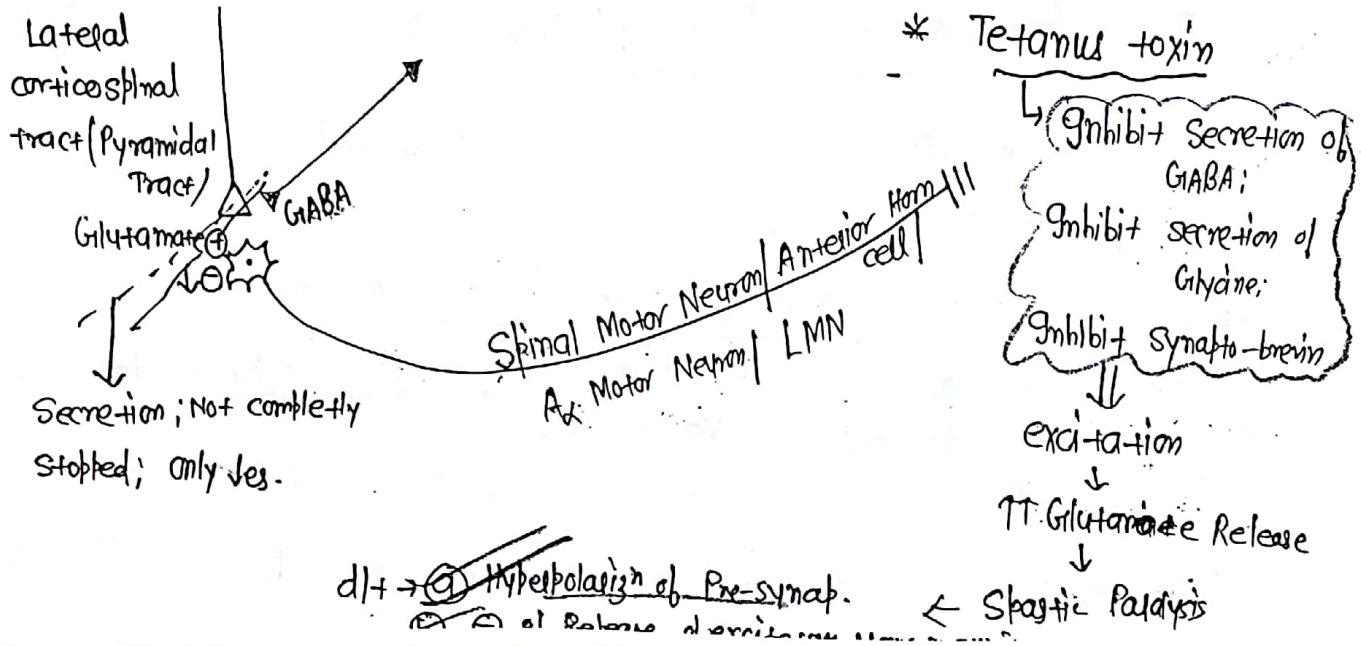
(So; Indirect Inhibition)

Advantage ⇒ Prevent Excessive Excitation of LMN

↓

Fine & Well controlled Movement

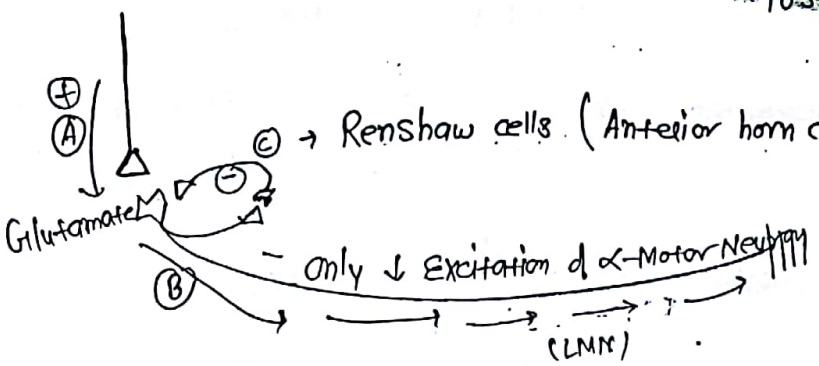
Fine and well controlled movement



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

III. FEEDBACK INHIBITION (RENSHAW CELL INHIBITION) ⇒

↳ Postsynaptic type of inhibition



UMN → ⊕ LMN → Stimulate Muscle cells; but some impulse goes to Renshaw cell; which will inhibit UMN

↳ "Feedback inhibition"

Advantage ⇒ Precise well control; Well Regulated Movement.
Prevent excessive excitement of LMN.

IV. FEED FORWARD INHIBITION ⇒

A neuron is connected through two pathway

A ~~Neuron is connected through~~ two pathways, one excitatory & one inhibitory

One: Excitatory and one Inhibitory

Neuron A ⊕→ Neuron B
↓⊖
Neuron C

• Typically seen in ~~cerebellum~~

Cerebellum

Cerebellum
↓
~~Granule cells~~
↓⊕
~~Basket cells~~
↓⊖
Purkinje cells

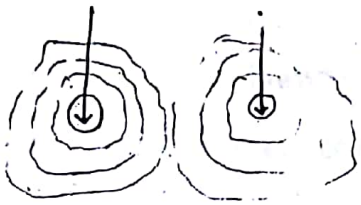
~~Granule cells~~
↓⊕
~~Stellate cell~~
↓⊖
Purkinje cells

V. LATERAL INHIBITION ⇒ 2 Point Discrimination,

* if 2 points Inhibit Simultaneously
↓
Inhibit Surrounding ®

* Min^m Separable → At finger tips (2mm)
So; Braille → 2-5mm

- Max^m Separable → At back (65mm)



ASCENDING TRACTS (Sensory System)

Posterior Column
- Fine Touch
- vibration
- consious Proprioception
- Localization
- 2 point discrimination
- Stereognosis
- Ability to judge different degree of Pressure

Spino-thalmic Tract
- Lateral Spino-thalmic Tract (STT)
  - Pain
  - Temperature
- Anterior Spino-thalamic Tract (STT)
  - Crude Touch
  - Itch
  - Tickle
  - Sexual Sensation
  - detection of Pressure (Barognosis)

Spino-cerebellar Tract
- Unconsious Proprioception
  - Dorsal → Uncrossed
  - ventral → Crossed

Q Posterior column lesion; What will happen to Barognosis ? (detection of "Pressure") [done by anterior STT]

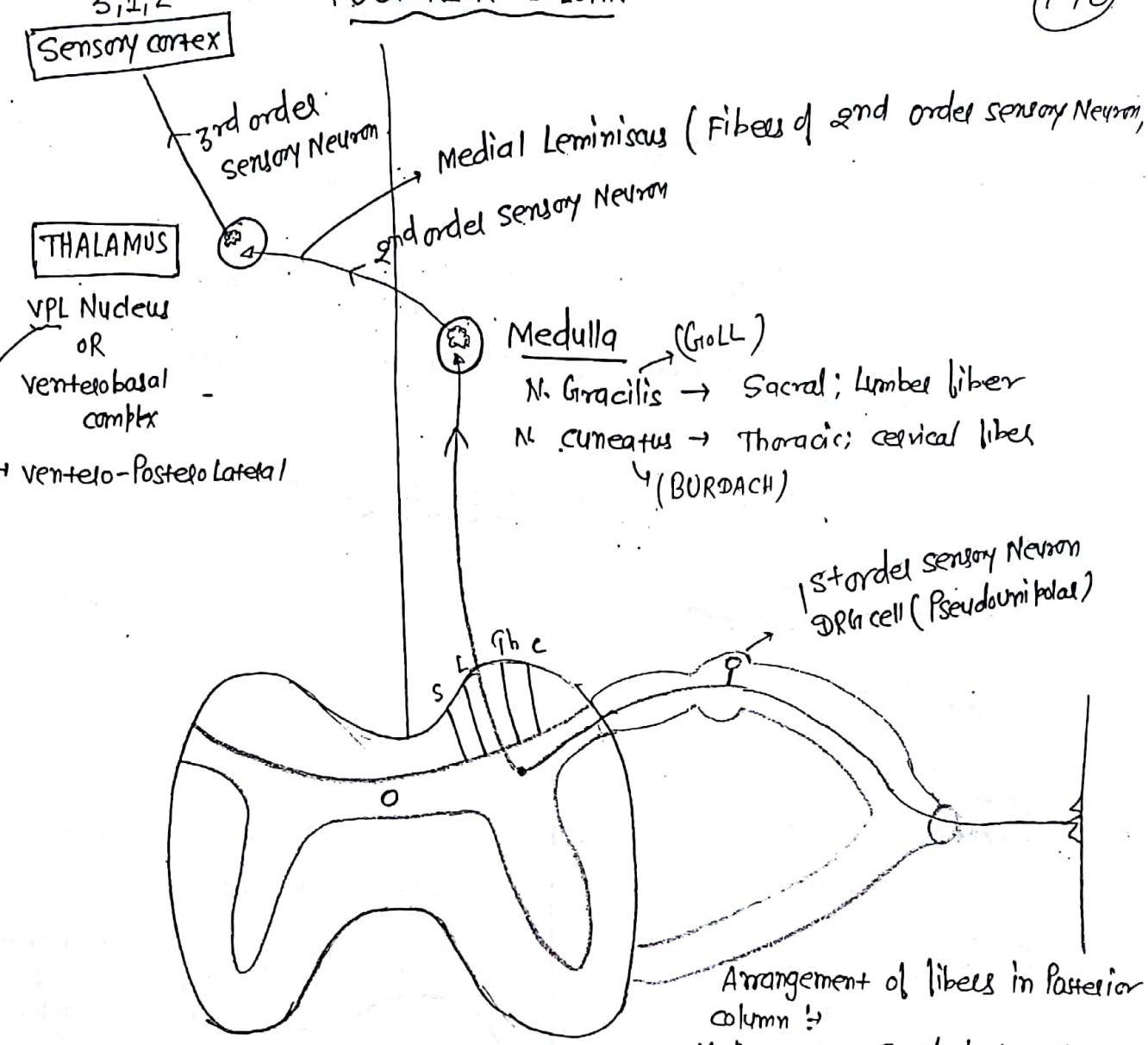
~~Int~~
~~nt~~

Graphesthesia (Localize the touch) is absent.

~~Proprioception is carried to Spinal cord by Aα Sensory Neuron, while other Sensation (Fine touch, Kinesthesia) all carried out by Aβ (type II) Sensory Neuron.~~

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

POSTERIOR COLUMN



Arrangement of fibers in Posterior column :-

Medial Most ⇒ Sacral > Lumbar > Thoracic > Ce Co

Fasciculus gracilis Tract of (GOLL) | Fasciculus cuneatus

Sensory cortex ⇒
- Posterior central Gyrus ;
- Area 3, 1, 2
- Sensory Homunculus (Physical Representation of Human body ; Located in Brain)

⇓

Grotesque Figure of Penfield & Rasmussen

Largest cortical Representation ⇒ Face Including Lips

Smallest cortical Representation ⇒ Trunk & Back

CEREBRUM ⇒ 6 Histological Layers ⇒ I, II, III, (IV), V, VI

(IV) ← Bulk of Sensory Information.

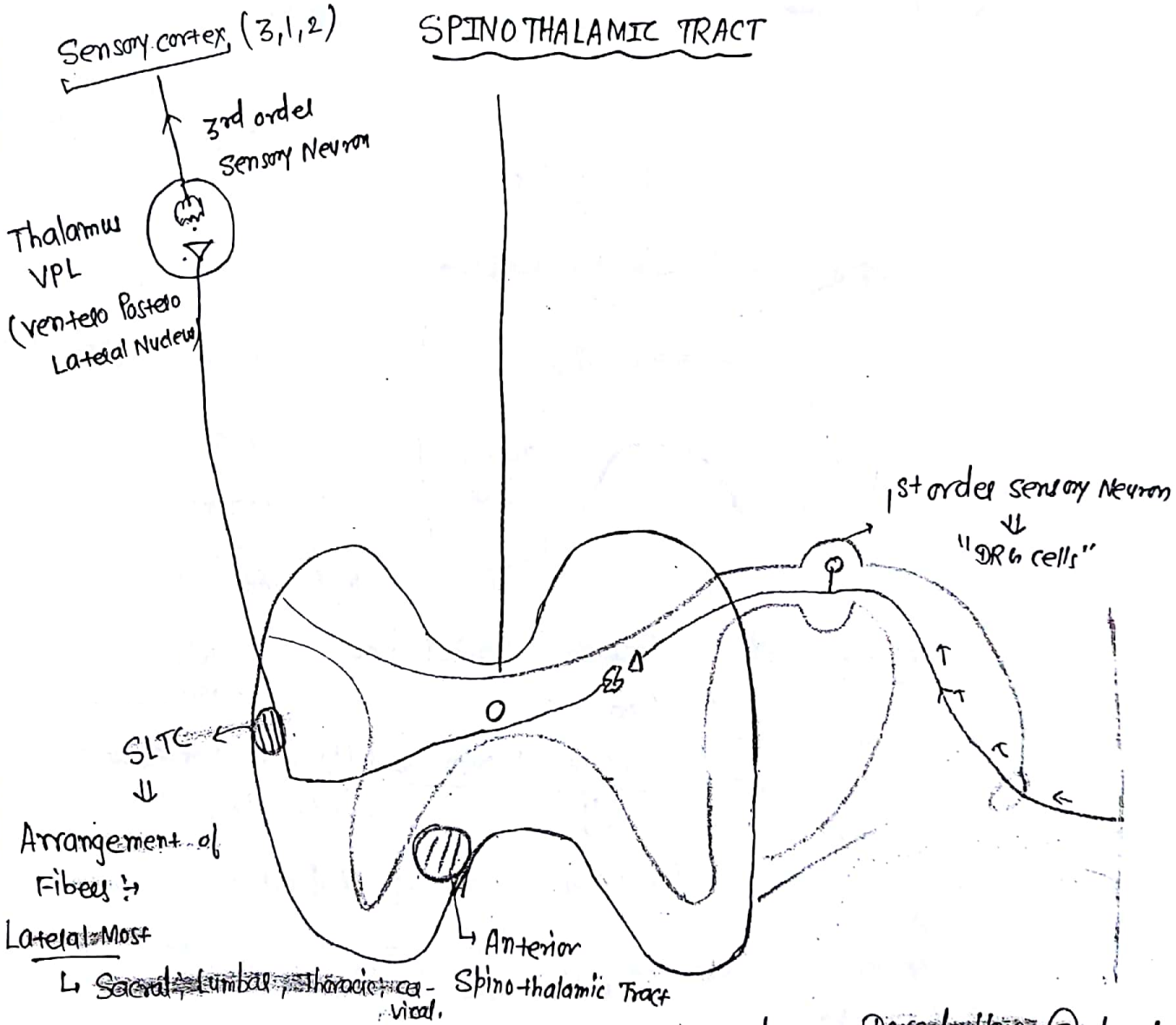
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Tract Specific for Stereognosis ⇒ Fasciculus cuneatus

QQ. Stereognosis Lost in lesion of → ⓐ Fasciculus gracilis
⇓ ⓑ Fasciculus cuneatus
Ability to identify an object ⓒ Cortex.
by feeling it.

* Fasciculus gracilis ⇒ Fibers from Lower part of body

Fasciculus cuneatus ⇒ Fibers from upper part of body



1st synapse → Dorsal Horn @ Level of Entry into Spinal cord or 1-2 Level above

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* FAST PAIN PATHWAY / EPICRITIC PAIN
↳ evolved Later

- Sharp pain; well localized
- Pricking Sensation
  Stabbing Sensation
-
- "Good Pain"
  ⇓
  (Responsible for Flexor withdrawl Reflex.)
- Carried by → "A_δ"
- Felt ∵ in 0.1 sec
- Velocity → 12-30 m/sec
- Stimulus → Mechanical / thermal
- Neurotransmitter → Glutamate
- Synapse - I / V (Lamina)

SLOW PAIN PATHWAY / PROTOPATHIC PAIN
↳ earlier evolved

Dull Pain; diffuse Pain

- Aching Pain
  Burning Pain
  Throbbing Pain
  Nauseous Pain
  "Bad Pain"
  ⇓
  (Autonomic symptom a/w Slow Pain Pathway)

"C"

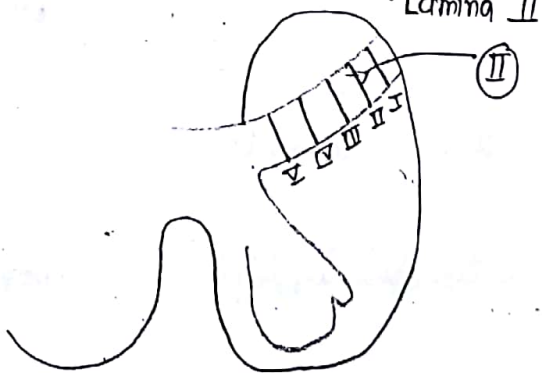
Felt after 1 sec

Velocity → 0-5 m/sec

Chemical

Substance-P

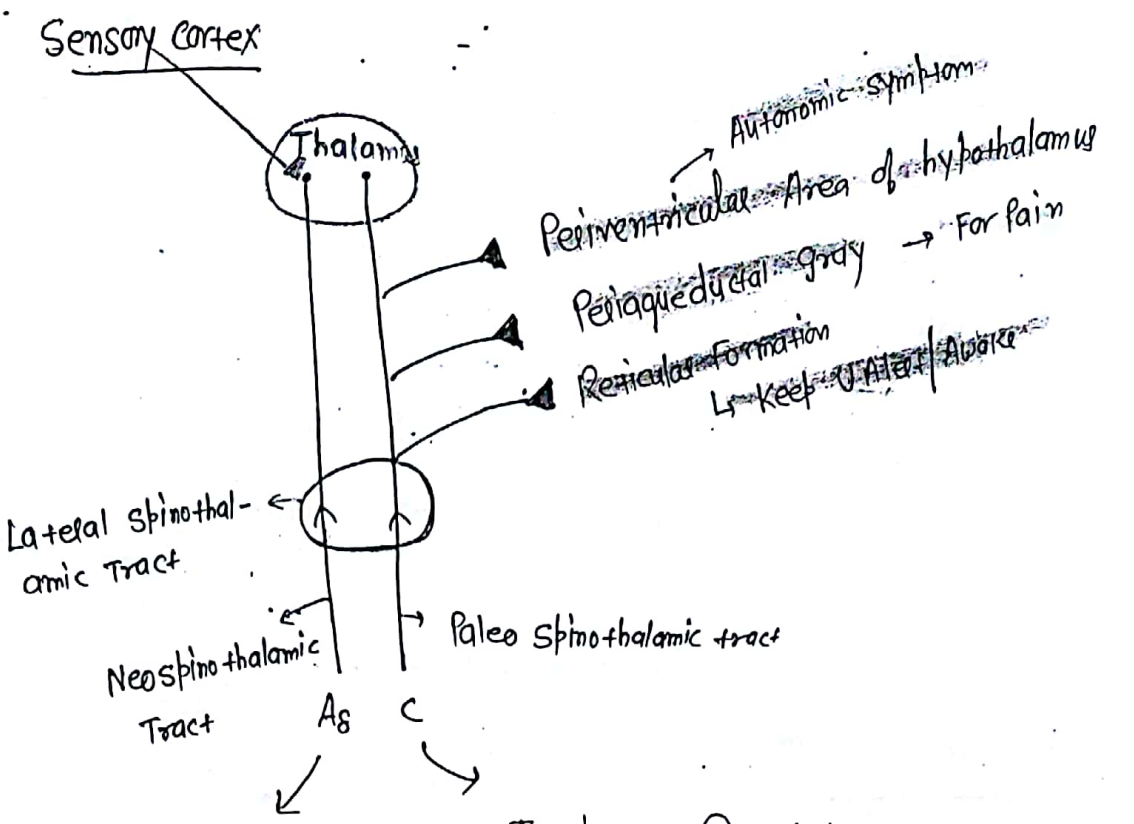
- Posterior Horn divided into 5 Laminae
  (Whole grey Matter → 9 Lamina)
- Lamina II → Substancia Gelatinosa of Rolando



A_δ Fibre → Klas "Neo-Spino-thalamic Tract".

C Fibre → Klas "Paleo-Spino-thalamic Tract" (Lateral Spino-thalamic Tract)

↳ Both go to the thalamus → IIIrd order sensory Neuron → S. Cortex.



- Terminates @ Sensory cortex
- No branching

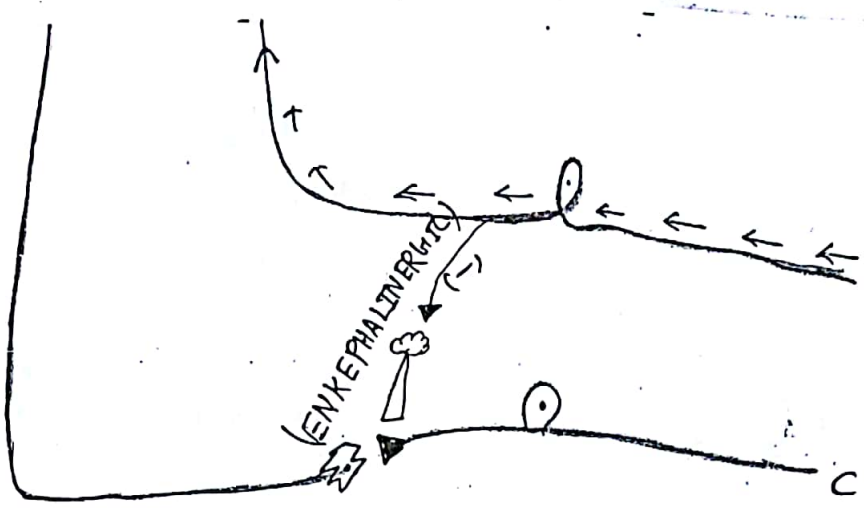
- Terminates @ Thalamus
- Gives branches (collaterals on the way)

• ENDOGENOUS ANALGESIA SYSTEM :⇒

1. Gate control theory of MELZAC & WALL :⇒

By Rubbing the Area → Large diameter Myelinated touch fibres excited

- Gives a Small collaterals → Synapse @ Inhibitory Neuron → Pre-Synaptic (-) of Pain Pathway.
- Aβ → they enter in Spinal cord & Ascends upward



(Aβ) on Rubbing ↓ Pain

C Pre-synaptic Inhibition of Pain pathway ⇓ ↓ Pain.

TENS → Trans-cutaneous Electrical Nerve Stimulation;

↳ based on Gate control theory of Melzac & wall;

↳ For Intractable Pain (cancer Pain) (Stimulate Aβ fiber) ⇓ By Transcutaneous Electro

2. DESCENDING PAIN INHIBITION PATHWAY ⇒

• It Starts from "Peri-aqueductal Gray (PAG)"

Slow Pain pathway ⊕→ PAG ⊕← cortex, ⊕← Hypothalamus, ⊕← Limbic system

they project to RAPHE MAGINUS NUCLEUS (In PONs)

↳ these are Serotonergic

↳ Means Serotonin Secreting Neurons.

Neurons descends down, Secret Serotonin

↓

Synapses ⊖ enkephalinergic Neurons in dorsal horn of Spinal cord

Causes (Inhibit transmission of pain) by Pre & Post synaptic Inhibition of Pain Pathway.

De-cerebrate Rigidity

→ Severe extensor Rigidity

Neck
Upper Limb ⇒ Extended
Lower Limb

* Lesion @ Upper border of Pons

De-corticate Rigidity

→ Moderate Rigidity
Upper Limb → Flexion
Lower Limb → extension

* Lesion above Mid brain

* In Decerebration → Lesion Above the Pons ; Both cortex & Midbrain Lost ;

↳ cortico-Reticular fibres are destroyed

So; Inhibitory fibre for Medullary R.F lost ; only excitatory fibre to Pontine R.F. from collaterals int.

Which develop ⟶ TT tone @ extension
Severe (extensor Rigidity)

* In Decortication → Lesion Above Midbrain ; Mid brain give Some excitation (only cortex is gone)

- Some amount of Inhibitory fibres to Medullary Reticular fibre will be Intact
- excitatory fibre will be More ; but these will Moderate Ter of tone (Moderate extensor Rigidity)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

THALAMUS

- It is a "Grand Sensory Relay Nuclei"

Sensory Relay Nuclei

Non-specific
- Midline
- Intra Laminar

Specific
- For Somatic Sensation
  - ↳ VentroPosterior Lateral
- For Visual Pathway
  - ↳ LGB
- For Auditory Pathway
  - ↳ MGB
- For Taste Pathway
  - ↳ VentroPosterior Medial
- For olfaction
  - ↳ Medio dorsal thalamic OR Dorso Medial

* Motor Nucleus of Thalamus — Ventro Anterior Nucleus
Ventro Lateral Nucleus

- PAPEZ CIRCUIT — Involved in
  - Memory
  - Learning
  - Emotion
  - ↳ Interconnected closed circuit forms by various Nuclei of Limbic system.
  - ↳ It starts from Hippocampus of Brain
    - ↳ It convert Short term Memory → Long term Memory.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

AIIB

Hippocampus → Mamillary body of Hypothalamus

Hippocampus

↓ Mamillo thalamic tract OR Tract of vicq d'Azyr.

Anterior Thalamic Nucleus

Anterior Thalamic Nucleus

↓

Pre-frontal cortex

↓

Basal Forebrain (Nucleus basalis of MEYNERT) ⇒ Destroy ↳ in Alzheimer disease

Nucleus basalis of Meynert

→ AMYGDALA (Window of the Limbic system) → high emotional content Memory.

Amygdala

→ NEO-CORTEX (For Storage)

Neo-cortex

AIIS ⇒ Every thalamic Nuclei except → Reticular Nuclei sends axon to different part of cortex.

REFLEXES

- Based on No. of synapses.

① Asynaptic Reflex ⇒ Axon Reflex

↳ It is a part of Triple Response (Blunt Injury) ⇒ b/c of histamine > Axon Reflex **

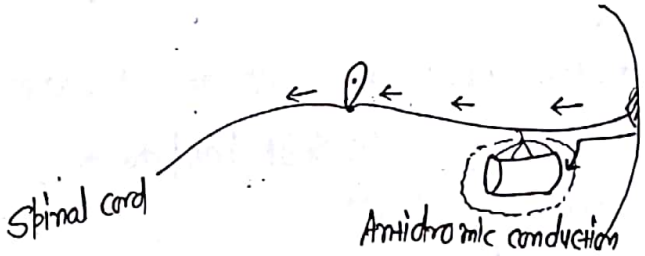
a) Red Reaction ⇒ b/c of Release of histamine

b) Flare Response ⇒ b/c of Axon Reflex

c) Wheal Response ⇒ d/t histamine & bradykinin

Axon Reflex ⇒ Blunt Injury over skin
↓
excite the Pain fibre
↓
Impulse goes to Spinal cord ; K/as "ORTHODROMIC CONDUCTION".

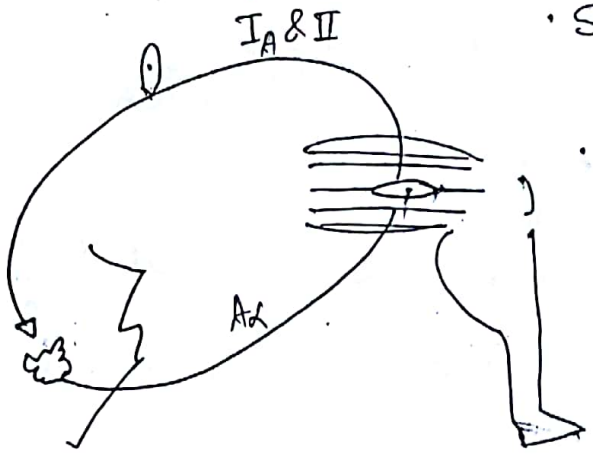
- These fibre also Receive branches from Blood vessels supplying these areas.
- Some fibres goes in "Antidromic conduction" of impulses to the blood vessels supplying the Area
↓
Arteriolar dilatation
↳ Spreading Redness
↳ K/as ⇒ "Flare Response" ***



② MONOSYNAPTIC REFLEX ⇒ Deep tendon Jerks ;
Stretch Reflex/ Myotactic Reflex.

Knee Jerk – Strike over Patella Tendon
↓
Tendon Indent
↓
Jerk in Muscle length
↓
Muscle Spindles get stretched
↓
Sensory fibres I_A & II enters into spinal cord
↓
In Spinal cord synapse ē Aα fibres

Increase in Muscle length



- Stimulus for stretch Reflex
  - ↑ in Muscle Length.
- Receptor for Reflex
  - Muscle spindle
- Afferent fibres
  - I_A & II
- Centre for stretch Reflex
  - Spinal cord
- efferent fibres for Reflex
  - A_α
- Response of Reflex
  - Muscle contraction
- No. of Synapses
  - 01 (one).

* During a stretch Reflex ⇒ Dynamic Response > Static

Nuclear bag (dynamic) >> Nuclear bag (static) & Nuclear chain fibre

* When a Muscle spindle is excited (↑ Muscle Length, ↑ Aγ discharge)

↓

Cause Muscle contraction

* Aγ Motor Neurons are Not powerful enough & Not strong enough to produce Muscle contraction

⇓

So; they ↓ Muscle tone

QQ. Which tract control Aγ Motor Neuron??

⇓

Reticulo-Spinal Tract

QQ Which tract control A_α Motor Neuron??

⇓

Cortico-Spinal Tract

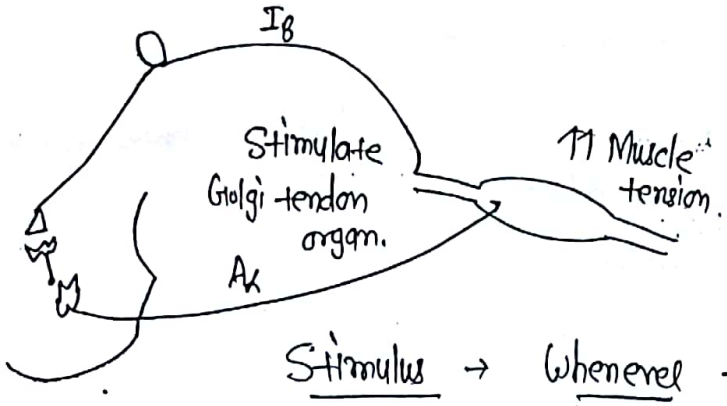
Aγ Motor Neuron discharge ← ⊖ Medulla / Inhibitory Reticulospinal tract

↑ ⊕

Pontine / Excitatory Reticulospinal Tract.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

③ BISYNAPTIC REFLEX ⇒ Inverse Stretch Reflex (Muscle Relaxation)



Stimulus → Whenever there is **↑es in Muscle** tension; it stimulates Golgi **tendon organs** (Receptors)

↓ Nerve fibres Ib

Synapse in **Inhibitory Neuron**

↓

Inhibits Aα Motor Neurons going to particular Muscle

* Stimulus ⇒ ↑↑ Muscle tension;
* Receptor ⇒ Golgi tendon organ (G.T.O.);
* Afferent Fibre ⇒ Ib ;
* Centre ⇒ Spinal cord;
* Efferent Fibre ⇒ Aα
* Response ⇒ Muscle Relaxation
* No. of Synapse ⇒ 02 (Two) NEET 16

* When Muscle spindle excites ⇒ Muscle Contraction (at Moderate stretch)
* When Golgi tendon organ excites ⇒ Muscle Relaxation (on excessive stretch OR ↑ Muscle tension) → It has high threshold for stretch.

* There are 3-25 Muscle fibres | Golgi tendon organ.
* Golgi tendon organs acts as "Muscle tension-detector".

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

④ Polysynaptic Reflex ⇒ Most Reflexes

- Flexor withdrawl Reflex
- Crossed Extensor Reflex
- Micturation Reflex
- Defecation Reflex
- Sexual Reflex

} Higher centre control

DESCENDING TRACTS (MOTOR PATHWAYS)

Medial

- Control Axial Muscles (Tone & Posture)

- Anterior corticospinal Tract
- Vestibulo spinal Tract
- Tecto-spinal Tract
- Reticulo-spinal Tract
  - Pontine Reticulo-spinal Tract
  - Medullary Reticulo-spinal Tract

} ↓ especially Lower Limb Extension

} ↓↓ especially Lower Limb Extension.

Lateral

- Control Distal Muscles (Fine; Skilled Movements).

- Lateral cortico-spinal Tract (Pyramidal Tract)
- Rubrospinal Tract (Alternate Pathway) → (Extrapyramidal Tract; Similar acting Pyramidal Tract)

⇒ ↓↓ especially in Upper Limb flexion.

* CORTICOSPINAL TRACT

Origin → ① Primary Motor cortex ⇒ Contributes 30% fibres of corticospinal Tract;
↳ Located in Pre-central Gyrus; Area 4*

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Motor Homanculas

↳ Largest cortical Representation *

↳ More complicated Movement.

Largest – Muscle of Vocalization; (Max^m)
Muscle of Mastication; (2nd Max^n)
Muscle of Thumb

Smallest cortical Representation – Muscle of Trunk/Back.

(2) Pre-Motor | Supplementary Motor Area :⇒ Area 6 ++

↳ Contributes 30% of the fibres.

(3) Sensory cortex ⇒ contributes 40% of the fibres (so; there are 40% sensory fibres in corticospinal tract).

↳ Area 3, 1, 2

Histological Layer of cerebrum.

I
II
III
IV → bulk of incoming sensory information (Layer IV)
V → Motor output (Majority of Motor fibre).
VI

Pyramidal cells of BETZ

Betz cells

↓

Large (16 µm) Myelinated fibre originated from "Giant Pyramidal cells".

– Found in Primary Motor cortex.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* CORTICO - SPINAL TRACT - COURSE

Fibres from different Areas of cortex

↓

Pass through Internal capsule

↓

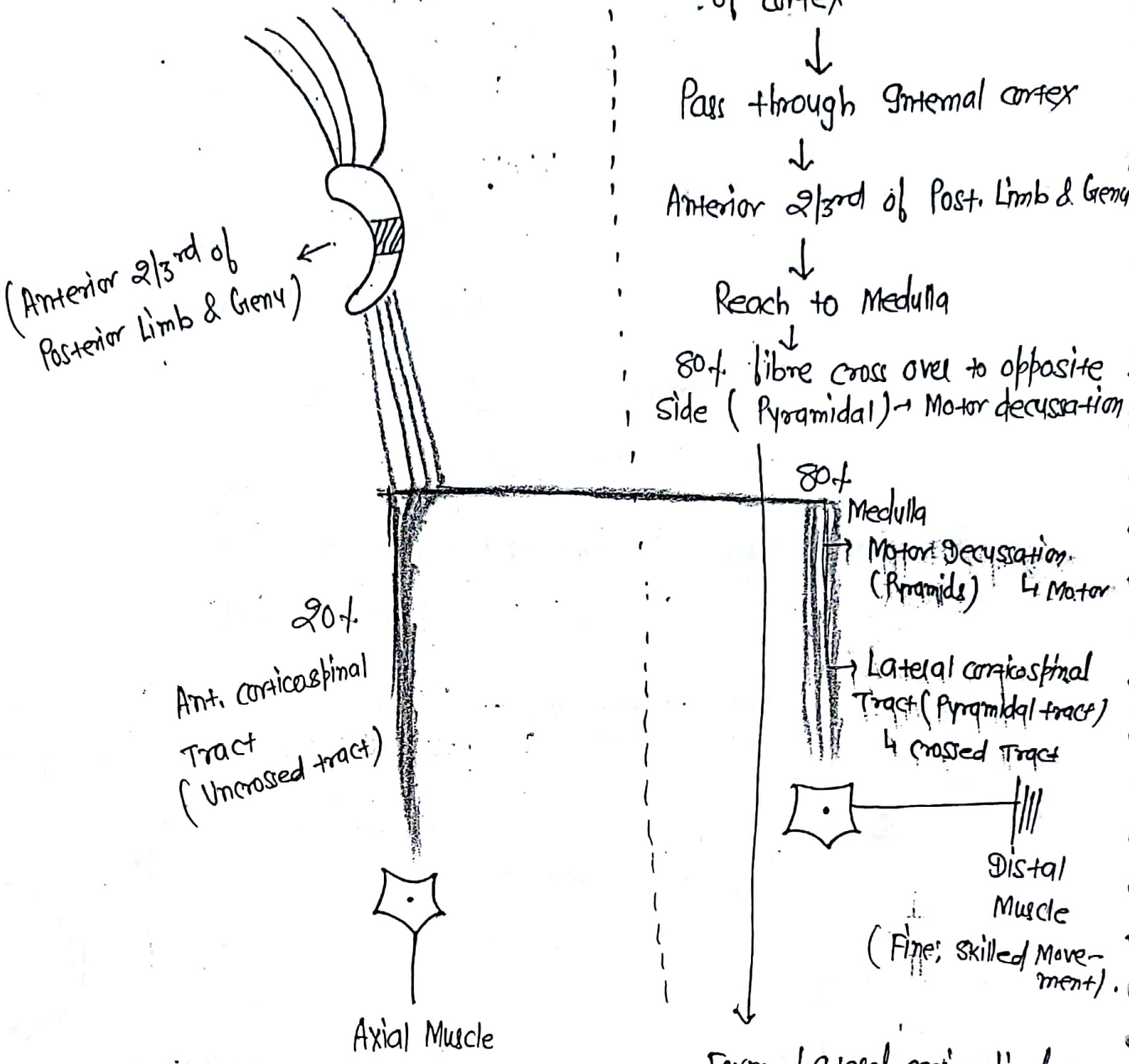
Anterior 2/3rd of Post. Limb & Genu

↓

Reach to Medulla

↓

80% fibre cross over to opposite side (Pyramidal) → Motor decussation



Form Lateral corticospinal tract (Pyramidal tract)

20% Fibre ; which Not cross

↓

Form Anterior corticospinal Tract (Uncrossed)

↓

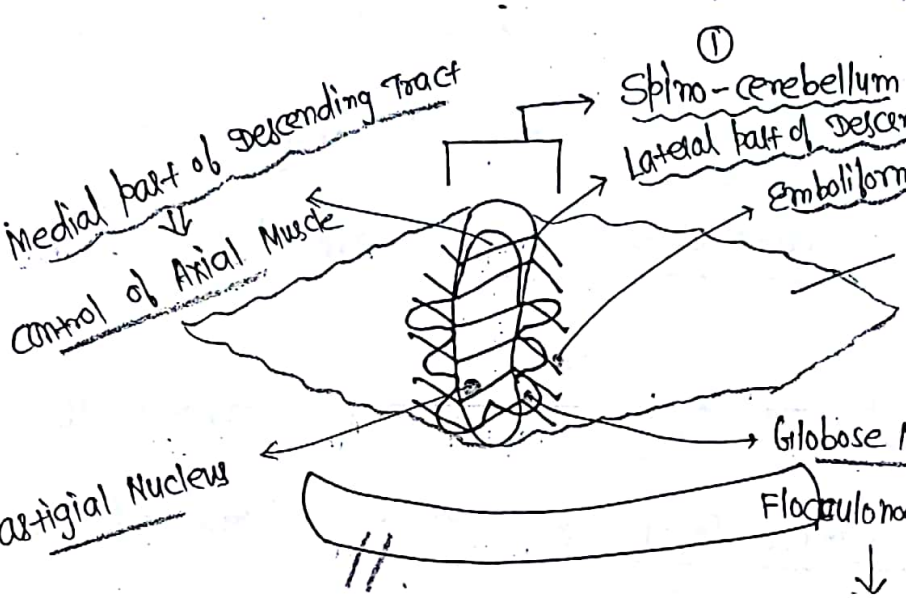
For Axial Muscles.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

CEREBELLUM

- 3 parts ;
- 4 Nucleus (4 pair) ⇒ Collection of Gray Matter.
- 5 cells ;

Collection of Gray Matters



① Spino-cerebellum → Motor co-ordination.
Lateral part of Descending Tract → Distal Muscle contro
Emboliformis Nucleus
dentate Nucleus (Largest Nucle
② cerebrocerebellar
(Neo-cerebellum)
↳ involved in Motor planning.
Globose Nucleus
Flocculonodular Lobe (oldest part)
↳ No Nucleus.
↓
aka " Vestibulo-cerebellum "
⇓
this part is Responsible for
- Balance
- eye Movements.

QQ Most imp. function of cerebellum :-
a) Motor co-ordination;
b) Motor planning.

* 4 Nucleus → Medial to Lateral
① Fastigial Nucleus → Medial part of Spinocerebellum
② Globose Nucleus
③ Emboliformis Nucleus → Lateral "
④ Dentate Nucleus → Neo-Cerebellum,
↳ Largest Nucleus.

* 5- cells →
  i) Granule cells → excitatory;
  ii) Basket cells
  iii) Stellate cells
  iv) Golgi cells
  v) Purkinje cells
  → Inhibitory;
  ↳ Largest cells.

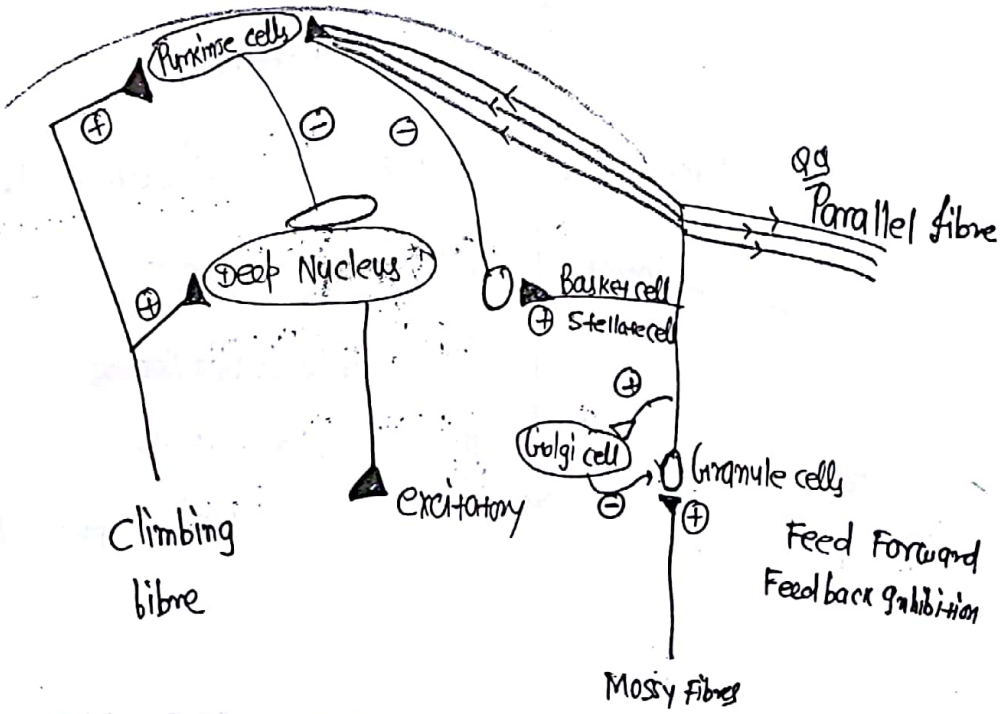
* Cerebellar cortex arranged in three Layer ⇒

① External Molecular Layer ⇒ Contains Basket cells & Stellate cells;

② Middle Purkinje cells ⇒ Contains Purkinje cells;

③ Inner Granular Layer ⇒ Contains Granule cells & Golgi cells

* OUTPUT OF CEREBELLUM ⇒ From deep Nucleus (excitatory output)
  ↳ Purkinje cells inhibit the output of deep Nuclei.
  * Output of cerebellar cortex → Purkinje cells.



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

INPUT INTO CEREBELLUM :- via 2 types of fibre

CLIMBING FIBRE

- Strong excitatory input ;
- Formed by fibres of the Olivo-cerebellar tract (it brings proprioceptive impulses from whole body)

* Climbing fibre → ⊕ Deep Nucleus
So; it is 1st excitatory then it is also give ⊕ stimulus to Purkinje cells; so; Later on it is inhibitory.

** "Climbing fibres" brings information only from "Inferior olivary Nuclei"

MOSSY FIBRES

- Weak excitatory input
- Rest all fibres.

Mossy FIBRES → They Synapse ⊂ Granule cells

Granule cells → excite Basket cells (or stellate cells) → ⊖ Purkinje cells

Parallel fibres travel into Cortex

Synapse ⊂ Multiple Purkinje cells

Inhibit deep Nucleus

* Granule cells excite a Golgi cells

Inhibits

* ROMBERG SIGN – ⊕ In Posterior column lesion
a/k/a ⇒ "Sensory Ataxia"
↳ When eye closes → Ataxia
open → Stable (good balance)

BASAL GANGLIA

- Involve In Motor Planning
- Co-ordination of Autonomic and Associat. Movement
  - ↳ Swinging of Arms while walking
  - Facial expression while talking
  - ↓ cycling.
- To kill a Fly (Insect)
  ↓ we Need
  Cerebellum control
  ⇓
  Rate, Range, Force, direction } of Voluntary Movement

caudate Nucleus
⇓
Major Role in cognitive control of Motor activity

- Components – 1. Caudate Nucleus
  2. Putamen
  } Striatum ↑ Receives Most of the afferent Input coming to the basal Ganglia.
  ⇓
  95% of Neuron Secrete ⇒ GABA
  5% of Neuron Secrete ⇒ Ach
  Somatostatin

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

3. Globus Pallidus → In Athetosis; Mainly affected part
   ↳ cond^n in which abnormal Muscle contraction causes Involuntary writhing Movements.
   - External segment ⇓ GABA Secrete
   - Internal segment ⇓ GABA Secrete

4. Substantia Nigra → Principal output Nuclei i.e the efferent arises from these
   - Substantia Nigra Pars Reticulasis ⇓ GABA Release
   - ~~Substantia Nigra~~ Pars ~~compacta~~ ⇓ Dopamine Release → destroy in Parkinsonism.

5. Subthalamic Nucleus of Lewis → if affected "BALLISM" may cause.
   ↳ Release Glutamate ⇒ Excitatory Neurotransmitter

PATHWAYS ⇒
① Striato Pallidal GABAergic Pathway;
② Striato Nigral GABAergic Pathway;
③ Intra-striatal Cholinergic Pathway;
④ Nigro-striatal Dopaminergic Pathway;
⑤ Subthalamic Nucleus of Lewis → Glutamate → Globus Pallidus External segment, Glutamate → Globus Pallidus Internal segment.

* In Huntington chorea ⇒ Mainly "striatum" part Involved (~~caudate~~ Nucleus; ~~Putamen~~)
   ↳ Loss of Intrastriatal GABAergic & cholinergic Neurons occurs.
   ↳ Both cholinergic & GABAergic Neuron Involved.

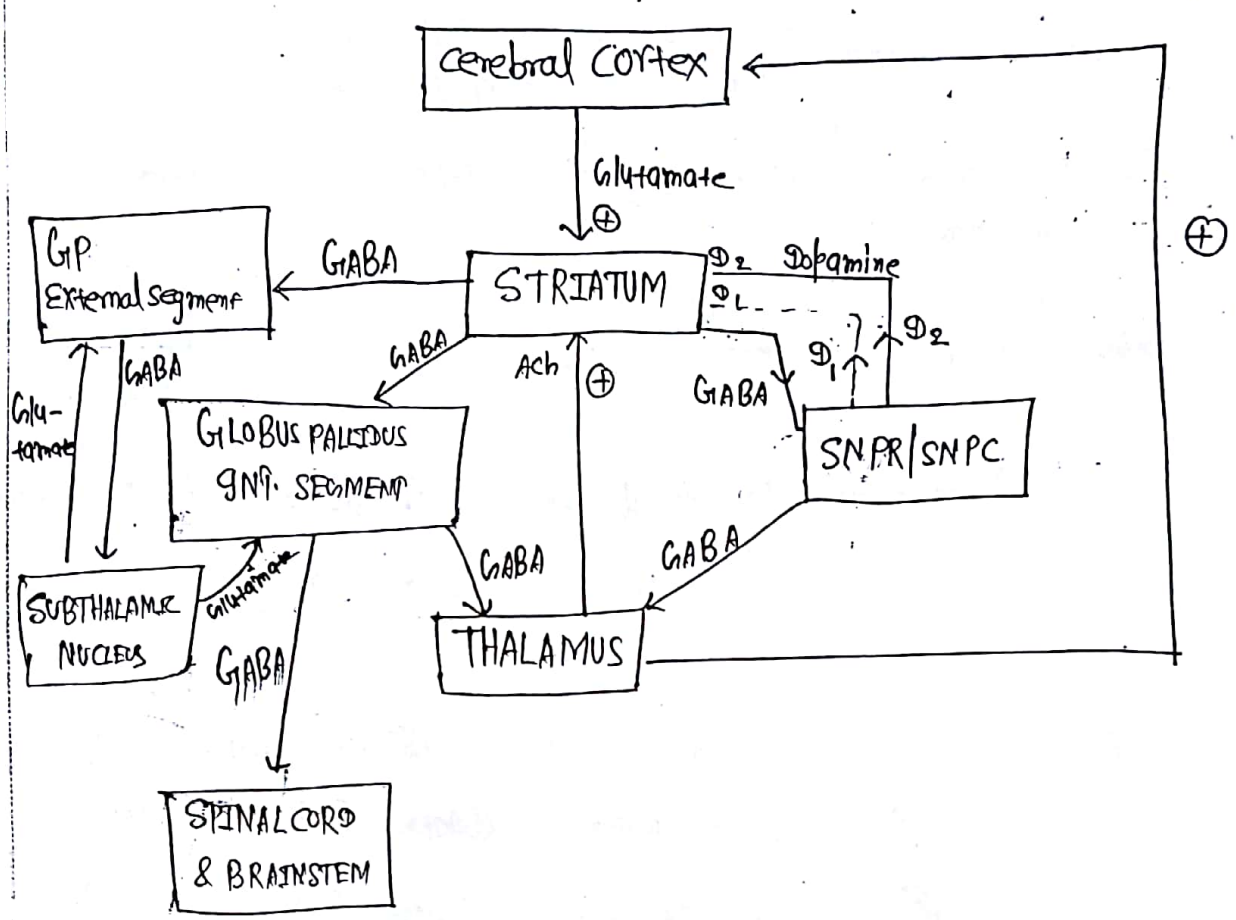
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Dopamine Receptor Ont in → Striatum

D_1 → Excitatory

D_2 → Inhibitory

* CONNECTIONS ⇒



POSTURAL REFLEX

POSTURE ⇒ Static position of Any part of the body.

• This Reflex helps to Maintain posture.

Mainly of Four types ⇒ i) Spinal; ii) Medullary; iii) Mid brain; iv) cortical.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

A. SPINAL POSTURAL REFLEX ⇒ 1. Stretch Reflex (Basic Postural Reflex) ;

→ Stimulus of Stretch Reflex is Passive stretch

2. Inverse spinal Reflex :

3. ⊕ve Supporting Reaction : Also "Magnet Reflex"

Receptor → Touch ® on foot Pad

↓

extension of Limb.

4. ⊖ve Supporting Reaction : if foot pad contact Move from ground ⟶ Flexion of Limb.

5. Standing :

6. Walking :

7. Galloping :

B. MEDULLARY POSTURAL REFLEX ⇒ 1. TONIC NECK REFLEXES → changes in posture ; d/t Movement of Neck ;

Receptor ⇒ Neck Proprioceptors.

* Neck flexion → Flexion of Forelimb
  → extension of Hindlimb.
* Neck extension → extension of Forelimb
  → Flexion of Hindlimb.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

2. Vestibular | Labyrinthine Reflex :→

Keeps the head horizontal w.r.t. ground

Receptors → Otoliths (in Semi-circular canal).

C. MID BRAIN REFLEXES :→

- All Righting Reflex — Except — Visual Righting Reflex
(correction of Body Posture) ↳ centre in cortex.

• Vestibular Righting Reflex
eg → Head on Body Righting Reflex ↳ centre in Medulla.
Body on Body Righting Reflex.

D. CORTICAL REFLEXES :→ Hopping Reflex
Placement Reflex.

* CSF

→ 150 mL

→ Daily Secretion ⟶ 550 ml/day | 0.38 ml/day

→ Secreted by "choroid plexus"

→ circulate by "Subarachnoid Space" & Absorb by "Arachnoid villi"

→ It is Secreted & Absorb ⟶ 3.7 times per day
(once every 6 hr)

→ (N) CSF pressure ⇒ 70-180 mm H_2O
8-12 mm of Hg

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Rate of CSF Secretion ⇒ Independent of CSF Pressure;
* Rate of CSF Absorption ⇒ Dependent on CSF Pressure.

* At CSF Pressure

112 mm H_2O ⟹ Secretion = Absorption

> 112 mm H_2O ⟹ Absorption ↑

< 112 mm H_2O ⟹ Absorption ↓

< 68 mm H_2O ⟹ No Absorption.

* TRANSMISSION ON AUTONOMIC GANGLION

FAST RESPONSE

↓

Fast EPSP

↓

d/t Ach acting on Nicotinic ®

· Response time ⇒ mSec

SLOW RESPONSE

Slow EPSP	Slow IPSP	Late slow EPSP
↓	↓	↓
Ach acting on M_1 Receptor	Ach acting on M_2 Receptor	GnRH Receptor
Response time = Sec	Sec	(Min.)

HYPOTHALAMUS

→ Vegetative Brain;

· Hunger Centre ⟶ Lateral Hypothalamus

Satiety Centre ⟶ Ventromedial Hypothalamus

Thirst Centre ⟶ Lateral Superior Hypothalamus

Circadian Rhythms ⟶ Suprachiasmatic Nucleus.

* Regulation of Thirst ⇒

① ↑ Plasma Osmolality ⟶ Stimulate osmo-Ⓡ (Anterior Hypothalamus)

* Ineffective osmoles (glucose & urea) don't induce osmoⓇ.

Thirst center (Lateral Hypothalamus) → ↓ Ters water intake → Osmolality Restored

Supraoptic Nucleus (ADH Release) → ↓ Vers Urine Volume → Blood volume Restored

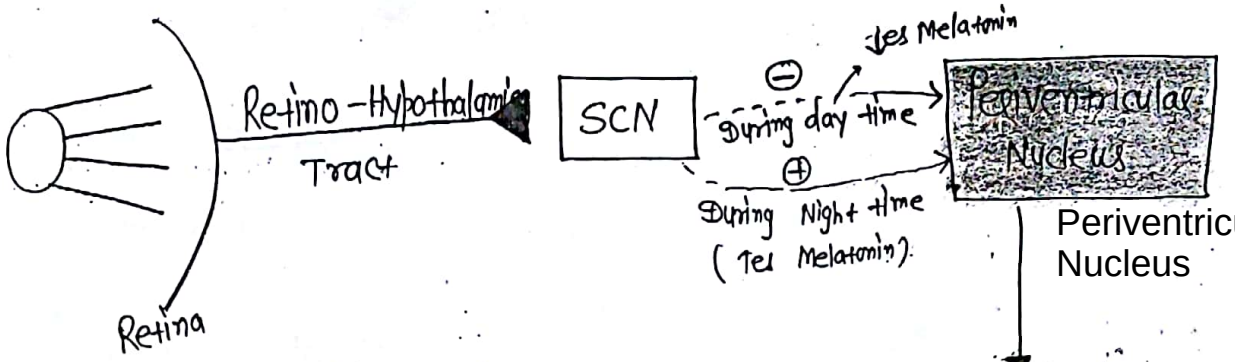
② Hemorrhage ⟶ Hypovolemia

Renin-Angiotensin System → ↓ Angiotensin II → ↓ Subfornical organ (OVLT) → ↓ Thirst center (Lateral Hypothalamus) → ↓ Ters water intake → ↓ Osmolality Restored

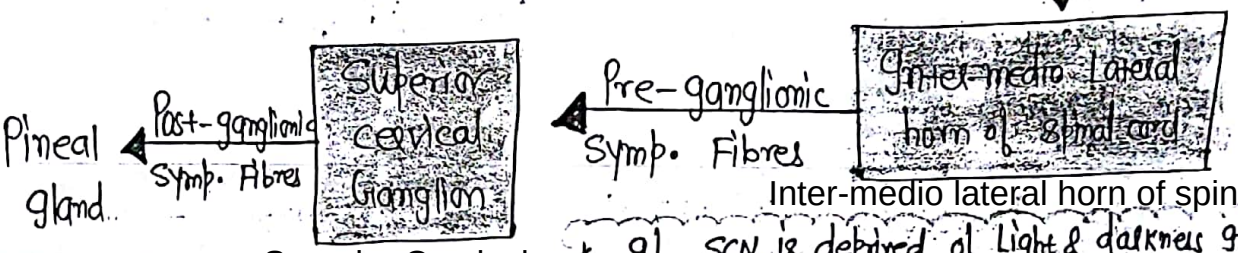
Baroreceptors in heart & blood vessels → ↓ SUPRAOPTIC NUCLEUS (ADH Release) → ↓ Vers Urine volume → ↓ Blood volume Restored

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Circadian Rhythm - Supra-chiasmatic Nucleus is involved.
  ↓
  believed to contain the "Biological clock"

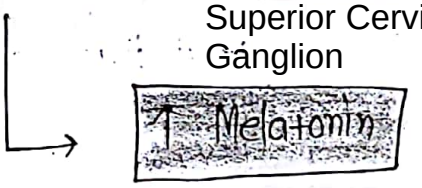


Periventricular Nucleus



Inter-medio lateral horn of spinal cord

Superior Cervical Ganglion



Increase Melatonin

* If SCN is deprived of Light & darkness Informa.
  ⇓
  Precision of circadian Rhythm is disturbed but an approximately 24 hours Rhythm is still Maintained.

* RAGE CENTRE → Lateral Hypothalamus (Aggressive)
* REWARD CENTRE (Flaccid) → Medial Forebrain bundle
  Nucleus Accumbens (Drug Addiction)
  Ventro-medial hypothalamus.
* PUNISHMENT CENTRE → Posterior Hypothalamus & Dorsal Mid-brain;
* AVERSIVE RESPONSE → Learned Negative/Undesired Reaction to an Unpleasant event.
  ↳ Peri-aqueductal-gray (PAG)
* SELF STIMULATION EXPERIMENT → Experiment Animal Kept in a cage.
  ↳ electrodes are placed in different Areas of brain & they are connected to a Lever; when he presses the Lever → Response:

* It is Most effective ; if electrode is placed at Medial Forebrain Bundle.

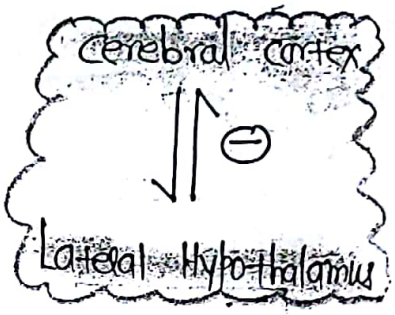
* SHAM RAGE ⇒ Sham Means False.

⇓

Seen in Decorticate Animals

⇓

Animals whose whole cerebral cortex has been Removed.



* Slight provocation to Animal ⟶ Goes into Rage (b/c No Inhibition to Lateral Hypothalamus).

* This Rage is Not ** Goal directed

* Sexual Responses ⇒ Anterior Most & Posterior Most portion of Hypothalamus
  - Anterior Hypothalamus (especially Medial Pre-optic Nucleus) is More Important.
  - In Males Additional Area ⇒ Piriform cortex.

*

TEMPERATURE REGULATION (PRE-OPTIC REGION)

Posterior Hypothalamus
(Heat gain centre)
↓
Response to cold (winter)
i) ↑ Sympathetic discharge
↳ Peripheral Vaso-constriction

Anterior Hypothalamus including pre-optic Nucleus
(Heat Loss centre)
↓
Response to warm (Summer)
i) Peripheral Vasodilation;
ii) Sweating
(Sympathetic cholinergic fibres)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Posterior Hypothalamus

ii) Non-Shivering thermogenesis

↑ Sympathetic discharge → Nor-epinephrine → β_3 ® (Brown fat)

↓

Uncoupling of oxidative Phosphorylation

(c the help of UCP-1)

⇓

Uncoupling protein-1

Heat produced ←

⇓

only 10-15% of total heat is produced by this Mechanism.

(+)nt in → Interscapular Region; Subscapular Region; Around the Neck; Axilla; b/w shoulder blades; kidney, Adrenal gland; Around Thoracic abdominal great vessels.

iii) Shivering

** Radiation is Major Mech^{n} for Heat gain & Heat loss.

dominant for Language in over 95% of Rt. handed & in over 60-70% of Left handed; so)

* Dominant / Categorical Hemisphere :⇒ Left hemisphere is klas "Dominant hemisphere"

In 95% Person → Left side

· B/c Wernicke's & Broca's Area is More developed in Left side → "Calculation"

So; if Left hemisphere damage ⇒ Acalculia.

* Non-Dominant / Visuo-Spatial Hemisphere :→ Rt. side

Involve in Fine Art; Creativity; Dance; Music

Rt. Inferior temporal Lobe ⇒ Recognition of Faces

Loss → PROSOPAGNOSIA / FACE BLINDNESS

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

QQ. Temporal Lobe functions are all except :⇒

a) Memory ;

b) Hearing ;

c) Behaviour → Ant. Most part of Frontal & temporal Lobe (Mainly Motivation)

d) ~~Spatial~~ orientation
↳ Completly Parietal Lobe function.
↳ GPS of Brain *

* CIRCUMVENTRICULAR ORGAN (OUTSIDE BBB) :⇒

Structure in the brain that are characterized by their extensive vasculature & Lack of Normal BBB.

① OVLT (organum vasculusum of Lamina terminalis) ;

② S.F.O. (Subfornical organ) ;

③ Median eminence ;

④ Area - Postrema → control → CTZ (chemoReceptor Trigger Zone)
→ CVS
→ Medullary Structures in the brain that controls vomiting.

⑤ Posterior Pituitary (Neurohypophysis)

EEG (ELECTROENCEPHALOGRAPHY)

Delta wave (S-wave) ⇒ Origin = Cortex ;
↳ Occur Independent of activity in Lower Areas.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

NREM

* Also "Synchronized sleep"
OR
"Quiet sleep"
OR
"orthodox sleep". QQ

- Events ⇒
  - SOMNAMBULISM (Night walking)
  - SOMNILOQUY (Sleep talking)
  - NOCTURNAL ENURESIS
  - BRUXISM (Teeth grinding)
  - NIGHT TERRORS (Pavor Nocturnus)

→ NREM (III & IV)

* Saw tooth waves (Low voltage fast activity);
Reappearance of α-wave

REM

- Spontaneous Awakening occurs in REM Sleep.
- This is period of Autonomic Instability
  - HR
  - BP
  - RR

  ] Irregular.

* PGO spikes are seen
(Ponto-geniculo-occipito)

PONS ⇒ PGO on cell
- Ach Release

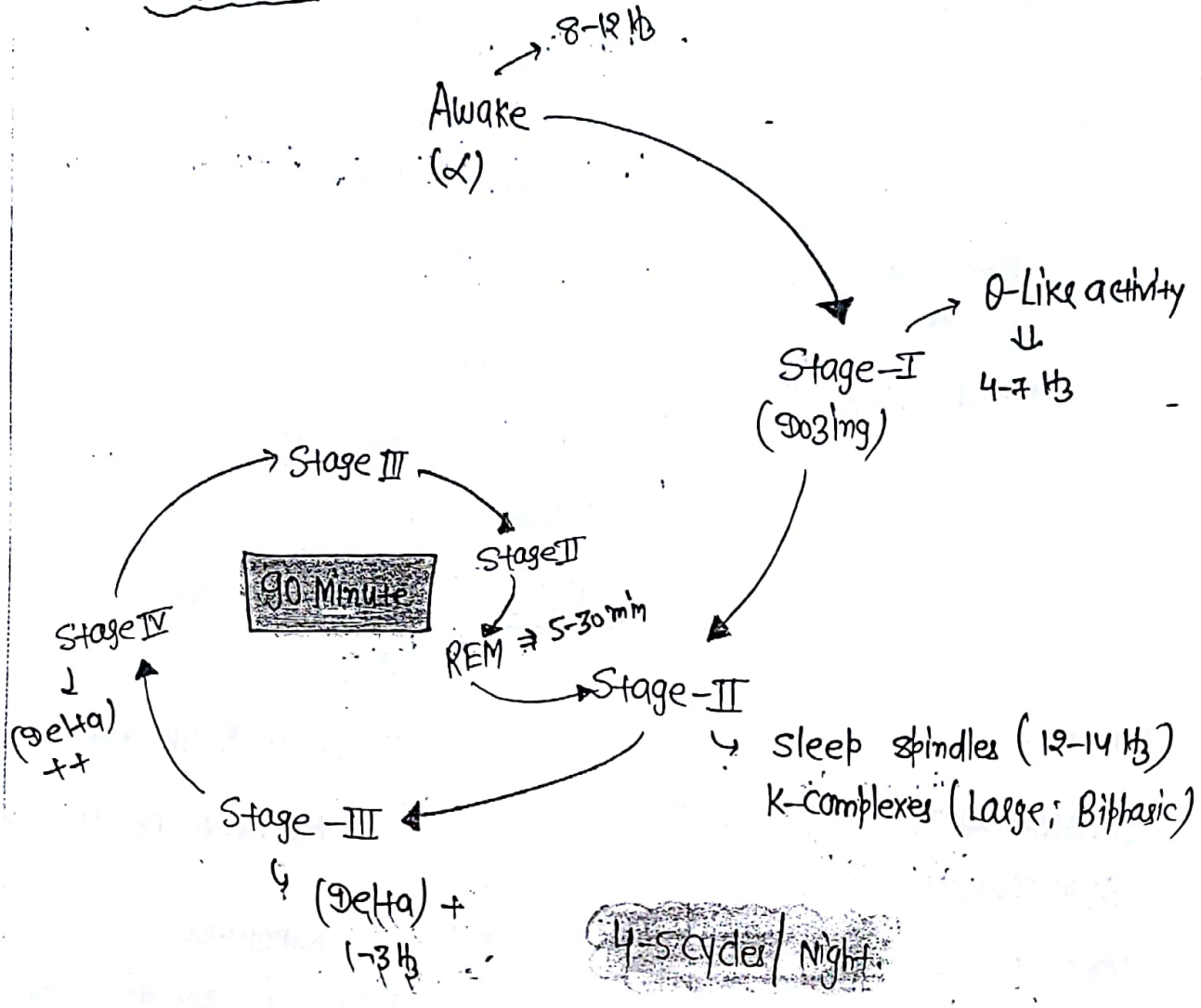
Events ⇒ NIGHT MARES ;
- NOCTURNAL PENILE TUMESCEN
- NARCOLEPSY (excessive day time sleep)
  - q/w Cataplexy (↓es in Muscle tone).
  - Hypnagogic hallucination
  - Sleep paralysis

* Tone of Neck Muscle is Markedly Reduced in REM sleep
(Other Muscles Retain their tone)

* Locus ceruleus Mediated Relative Paralysis ⇒ in REM Sleep.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Sleep cycle ⇒



Most difficult to Arouse ⇒ Stage III & IV

↳ Deep sleep or Slow wave Sleep; high Arousal threshold

* Total time spent in REM Sleep ⇒

Preterm	⟶	80% of Sleep time
Term	⟶	50% "
Adults	⟶	25% "
Elderly	⟶	15% "

* On an average; REM Sleep occupies 20-30% of Total Sleep.

NREM Sleep occupies 60-70% of Total Sleep.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Time spent by different stages of NREM sleep :-

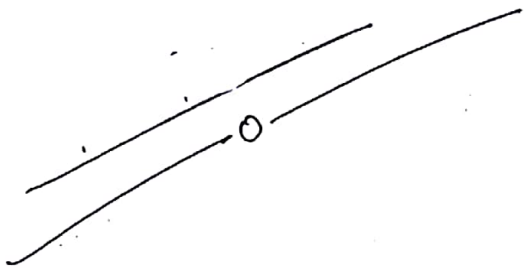
Stage I ⇒ 5-10%.
Stage II ⇒ 40-50%
Stage III & IV ⇒ 15-20%.

Total ⇒ 60-70% ↓ NREM sleep.

RAS (Reticular Activating System)

- ~~Ascending Polysynaptic Pathway~~
- ~~Non-specific system~~ ; which can be ~~excited by Any sensation~~
- on Arousal from sleep, the EEG pattern changes to high frequency low voltage activity (β-wave) from high voltage slow wave (δ-wave) of sleep ⇒ "δ-block"

→ ***Activation of RAS is Responsible for Arousal from sleep.**



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

FMT

Handwritten notes

MBBS Help

http://mbbshelp.com

http://www.youtube.com/mbbshelp

http://www.facebook.com/mbbshelp.com

Name: _____

Subject: FMT

MBBSHELP.COM

FMT

Dr. Mohit Sir
26/4/18 ①

Forensic Medicine :→ Application of Medicine in Law.

After P.M. ⇒ What is the Manner of death? → Police is Not Registering the case

↓

it means death is → Natural
→ Unnatural → Accident, Homicide, Suicide

Q. 33 yr old ♀; Healthy condⁿ; visited her friend in hosting; Returned home & had hemiplegia & contusion all over body? cause of death?

- H/o → How Many years (∵ Marriage)
  → How Many kids
- Any H/o Disease
- Any H/o Drug intake

⇒ OCP induced coagulopathy
↓
Natural cause of death

Medical Jurisprudence (followed by Anybody (doctors, government people))
- Law in Medicine
- How the Law affects all Profession

Medical etiquettes (followed only by doctors)
- → Conventional Law of Courtesy
- eg ⇒ Not charge for doctors colleque
- → A breech of etiquettes is Not punishable

Medical Ethics
- → Moral Principles
- → [Self imposed code of conduct.
  - MCI | SMC
    ↓
    Code of Medical ethics
    ↓
    WARNING NOTICES

6 A's ⇒
① ADULTERY (Cheating of Spouse)
② ASSOCIATION / COVERING ← c unqualified individuals Like compounder
③ ADVERTISEMENT
- Advertise on Small Board c Name, qualification
- can't display Fee other than chamber
- Not More than twice advertisement.

④ ALCOHOL (Not examine c drunk cond)
⑤ ADDICTION (Being drug addict)
⑥ ABORTION (UNLAWFUL) → violates the MTP

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

⑦ ISSUING FAKE CERTIFICATES : Any certificates — Death, Birth, Disability, MLC

⑧ DICHOTOMY (FEE SPLITTING)

⑨ PROFESSIONAL SECRECY

↳ exception ⇒ "PRIVILEGED COMMUNICATION"

↳ Concerned Authority ⇓ it Makes communication Privileged.

Concerned Authority ⇓

CIVIL SIN

C: Crime
I: Infectious D2
V: Veneral D2
I: In Patient's interest
C: Court of Law

S: Servent of Employers
I: Interest self
N: Notifiable D2 & Negligence Suit

Crime → Some one told that he act the crime → Tell the Police

- Some one has AIDS → Sexual Partner
- Court
- Patient Interest - eg. Colour blindness - Call taxes

If Violates the warning Notice ⇓ Serious Professional Misconduct / Infamous conduct / Ethical Negligence ⇓ Punishment

(A) WARNING Again ..... (B) Penal PENAL ERASURE OR PROFESSIONAL DEATH SENTENCE

PROFESSIONAL DEATH SENTENCE → Temporary / Permanent

Fine
Imprisonment } (X) → given by court only,

⇒ Punishment of Infamous conduct is given by firstly "State Medical council"

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

↓

Who decides in SMC? ⇒ Professional colleque in SMC

⇓

if Not happy ē the decision; Appeal

⇓

At Central Health Ministry

↓ Forward to

MCI ↳ Decide

Q. The Disciplinary control over Professional Misconduct is primarily Maintained in ⇒ "State Medical council (SMC)".

LEGAL PROCEDURE

INDIAN PENAL CODE (1860) ⇒ Definition & Punishment of crime
(I.P.C)

CRIMINAL PROCEDURE COURT (1973) ⇒ Procedure followed after crime

INDIAN EVIDENCE ACT (1872) ⇒

[RPC: only in J&K
CrPC: Not valid under section 370
↳ Ranbir Panel code]

↳ Definition | Relevancy | Recording | Weightage of evidence

⇓

Oral > written

↳ b/c of cross-examination

AMENDED/MODIFIED ⇒ CRIMINAL LAW (AMENDENT) ACT, 2013

INQUEST

↳ Enquiry into the cause of death

1. POLICE INQUEST;
2. MAGISTRATE INQUEST;
3. CORONER INQUEST; → started in 1872; Last done 1999 (Bombay)
   ↳ JURY Decide the guilty or N
   ↳ odd No. of Members (5, 7, 9, 11, 13)
4. MEDICAL EXAMINER INQUEST. → Best inquest
   ↳ Not done in India

POLICE INQUEST ⇒ 174 cr.P.C; M/c in India NEET'11

↳ Lowest Ranking who do the Police inquest ⇒ Head constable

MAGISTRATE INQUEST ⇒ 176 cr P.C

↳ done in → ① Death in custody; ② Death in Prison; ③ Death in Police firing; → Judicial Magistrate

eg ⇒ death in juvenile home, death in outside court

④ Exhumation

⑤ Dowry death → Executive Magistrate / Tahsildar / Sub-divisional Magistrate / District Magistrate / collector

constable → Head constable → Assistant Sub-Inspector → Sub-Inspector → Inspector → SHO (Station House officer)

Lowest Police to conduct inquest.

- DOWRY DEATH ⇒ 304 (B) I.P.C
  - Death within 7yr of Marriage
  - Punishment ⇒ 7 yr - L.I.**

- DEMANDING DOWRY ⇒ Dowry prohibition act; 1961
  - 5 yrs + 15000/- + Return the dowry = Punishment

- EXHUMATION ⇒
  - Digging out the dead body
  - Early Morning hours
  - No time Limit (can be done at any time after death)
  - Preserve about 500 gm of earth in contact with body from 6 different site

⇒ where the Poison diffuses the soil into the body

↓

P.M. IMBIBITION (M/c ⇒ As Poisoning)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

POWER OF COURT (Sec. 29 Cr.P.C)

	FINE	IMPERSONATION
(I) MAGISTRATE COURT		
1. 2nd CLASS JUDICIAL MAGISTRATE	5000/-	1 yr
2. 1st CLASS JUDICIAL MAGISTRATE	10,000/-	3 yr
3. CHIEF JUDICIAL MAGISTRATE	No Limit	7 yr
(II) SESSION COURT ⇒ Highest court of District		
1. ASSISTANT SESSION COURT	"	10 yr (a)
2. SESSION COURT	"	L.I. / Death sentence (a)

(III) HIGH COURT ⟵ Confirmed by ⟵ Highest court of State

(IV) SUPREME COURT ⇒ Highest court of Nation

Q. Lowest court who commute the decision? ⇒ High court.

Q. Who will grant the Amnesty? ⇒ President of India

Amnesty = Full Pardon (पूरा माफ)

High court ⇒ Law of State

Supreme court ⇒ Law of Nation

Q. Lowest court to imprison Max^m for 10 yr / ⇒ Assistant session court

A. " " " " for death ⇒ Session court

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

EUTHANSIA | MERCY KILLING

ACTIVE

⇒ M/c by "Drug Administration"
- M/c used drugs ⇓ "Phenobarbitol"

⇒ Not allowed in india till date

⇓

Article 21 ⇒ Right to Life

"Netherland" Legalise euthanisia firstly. (Both Active & Passive)

PASSIVE

⇒ Life support withdraw

⇒ Bombay high court legalise

⇓

Judgement by supreme court.

⇓

Allowed in whole Nation

→ Decision comes in "ARUNA SHAUBERG" Case 2011 (7th March)

Euthansia May be :-

⇒ All three are Not allowed in India

Voluntary
- Patient wishes

Non-voluntary
→ Patient in coma

Involuntary
→ No patient concern (Pt. don't wants to die; doctor say u r harmful to country, shall die)

- Why Euthansia is Not Allowed? CONSTITUTION
  - Article 21: Fundamental Right: "Right to Life"

COURT PROCEDURE

⇒ Victim

⇓

Complain the court

⇓

Klas" COMPLAINANT | PLAINTIFF"

⇓ Lawyer

PROSECUTOR

⇒ JUDGE

⇓

"SUMMON" to the person; who was @ the crime/scene

⇓

CUSTODY

⇒ Accused

⇓

Defend himself

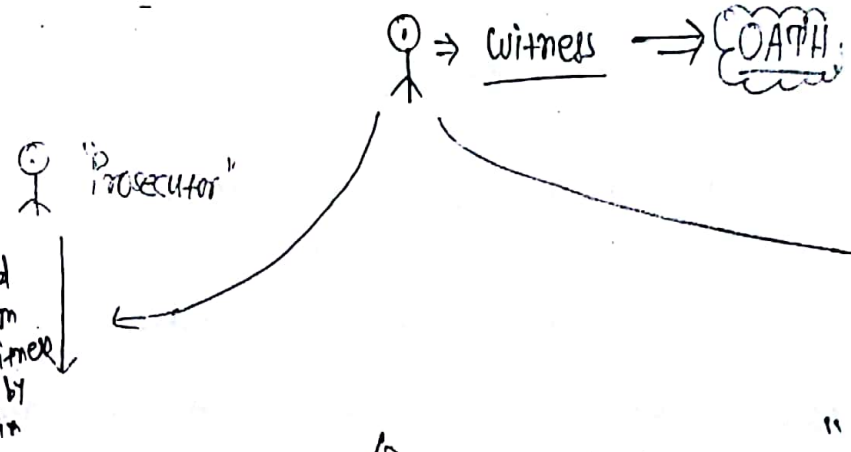
⇓

Klas" DEFENDENT"

⇓ Lawyer

DEFENCE LAWYER

http://mbbshelp.com WhatsApp: +1 (402) 235-1397



"EXAMINATION-IN-CHIEF" / "DIRECT EXAMINATION"

"CROSS-EXAMINATION" (No time limit)

Again question from Prosecutor

"RE-EXAMINATION"

↳ New facts can be add ↳ But "that New fact" also be "cross-examined"

Question by judge (Any time)

* When witness called by "Defense Lawyer" then cross-examinati done by Plantill; Re-examination | Examination-in chief by defence Lawyer

* LEADING QUESTIONS :- ┌ sec 141 On cross-examination
↳ Answer is in Yes/No.

* Regarding OATH :- ┌ Also Necessary In a wound certificate; A Medical certificate & a postMortem certificate (UP03).
c/out Oath evidence can't be Recorded.

≥ 12yr ⇒ take oath

* False evidence under oath ⇒ "PERJURY"
↳ sec. 191 I.P.C (definition)
↳ Punishment ⇒ 193 I.P.C (life imp.)

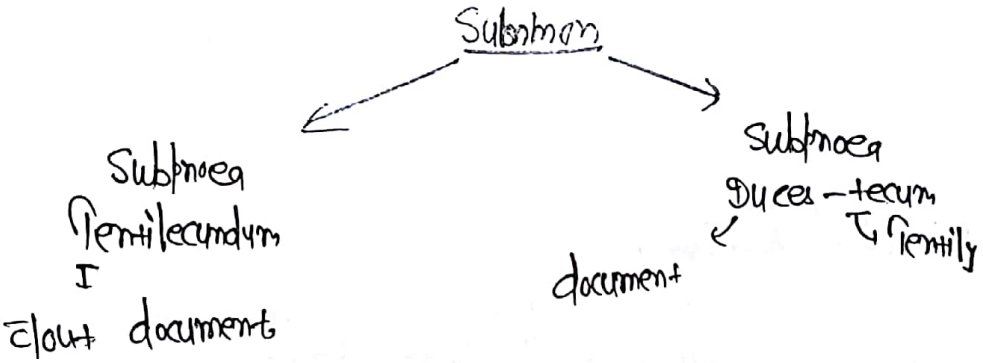
SUMMON (S.61-69 Cr.P.C)

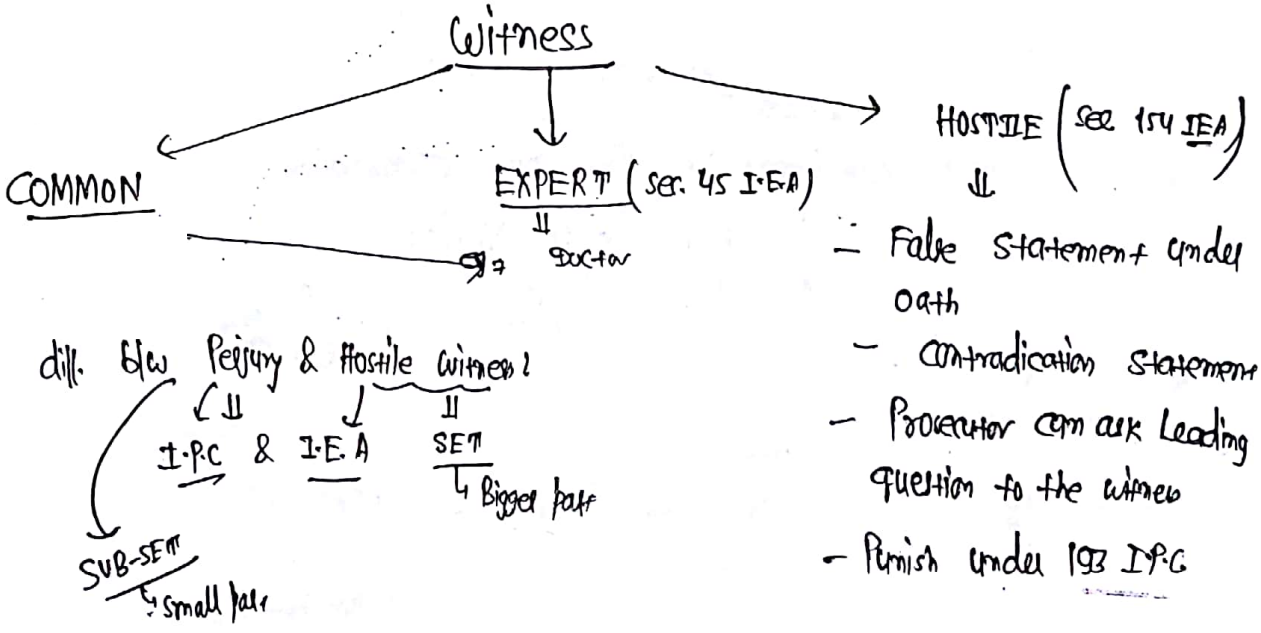
Klas " SUBPNOEA"
↳ Undee Penalty
⇓
Both civil & criminal can Punishment

Q. Higher court always have priorties than Lower court; No matter what is the case "civil | criminal".

CONDUCT MONEY ⇒ Money given to attained Summon in civil cases.

DIET MONEY ⇒ In criminal cases





Dying Declaration (Sec. 32 I.E.A)

- Circumstances leading to death (Statement talking about)
- No oath
- Anyone can Record; Best Recorded by

  ⇓

  Magistrate > Doctor > Police > civilian

  ⇓

  all should Read out @ court; if individual gave dying declaration in front of all.

- if the patient Survive; then it has "CORROBORATIVE VALUE"
- Role of Doctor :⇒ COMPOS MENTIS (Pt. is fit for statement)

Dying Deposition

- Witness gave Statement; whole court comes @ Hospital

  ⇓

  Oath
  Cross-examination
  Re-examination
  EIC

  ⇐ Single best answer; who Makes it better than dying declaration

  blc "Leading questions" allowed

- Not practice in India
- Dying deposition > Dying declaration

Q: ♀ died within 4 years Under Suspicious circumstances! Autopsy?
ⓐ 304; ⓑ 302; ⓒ 174 Cr.P.C ⓓ 176 Cr.P.C

Q: Power to Recall witness? Cr.P.C 311

Q: evidence Recording in previous proceeding is relevant in Subsequent proceeding?
S.33 I.E.A. (Same Recording is Relavant in future proceeding).

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

NEGLIGENCE | PROFESSIONAL NEGLIGANCE

PROFESSIONAL MALPRACTICE

⇓

- Fined | Prison
- Case would be decided by court.

civil (Tort)

- Any Negligence that can be compensated by Money.

criminal

↓

- Gross Negligence
- decide by supreme court of india
- illegal
- Gross inattention toward patient.
- Negligence that can't be compensated by Money.

4 D's ⇒

① DUTY ; - Pt - Doctor Relation

② DERELICTION ; - You don't follow standard

③ DIRECT CAUSATION ; - Cause harm (direct)

④ DAMAGE.

* If Doctor is Negligent; He is punished Under :-

304(A) I.P.C ⇒ Negligent causing ⟶ Death
2yr ± Fine

337 I.P.C ⇒ Negligent causing ⟶ Hurt
6months ± Fine

338 I.P.C ⇒ Negligent causing ⟶ Grievous Hurt
2yr ± Fine

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Sec 269 IPC ⇒ Negligent Regarding infectious disease
6 Months ± Fine

Sec 270 IPC ⇒ Malignant Act Regarding infectious disease
2yr ± Fine
With Intention

* Defences available to a doctor in a Negligence :-

① Corporate Negligence :⇒ Hospital has to provide
- Infrastructure
- Manpower
} ⊗ → If Not; Hospital is Negligent

② Products Liability :⇒ Manufacturer Negligence for his product.

③ Error of Judgement :⇒ You decide to go in the interest of Patient

④ Therapeutic Misadventure :⇒ Idiosyncratic Rxn to Drug
↳ अपनी तरफ से अच्छा किया; but Something Not controllable, or Not in My Hand

⑤ Res Judicata / Doctorine of double Jeopardy :⇒
↳ एक ही चीज के लिए दो बार No Punishment,
Rest the decision Rest.

⑥ Res Indica – Limitation period ~2yrs.
↳ If I am Negligent; then pt can file the case upto 2yrs.

* All Above defence can use @ civil / criminal both neglence

⑦ Contributory Negligence :⇒ Defence only in civil cases
↳ Both Patient / Doctor are responsible

Two ways to determine : Who is More Negligent

① Last clear chance Doctorine ↓ Doctor is Responsible

② Avoidable consequence Rule ↓ Patient is Responsible

"if the doctor fails to prevent damage resulting from the Negligent act of the patient; even after getting clear time, he can't pleaded Contributory Negligence in civil case"

AIIMS May 15 Q.

Pt. comes to you ∈ large Laceration. You did Regular dressing. Pt. didn't give Much care. During follow-up ; patient was repeateadly told to get the dressing done timely but patient didn't do the dressing himself, saying that he was busy. Finally the wound enlarged & Underlying bone developed osteomyelitis. which of the following Statement is true Regarding above Mention situation?

a) Doctor is guilty under "Last clear chance" Doctorine
b) Doctor is not guilty under "contributory Negligence".
c) Doctor is Punishable under avoidable negligence
d) Doctor is guilty as he prescribed wrong Medicines

Terms in Negligence :

① RES IPSA LOQUITER :→ Fact speaks itself.

② VICARIOUS LIABILITY / RESPONDANT SUPERIOR / CAPTAIN OF SHIP DOCTORINE :→ Let the Superior Reply

"HOD Medicine" (captain) "Intern" (employee).

* applicable only in civil Negligence Not in Criminal cases

→ the employer is Responsible for Negligence of employee
↳ Hospital Responsible (vicarious Liability)

DOCTORINE OF DEEP POCKETS :→ उसको पकड़ो जिसका Pocket (Money) बड़ा हो।

BORROWED SERVENT DOCTORINE :→

(III) NOVUS ACTUS INTERVENIANS ⇒ Defence very commonly seen in Homicide (7)

New Act Intervening.

⇓

Usually Not accepted by the court; Unless the Doctor is confirmed Negligent,

Head injury to the patient ⟶ Doctor came ⟶ Septicemia ⟶ Death

DNB May 2017

Compoundable offenses ⇒ There can be out of court Settlements.

└ eg ⇒ Theft.

* Non-Compoundable offenses ⇒ These offenses can't be out of court settlements.

└ eg ⇒ Murder

* SUMMON : Issued Under (S. 61-69 Cr.P.C)

{ (Not attended)

2nd summon : (Again Not attended)

{

NOTICE (S. 350 Cr.P.C.) → Valid Reason (No Punishment)

(Show cause Notice) → Invalid Reason (Punishment : Rs 100/-)

{ Again Not attend

Bailable warrant

{

Non-Bailable warrant } Fine + Imprisonment

Ans. Burn Pt.; ♀ by husband; treated ⇒ She goes into O.T. for plastic Sx. - Anesthetics give Sch → Pt. dies on Sx table ; who is Responsible?

(a) Anaesthesiology

(b) Surgeon

(c) Husband

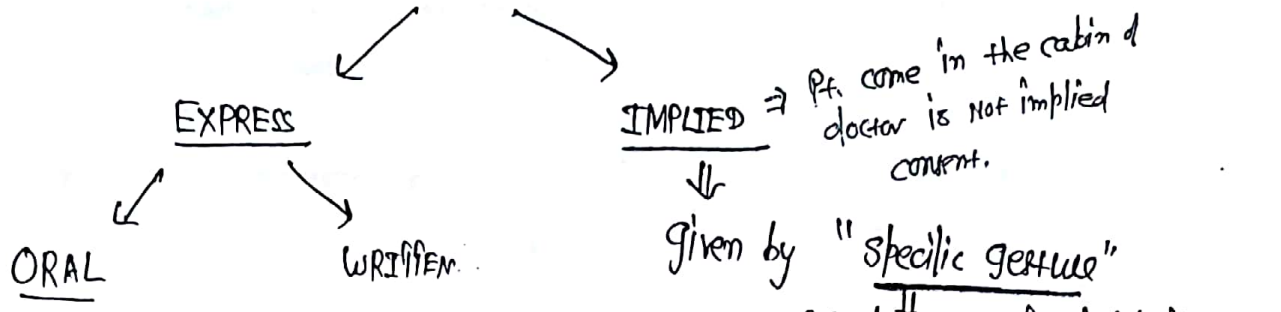
(d) Surgeon d/t Vicarious Liability

⇒ Pt. is burnt case ; ∴ Sch is Not preferred; also Anaesthesiologist is Not controlled by Surgeon.

http://mbbshelp.com . WhatsApp: +1 (402) 235-1397

CONSENT

- Sec. 13 – Indian Contract Act; 1872
- Voluntarily Agreement



→ All the consent is valid in court of Law.

→ Consent should always be "Informed"

⇓

- You are telling Full disclosure to patient.
- except ⇒ "Therapeutic privileged"

* BLANKET CONSENT ⇒ Invalid in India

↳ Consent taken for everything together

* - Consent taken bl/c of Assault ⇒ 351 I.P.C

↳ w/out consent

↳ except emergency ⇒ protected under 92 I.P.C

↳ Like saving Rx

↳ Consent can't obtain w/out Reasonable delay

eg ⇒ RTA → Profusely bleeding → Conscious; oriented → give No Consent

⇓

Informed Refusal ↳ No Rx.

CONSENT AGE

- < 12 yrs: Can't give consent Under IPC 90
- 12-18 yr: Consent for general physical examination
- ≥ 18 yr: All consent under 87 IPC

91 I.P.C ⇒ Consent for illegal Act is invalid
eg ⇒ Murder ke liye consent ; Not valid (illegal)

SECTIONS

Cr. P.C.

OFFENCES

Cognizable

- Arrest ⊂ / out warrant
- 2(c) cr.P.C

eg ⇒ Murder ; Dowry death ;
Rape ; Dacoity ;
Robbery ; Attempted suicide
Ragging ;
Grievous hurt ;
Voyeurism ;
Stalking ;

Non cognizable

- Arrest ⊂ warrant
- 2(L) cr.P.C

eg ⇒ Hurt.
Theft,

OFFENCES

Bailable ⇓
Police give bail

Non-Bailable ⇓
Court give bail

I.P.C

- Sec. 44 ⇒ Injury (Definition)
- Sec. 46 ⇒ Death (Definition)
- Sec 82 ⇒ Child < 7yrs is Not Responsible
  Railways Act : child > 5yrs is Responsible
  6yr old: Punishable for Pulling chain; Not Responsible for killing
- Sec. 84 ⇒ Criminal Responsibility of Insane
  (Mc Naughten's Rule) | Legal test | Right or Wrong test

CURREN's RULE
DURHAM's RULE
Irresistible impulse test
American Law Institute Rule
Federal Law
→ all are Rule for Insane

(X) Not applicable in India

⇒ If a person has Insight; then the person is Responsible for crime

eg ⇒ Psychosis ⟶ Insight → (X) ⇒ Not Responsible
Neurosis ⟶ Insight → (✓) ⇒ Responsible
Kleptomania ⟶ Insight → (✓) ⇒ Responsible
Delirium ⟶ Insight → (X) ⇒ Not Responsible
Automatism ⟶ Not Responsible
Sleep walking ⟶ Not Responsible
Hypnosis ⟶ Responsible

* DURHAM's RULE ⇒ Accused is Not Responsible for the act; if his acts Resulted from Mental disease or defects.
* CURREN's RULE ⇒ A Person is not Responsible ; if @ the time of committing the crime; he didn't have capacity to Realise his conduct

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Sec 85 ⇒ Act under involuntary intoxication
↓
Person is Not Responsible

Sec. 86 ⇒ Act under voluntary intoxication
↓
Person is Responsible

* if crime done in delirium tremens → d/t Alcohol withdrawal.
↓
Not Responsible

Sec. 88 ⇒ Act Not intended to cause death; but can cause death or grievous hurt; done by consent in good faith & for the benefit of that person eg ⇒ Death of pt caused by surgery done by surgeon

Sec. 197 ⇒ Issuing False certificate
↳ Punish ≤ 7yr
Penal erasure ⇒ only Medical council; Not Court.

Sec 201 ⇒ causing disappearance of evidence
↳ Punishment = 2yr ± Fine

eg ⇒ Embalming w/out Death certificate
↳ Punishable under 201.

- once a death certificate is approved it means person had already Post-Mortem
- Embalming agent ⇒ Methanol;
  Formalin;
  Phenol;
  Glycerine etc
- Unclaimed Body ⇒ after 48 hrs

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Sec. 299 ⇒ Culpable homicide (Definition)

Sec. 300 ⇒ Murder definition

Sec. 302 ⇒ Murder (Punishment)

Sec. 304 ⇒ Culpable Homicide (Punishment)

MURDER :→ Intention to kill
CULPABLE HOMICIDE :→ Death to be happen

Difference
"Gravity of killing"

Sec. 307 ⇒ ATTEMPT TO MURDER :→ Intention high ; Dead not happen.
↳ 10yr Imprisonation + fine

Sec. 308 ⇒ ATTEMPT TO CULPABLE HOMICIDE :→ Intention Less ; Dead not happen.
↳ 3yr Imprisonation + fine

Suicide

Abetment (उकसाना)
- Provoke for suicide
- Punish in 306 IPC

Attempt
- Punish in 309 IPC
- 1 Yrs. Punishment
- Non cognizable offence
- Not Required to Report the Police
- G/C Sec. 39 Cr.P.C
  ↓
  Public to give Information of certain offences ; Not talk about 309 IPC

* Gravity of Killing is determined by Nature of actions of Accused :→
eg ⇒ Stab once & Run Away : chance of survival : Culpable Homicide
Stab so Many times : No chance of survival : Murder

http://mbbshelp.com

Sec. 312-316 ⇒ Criminal Abortion

= expulsion of product of conception before full term according to Law

Sec 312 : Abortion c consent → Death of ♀ (Death during Abortion) → 314 I.P.C

Sec. 313 : Abortion c/out consent → Death of ♀ (Death during Abortion) → 314 I.P.C

Sec. 315 : Infanticide

Sec. 316 : causing death of a (quick) Unborn child; while trying to kill Mother: (culpable Homicide)
- Moment in ♀ ; When the ♀ woman starts to feel or perceive fetal Movement in uterus.
- quickening in Primi ⇒ 20 weeks
- quickening in Multi ⇒ 16-18 wks

Sec. 317 : Abandoning a child < 12yr of Age

Sec 318 : concealment of child
↳ Any birth/death should be reported c/in 21 days.

Sec 319 : HURT (DEFINITION)

Sec 320 : GRIEVOUS HURT (DEFINITION) : 8 clauses :→

(A) Emasculation/Impotence (Applicable only to Males);

(B) Permanent privation of Sight of either eye (5%/10%/100%)
↓
Injury Not healing itself; do Sx.

(C) Permanent privation of hearing of either ear

(D) Privation of Member/joint [Anything that has its own function ↓ Member of body]

(E) Permanent destruction/Impairment of Power of Member/Joints

(F) Permanent disfigurement of Head & face
↓
eg:- 60yr old & 20yr Model; shave of Head? No one is grievous hurt

(G) # / dislocation of Mandible (Bone); / tooth.

(H) Any Hurt that endangers life or causes severe bodily pain for 20 days or unable to follow ordinary Pursuits

Profession is Not ordinary Pursuits.

Any injury ; where death can happen

DANGEROUS INJURY ⟹ Any injury ; which causes threaten to Life
↳ Part of Grievous hurt.

* Sec. 323 ⇒ Punishment for voluntarily causing Hurt ; Punish = 1yr
* Sec. 324 ⇒ Punishment for voluntarily causing Hurt by Dangerous weapons
↳ Punishment ⇒ 3yrs.
* Sec. 325 ⇒ Punishment for voluntarily causing Grievous Hurt
Punishment ⇒ 7yr
* Sec. 326 ⇒ Punishment for voluntarily causing Grievous Hurt by Dangerous weapons ; Punishment ⇒ 10yr
* Sec. 334 ⇒ Punishment for voluntarily causing hurt on Provocation
Punishment ⇒ 1month + 500/-
* Sec 335 ⇒ Punishment for Grievous hurt on provocation
Punishment ⇒ 4yr + 2000/-

Dangerous weapons ⇒ Shooting | Stabing | cutting

X (Not dangerous) —Stick; Bruise on Provocation→ Y (Bruise) ↳ Hurt ⇒ Sec 334
Voluntarily causing hurt on provocation.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

X → Y ⇒ Sec. 334
Knife
(Dangerous weapon) Abrasion on provocation

Sec. 334 = Voluntarily causing hurt on provocation
If provocation is Removed then 323 & 324 applicable.

Q Knife # Provocation { 326 10yr } 4yr + 2,000/-

Q: AIIMS X → Y
Shoots;
Intention to kill;
thigh → Bleeding

1. 324	1. 324	1. 324
2. 326	2. 326	2. 326
3. 335	3. 335	3. 307
4. 304	4. 308	4. 308

Sec. 354 : Assault (by Force) to outrage the Modesty of female

Sec 509 : Insult to outrage the Modesty of female
↳ by words (obscene comments)

Amendent in 2013 :-

- 354(A) :- Sexual Harrasment
- 354(B) :- Disobing a ♀ in Public
- 354(C) :- Voyeurism
- 354(D) :- Stalking

Physical (पीछा करना) / Digital ↳ via what's app ; email

for the 1st offence :- upto 3 yr Jail (cognizable & Bailable)

for the 2nd offence :- upto 5yr Jail (cognizable & Non-Bailable)

Sexual offences

Natural

- Intercourse is per Nature i.e Male intercourse ⊂ Female OR vice-versa
- Penis Penetrate vagina

eg ⇒ Rape ;

Incest - Not offence in India

Adultery ⇒ Sec 497 IPC
↳ Male Punish

UnNatural (377 I.P.C)

- Against Nature
- Men ⊂ Animal
  ⇓
  Bestality
- ⊂ I'm the same gender
  ⇓
  Homosexual
- Penis penetrating Anus orifice
  ⇓
  Sodomy
- Penis in oral orifice
  ⇓
  Buccal coitus / Sin of Gomorrah

Sexual Perservation

RAPE ⟶ Sec. 375 I.P.C (Definition)
↳ 2013 Amendent

Age of consent ⇒ 18 yr (Married / Unmarried)

Statutory Rape ⇒ Sexual intercourse < 18 yr.

♀ → Rape → Ⓧ ⇒ Not charged in India
↳ Gang Rape → Ⓧ ⇒ Not charged in India
↳ > 1 Person

Sec. 376 I.P.C ⇒ Rape Punishment
↳ 7 yr. — Life imprisonment
↳ Rest of Life

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Sec. 376(A) ⇒ Death occured

1. victim - Death
2. victim - Persistent vegetative state
   ↓
   coma → cortical Brain death,

⇓

Give Death Sentence to accussed.

Sec 376(B) ⇒ Husband - wife c/out consent during separation

⇓

2-7 yrs. Bailable (only bailable Rape)

Marital Rape ⇒ No Punishment in India.

↳ Husband has power to call sex after Marriage

- Gb you have to answer c/out option; No offence; then select 376B.

Sec 376(C) ⇒ Sexual Intercourse by a person in Authority

⇓

Punishment ⇒ 5-10 yr

Sec 376(D) ⇒ Gang Rape

↳ Punishment ⇒ 20 yr - L.I.

Sec 376(E) ⇒ Death Sentence to accussed if he is a Repeat offender.

Sec. 53(A) Cr.P.C ⇒ Medical examination of Rape accussed

- No Need of Consent
- Request of Medical examination ≥ Sub-Inspector

Sec. 164(A) Cr.P.C ⇒ Medical examination of Rape victim

- Consent Required
- for consent ≥ 12 yrs in this case
- Male/Female both doctor can examination in presense of Female attendent.
- Test ⇒ · I.i. Toludiene blue
  ⇓
  to visualize Micro-laceration

  · Lugol's iodine
  ⇓
  can be used for Max^m 4 days after intercourse

Sec. 327 Cr.P.C ⇒ In "Camera trial" done in Rape cases
⇓
Misnomel ⇒ Limited people allowed in court,

Sec. 228(A) I.P.C ⇒ Punishment of disclosing the identity of Rape victim
↳ Punishment ⇒ 2 yr.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

UNNATURAL SEXUAL OFFENCE

Male homosexuality

Female homosexuality

Klas" Tribadism / Lesbinism"

- **Active** → Klas "Butch / Dyke / Bull Dyke"
- **Passive** → Klas "Femme"

* SODOMY / BUGGERY / ANAL INTERCOURSE ⇒ "Greek Love"

- **ACTIVE**
  - Preferred children
  - Klas "Pederast / Pedophile"
- **PASSIVE**
  - → Child ⇒ Klas "Catamite"
  - → Act Klas "PEDOPHILIA"
  - → if old age ⇒ Act is "GERONTOPHILIA"

* SIN OF GOMORRAH (BUCCAL COITUS) ⇒ Fellatio ⇒ oral stimulation of Penis;
Cunnilingus ⇒ oral stimulation of female genitals

* Feature of Habitual Passive agent :

1. Lateral buttock traction test ⇒ (+)
   - In knee/elbow position; Anal sphincter is completly Relaxed ⇒ (+)
2. Tyre's sign ⇒ (+)
   - Bluish discolouration seen around Anal Margin d/t dilatation of vessels.
3. Skin tags are present;
4. Funnel shaped Anus;
5. Skin will be shaved.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Sexual Perversation / Paraphilia

- Sexual gratification c/ou+ intercourse

SADISM ⇒ Pain → Partner;

MASOCHISM ⇒ Pain → Self

↳ Seen in "Autoerotic Asphyxia"

↳ Co-existing together ⇒ "BONDAGE"

FETICHISM ⇒ Object of desire

↳ PARTIALISM ⇒ Desire for part of body.

Klismaphilia ⇒ Pleasure by use of enema.

Urophilia / Urodinism ⇒ Pleasure by sight / urine / making a person urine on self.

Coprolalia / Scatophilia ⇒ Pleasure by obscene Language.

Masturbation / Ipsation / Onanism ⇒ Punishable act; if done in Public; otherwise Not.

Punishable sexual Perversation

Exhibitionism ⇒ display of private part in Public

↳ Under 294 I.P.C

Frotteurism ⇒ Rubbing against private part of Unsuspecting Individual in Public

↳ Under 354 / 354(A) / 290 I.P.C

Necrophilia / Necrophagia ⇒ 297 I.P.C ⇒ Showing disrespect to a dead body

II Love — II eat — ↳ 1yr + Fine

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Voyeurism | Scotophilia | Peeping tom :⇒ Pleasure by watching other people Intercourse or by watching Undress

↳ Under 354(c) I.P.C

1st offence ⇒ 1-3 yr (cognizable bailable)

2nd offence ⇒ 3-7 yr (cognizable Non-bailable)

TRANSVESTISM / EONISM

Cross Dressing

- Individual identity himself as opposite gender
- Not perversion – Gender Misidentity disorder
- M/c in ♂.

Sec. 497 : Adultrey (i.e voluntary sexual Intercourse b/w a Married Person & a person ; Married or Not ; other than his/her spouse).

Sec 498(A) : Cruelty on a ♀ by husband / Relatives

↳ Not on ♂.

Q. ♀ → 4 yrs under Marriage → ♀ Autopsy ?

① 304 B I.P.C ③ 174 Cr.P.C

② 302 I.P.C ④ 176 Cr.P.C

Q. Power to Recall a witness ?
Under Cr.PC (311)

Q. evidence Recorded in Lower court ; is applicable in higher court ?
Under I.E.A. (33)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

JUVENILE JUSTICE ACT, 2000

Juvenile ; child ; Minor ⇒ < 18 yr.

Juvenile in crime ⇒ Juvenile - In-conflict with Law (JCL)

That Means any Juvenile offender/ Juvenile delinquent. He is called "JCL" & is never sentenced to death/imprisonment.

Juvenile Justice Board

① 1st class Judicial Magistrate (♂ or ♀) ⇒ Principle Magistrate

② 2 NGO Member

1 → ♀ Must

Reformatory / BORSTAL

↳ Age upto 21 yrs Maxm

Maxm Punishment → 3 yrs.

- Amended 2015 ; ⇒ Maxm Punishment ⇒ Death Sentence

Age of Juvenile depends upon crime committed.

Age	depends upon	Crime
< 18 yrs	①	Petty
< 18 yrs	②	Serious
< 16 yrs	③	Heinous

Petty crime Punishment ⇒ ≤ 3 yr - eg : 323 IPC

Severe ⇒ 3 yr - 7 yr - eg : 324, 345 IPC

Heinous ⇒ ≥ 7 yr

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

TRANSPLANTATION OF HUMAN ORGAN & TISSUE ACT, 2011

Brain stem death

- Definition ⇒ Section 2(d);
- Criteria ⇒ Minnozota

Team of Doctors :-

1. Hospital In charge (HIC);
2. Specialist appointed by HIC;
3. Independent Neurologist / Neurosurgeon
4. Treating Doctor

→ All are Not Part of operating Team

Live individual

- Donate d/t Money Mainly.
- NEXT OF KIN

Grand parents
↑
Parents
↑
(I) → spouse
↓
child
↓
Grand child

- Punishment ⇒ to Doctor

10 yr + 20 Lac to 1 crore

- MCI can Remove for 3 yr → 1st offence
  Permanent → 2nd offence

INDIAN LUNANCY ACT, 1912

- Replaced by Mental health act 1987
- Replaced by Mental health care act, 2017
- ① ECT → pre-treated ∈ Muscle Relaxant.
  ECT in child → Permission from Medical Review Board (MRB)
- ② Advance directions are allowed for a future Medical illness
  ⇓
  Override ⇒ MRB

③ 309 I.P.C ⇒ Non-cognizable offences.

Medical Review Board

Peoples in MRB ⇒ ① District Judge

② Representative of District Collector

③ 2 Doctor — Psychiatrist / Any Registered Practitioner

④ 2 People from NGO

if Doctor violated this Law

↳ Punishment ⇒ 6 month ± 10,000 - 1st offence

2 yr ± 50,000 - 5 lac - 2nd offence

Consumer protection Act ; 1987

We can file the case at → ① District forum;

② State commission;

③ National commission;

District Forum

3 Member

Jurisdiction

Case value upto < 20 lakh

State commission

3 Member

20 lakh - 1 crore

National commission

5 Member

> 1 crore

Not happy ⟶ States Not happy ⟶ National Not happy

↓

Go to supreme court.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

- Limitation period for filing a case in 2yrs.
- Case decided in 90 days.
- After decision appeal in 30 days.

IDENTIFICATION

CORPUS DELICTI – Body of offense / essense of crime

(I) DETERMINE SPECIES :→ Precipitin test
↳ Species identification test.

(II) DETERMINE RACE :→ (A) SKULL :-

CEPHALIC INDEX :→ $\frac{\text{Maximum Bredth of Skull}}{\text{Maximum Length of Skull}} \times 100$

	DOLICOCEPHALIC (→ Long-headed)	MESATICEPHALIC	BRACHYCEPHALIC (→ short-headed)
Cephalic Index ⇒	70–79 %	75–80 %	80–85 %
eg ⇒	Pure Aryans; Negro	Indians	Mongoid

(B) DENTITION ⇒ Mongoid ⇒ i) Taurodontism (Bull tooth);
ii) Shovel shape incisor
iii) Absent 3rd Molar
iv) Enamels Pearls

Caucosoids → i) Pointed canine roots;
ii) Carabelli's cusp
↳ extra cusp on Maxillary 1st Molar

Negro → i) Large teeth
ii) Multiple cusp.

(III) DETERMINE GENDER :→ Best from Pelvis

Pelvis → 95% (Best)
Skull → 90%
Long bones → 80%
Pelvis + skull → 98%
All bones → 100%

Sternum

i) ASHLEY'S RULE ⇒ Manubrium + Body

≥ 149 mm — ♂
≤ 136 mm — ♀

ii) Sternal index ⇒ Manubrium / Body

♀	♂
0.54	0.46

(IV) DETERMINE STATURE :→ Stature ⇒ Bony Length of Individual.

Length of bone is Measured by ⇒ "Hepburn's Osteometric Board"

Length of bone × M.F ⇒ Stature

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

BONE		M.F
FEMUR	⇒	3.6
TIBIA	⇒	4.4
FIBULA	⇒	4.4
HUMERUS	⇒	5.3
ULNA	⇒	6
RADIUS	⇒	6.4

This Multiplication factor is klas "KARL PEARSON COEFFICIENT".

* Bone		% of Height
· Humerus	⟹	20
· Tibia	⟹	22
· Femur	⟹	27
· Spine	⟹	35

→ 2nd Method to determine status ⇒ "Trotter & Glacer Method"

(V) Finger printing / Dactylography / Dermatogly

Discovered by ⇒ Sir William Herschel / Sir Francis Galton

· DNA Fingerprinting discovered by ⇒ Sir Alec Jeffreys

(N) Routine F/P ⇒ Better than digital F/P
↳ even different in identical twins
⇓
Guetlet's Rule

- Loops ⇓ 67% M/C
- Whorls ⇓ 25%
- Arches ⇓ 6-7%
- Composite ⇓ 1-2%

- 2 Set of F/P Need to identify.
- 8 points should Match in India; varies ac to country
  ↳ No Matter complete/Partial F/P.
- Little finger print — Both — (X) Not taken
- Dermis — depth - 0.6mm

- Finger print absent in — Leprosy, Irradiation & electrical injury.

- CALLIGRAPHY :→ Study of Hand writing.
- POROSCOPY :→ Study of pores on epidermal Ridges
  - Primarily use in partial finger print
  - Develop by - "LOCARD EXCHANGE PRINCIPLE"

- PALATOPRINT :→ Taken from Ant. 1/3rd of Palate
  - Rugoscopy
- CHEILOSCOPY :→ Lip prints
  - Tsuchi hashi classification
    - 6 tiers

- ANTHROMETRY :→ By "BERTILLON SYSTEM" DNB 17
  - Body Measurement.
    - Mostly axial | Lt. side except → one from Rt. ear
    - Only in Adults (Not for child)
    - No biological specimen Required
    - earliest criminal identification system.

- SUPERIMPOSITION TECHNIQUE :→ Skull bone
  - ⊖ve test is said better in this technique

- IDENTIFICATION BY AGE :→ ① By secondry sexual character
  ② By dentition
  ③ By ossification centre

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

2° sexual character

- Tanner's sexual Maturity Rating
  ⇊
  In Pediatrics

Ossification centre

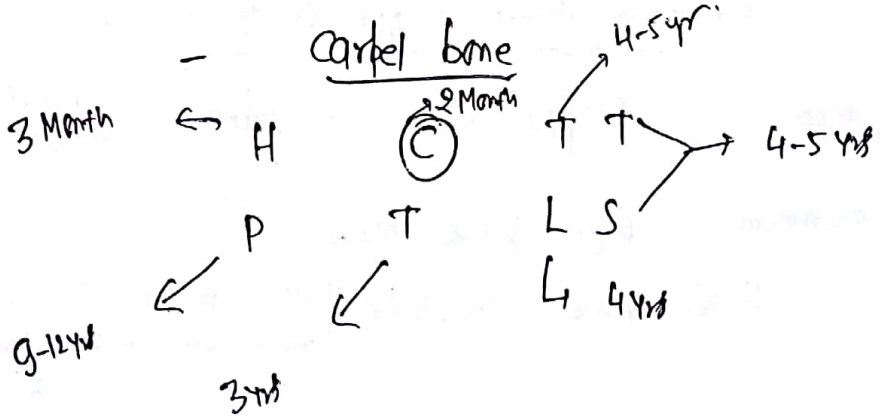
- 18+ to ossify
  - clavicle (5th week IUL)
- 2nd Mandible ⇒ 6th week IUL
- Calcaneum - 5th week of IUL
- Talus - 7th week of IUL
- Lower end of Femur - 9th week of IUL / just before birth

- Ossification centre @ birth
  - Cuboid
  - 4th part of body of Sternum
  - Upper end of tibia

Ossification centre @ 1yr

- Head of Humerus / Femur
- Lower end tibia / Fibula
- Capitulum

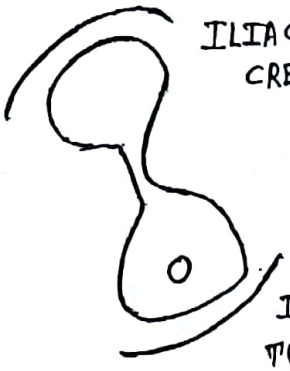
- Carpel bone



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Ossification centres Around Hip

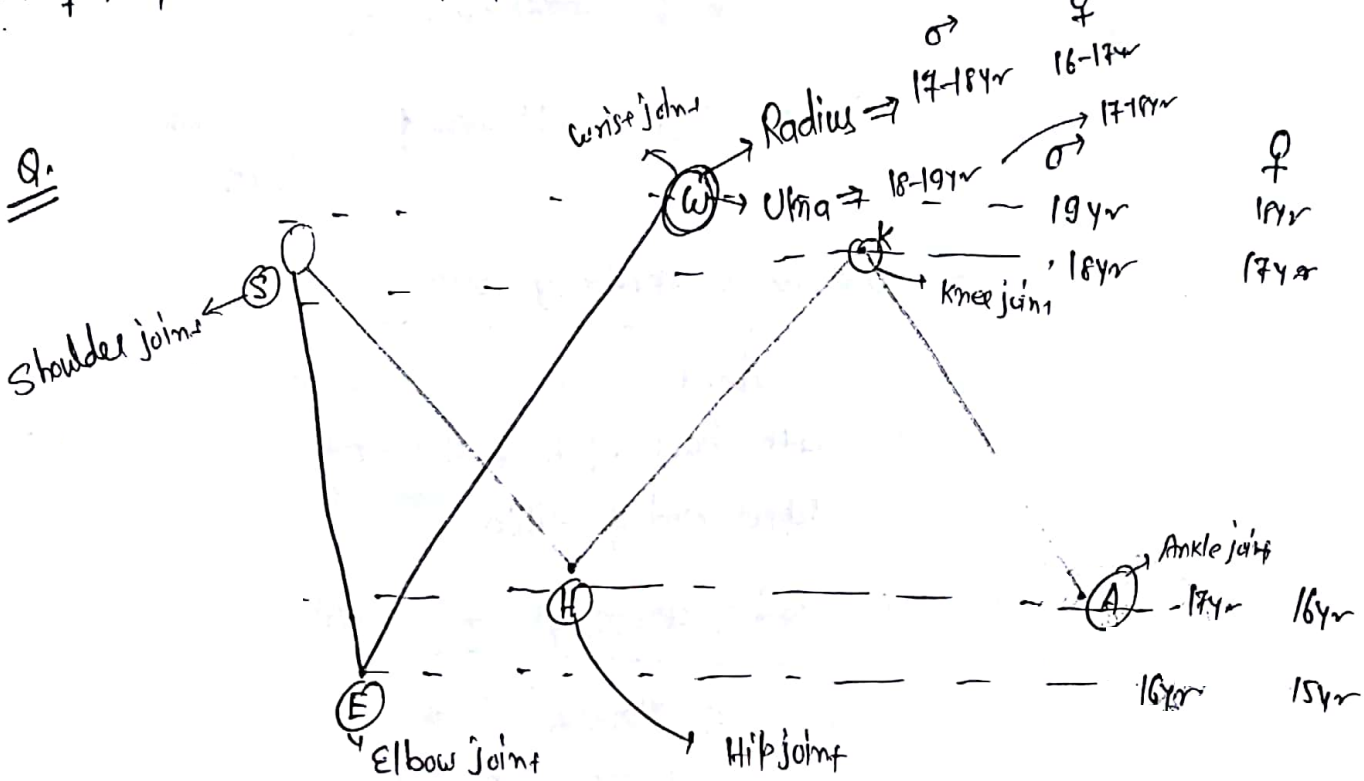
Ⓐ ⇒ Appearance
Ⓕ ⇒ Fusion



		♂	♀
ILIAC CREAST	Ⓐ ⇒	14yr	13yr
	Ⓕ ⇒	18-20 yr	17-19yr
ISCHEAL TUBEROSITY	Ⓐ ⇒	16yr	15yr
	Ⓕ ⇒	20-21yr	19-20yr

In ♀ ; o/c can be 1year earlier than ♂.

Q.



DETERMINATION OF AGE BY DENTITION

i) ~~Stacks Method~~ ⇒ Cut/Ht tooth ⇒ Infants (Age of infants can be known from height & weight of erupting teeth)

ii) ~~Boyd's incremental~~ Line ⇒ Also "Boyde's Method".
↳ Body's enamel ; In children (there is a line @ birth on enmel of tooth ; with its age ; More lines are added)

iii) Eruption

iv) ~~Gustafson Method~~ ⇒ Determines @ age > 21yrs.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Eruption		Tooth	
Temporary	→	I C PM 2 1 0 2	= 20
Permanent	→	2 1 2 3	= 32 total

1st temporary tooth to appear – Lower central incisor
⇓
Last temporary tooth to appear = 2nd Molar.

1st Permanent tooth to appear – Molar
↳ 6yr

Permanent dentition ⇒

Mummy Is In Bed Baby Cry Milk Milk

Mummy ⇓ Molar 1st ⇓ 6yr

Is ⇓ central Incisor ⇓ 7yr

In ⇓ Last incisor ⇓ 8yr

Bed ↳ Bicuspid / Premolar 1st ⇒ 9yr

Baby ⇓ 2nd Premolar ⇓ 10yr

Cry ⇓ Canine ⇓ 11yr

Milk ↳ 2nd Molar ⇓ 12yr

Milk ↳ 3rd Molar ⇓ 18yr

Mixed Dentition (6–12yr) ⇒ Both Temporary + Permanent

30 months ($2\frac{1}{2}$yr) ⇒ teeth = 20 in No.

@ 6yrs +4 (1st Molar) ⇒ teeth = 24 in No.

@ 12yr +4 (2nd Molar) ⇒ teeth = 28 in No.

@ 18yr +4 (3rd Molar) ⇒ teeth = 32 in No.

* No. of Permanent teeth ⇒ (Age – 5) × 4 (1st apply)
⇓
if ans. Not come from this; then apply
(Age – 6) × 4) + 2nd apply

M/c extra permanent tooth ⇒ Maxillary central Incisor

* GUSTAFSON METHOD ⇒ Used in >25 yr age

i) Attrition : Top part (Grinding part)
ii) Paradentosis : Recession of gingiva;
iii) 2o Dentine : 2nd Most Reliable parameter ; Pulp cavity Material
iv) Cementum opposition : Root part
v) Root Resorption : Least Reliable Parameter
vi) Root transparency : Most Reliable parameter

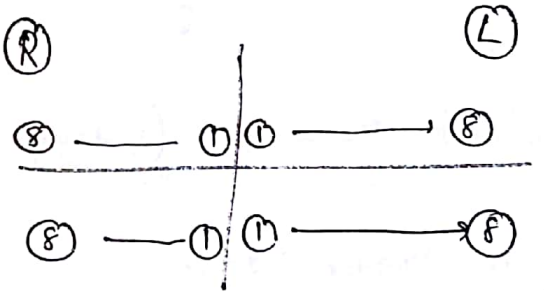
- Anterior teeth >> Posterior teeth for determination (I/C >> P/M).

DENTAL NOTATION METHOD

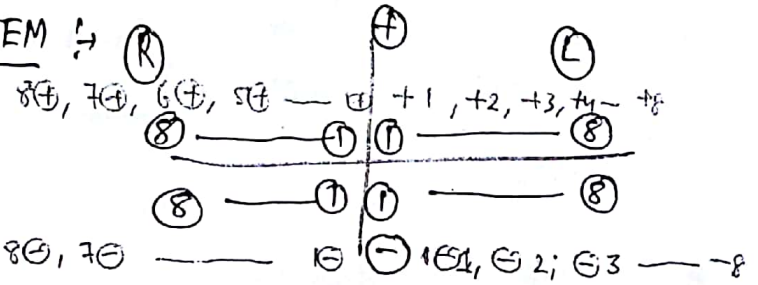
I. UNIVERSAL SYSTEM

II. DIAGRAMMERIC SYSTEM

III. PALMER'S SYSTEM :-



IV. HADERNUP SYSTEM :-

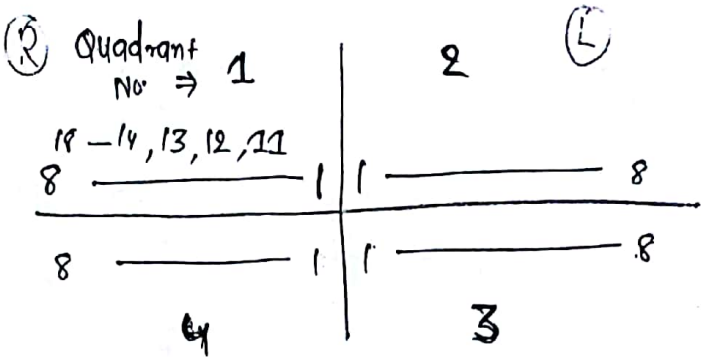


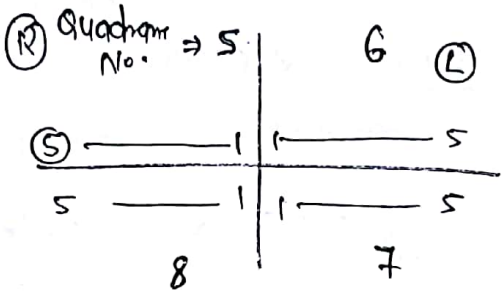
V. FDI SYSTEM (Federation Dentaire International) :- 2 digit Notation

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Quadrant No. ⇒ 1, 2, 3, 4

Used for Permanent Dentition





Temporary dentition

* Miles Method ⇒ Age can be known by change of Root transparency.
* METHOD OF CRIMINAL ABORTION ⇒

(A) Abortion Stick ⇒ Irritant plant calotropis
⇓
Reflux uterine contraction

(B) DRUGS
- Ecbolics → ↑ Uterine contraction
- Emmenagogues → ↑ Menstrual flow

(C) M/c complication of criminal Abortion ⇒ Hemorrhage
M/c immediate cause of death ⇒ Shock
M/c delayed cause of death ⇒ sepsis

416 Cr.P.C ⇒ Commutation of Death Sentence of ♀ Lady.
* If a ♀ Lady; she can't be hanged during/after delivery.
⇓
Death sentence will automatically change to Life imprisonment for that offence

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Difference b/w Male & Female Pelvis :⇒

♀	♂
• Wide Inlet	• Heart Shaped Inlet
• Shallow cavity	• Deep cavity
• Wide outlet ↳ Sub-Pubic Angle obtuse ↳ Ischial tuberosity are elevated	• Narrow outlet ↳ Anteverted ↳ Inverted.
• Chilotic Line ↳ Pelvic component > Sciatic component	Chilotic Line ↳ Sciatic component > Pelvic component.
• Coccyx ⇒ More Movable	Less Movable
• Preauricular Sulcus ⇒ More; frequent, broad & deep ⇓ attachment of Anterior Sacroiliac Ligament.	Not frequent ; Narrow; shallow
• Glea-pectineal Line ⇒ Rounded & Smooth	well Marked & Rough

* Stature (Body Length) is More in :⇒ ① Lying;
⇓ ② After death d/t Loss of Muscle tone;
n of Large joints;

* Statue is Less in :⇒ ① Afternoon & evening d/t ↓ elasticity of intervertebral disc & Longitudinal vertebral Muscle;
② Both Malnutrition & Advancing age

* 1st ever finger print bureau in the world ⇒ Calcutta

* Types of Fingerprinting : 1. Latent ⇒ which can't be seen ē Naked eye;
2. Visible ⇒ Can be seen ē Naked eye;
3. Plastic ⇒ type of visible finger print which is seen in plastic substance (like wax etc.)
4. Chance ⇒ Not a type of finger print ; used for crime investigation.

* In child: Foot print is taken ⇒ Develops by 12-16 wk of GUL.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* TATOO MARK

AIIMS '12

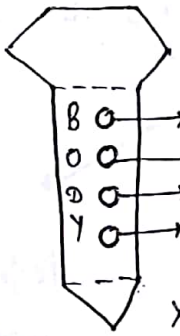
Commonly used dyes ⇒ Indian ink; Prussian blue; Vermilon; carbon; Indigo; Cobalt.

- Tatoo Mark is permanent
  - ↳ When dyes penetrated the dermis.
  - AI+13 Infra Red Photo-graphy makes old tatoo Readily visible

NEET 16 A faded tatoo Mark became visible by use of Ultraviolet Lamp;

AI-91 Marks all Recognized even in the Decomposed bodies; when the epidermis is Removed

* Sternum osilication centre



Manubrium ⟶ 5 Months of IUL ? 1 for Manubrium

1 ⟶ 5 months of IUL
2 ⟶ 7 months of IUL
3 ⟶ 7 months of IUL
4 ⟶ 9 Months of IUL
} 4 for body

Xiphoid ⟶ 3 yrs ? 1 for xiphoid process

* Manubrium fusion ≈ Body : 60–70 yrs.
* Xiphoid fusion ≈ Body : 40 yrs
* 14 yr ⟶ 25 yr. ⇒ Lower to upper body fusion
  (Started) (complete)

* Temporary tooth Eruption

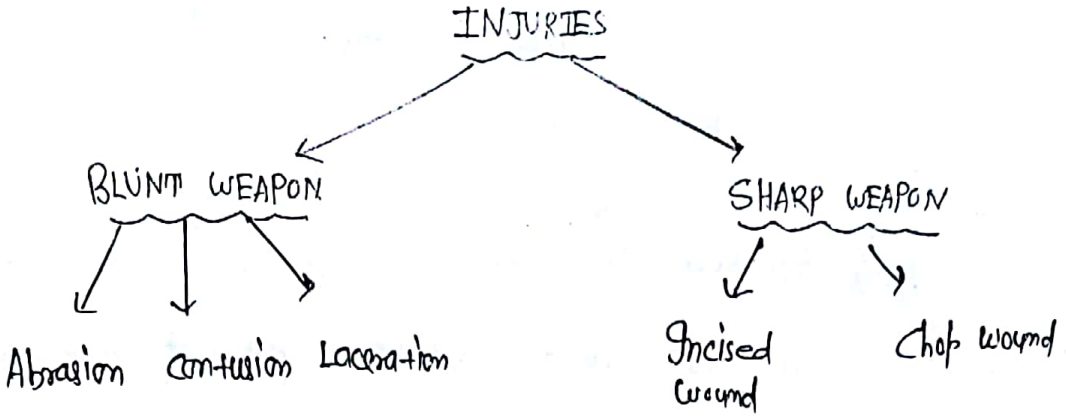
$2\frac{1}{2}$ yr ≈ 20
(All temp. tooth by 30 months)

7-9M	7-9M		12-14M	20-30M
I	I	C	M	M
I	I	C	M	M
6-7m	10-12m	17-20m	12-14M	

* " Super added permanent teeth" ⇒ 6 Permanent Molars; which erupt extra in each jaw ≈ out Replacing Any teeth.
* Successional permanent teeth ⇒ All other permanent teeth except Super-added Permanent teeth.
* In both, deciduous & permanent teeth, dentition occurs earlier in the Lower jaw except ⇒

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

MECHANICAL INJURIES



Stab wound ⇒ Depth > length or breadth of wound

↳ An i.m. injection should be stab wound

↳ but it enters tissue; Not in cavity ⇒ so "Puncture wound"

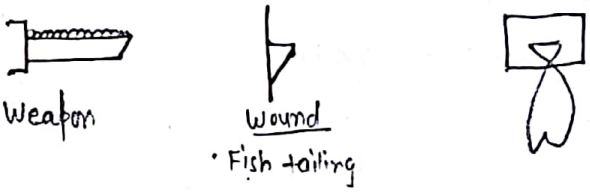
PUNCTURE WOUND ↓ Wound that enter tissue (not cavity)

Penetrating wound ⇓ Stab that enters cavity but doesn't come out.

Perforating wound ⇓ Stab that enter cavity & comes out from other site

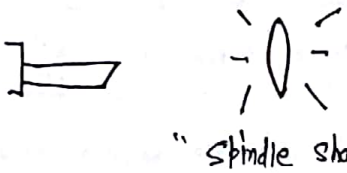
Single edge wound ⇒ Causes "Fish tailing" wound

- One edge Blunt
- One edge Sharp.



Double edge wound ⇒ Causes "Spindle shaped wound"

- Both Edges are sharp

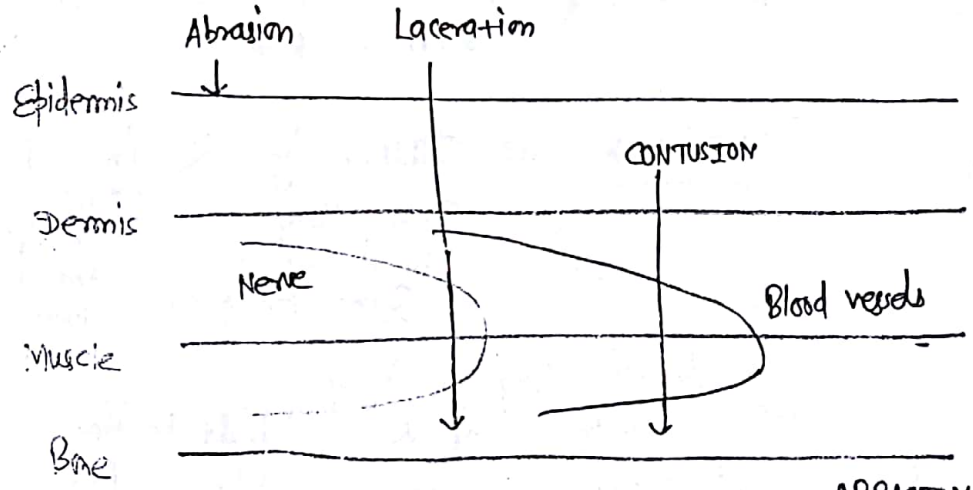


Weapon		Stab wound
Length	---------->	Depth of the wound
Width	---------->	Length of the wound
Thickness	---------->	Breadth of the wound

HARAKIRI

- Japanese Method of Suicide
- Honourable death
- Transverse cut over abdomen
- Cause of death ⇒ Shock & Hemorrhage

INJURIES – By Blunt weapon



- ABRASION ⇓ epidermis alone damaged.
- LACERATION ⇓ epidermis along ~~c~~ all underlined tissues damaged.
- CONTUSION ⇓ epidermis intact ; but only deeper

AI+IB

Shape of Stab wound depends upon ⇒
ⓐ Edge of weapon;
ⓑ Shape of weapon;
ⓒ Width of weapon.

ABRASION ⇒ Injury damaging the epidermis

Blood vessels → Not damaged → No bleeding

Lymph → Scab

↓

Age of Abrasion → 1-3 days → Reddish Brown

→ 1 week → Heals

Abrasion anywhere in body Never Grievous Hurt; except → Cornea

↳ bc it heals by itself.

TYPE OF ABRASION ⇒ 1. SCRATCH / LINEAR ABRASION :

2. GRAZE ABRASION : Multiple Lineal Mark

↳ Resulting in friction burn / Brush burn.

⇓

Not getting separate Lineal Mark

Seen in RTA

3. PRESSURE ABRASION : Caused by Sustained pressure

eg ⇒ Hanging. ↳ if tyre of car for 1 Min. then it cause sustained pressure.

4. IMPACT / IMPRINT ABRASION : Seen in RTA

↳ Something in Motion ;

component of velocity should be there

→ Pattern of object is seen ⇒ Kla "Patterend Abrasion"

- Speeding car → Impact
  - If Mark is present; Like "Tyre Mark" ⇓ "Patterned abrasion".
- Speeding car breaks & stops on leg → Pressure

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

**** Differential diagnosis (Antemortem Abrasion) :-

- Ant bite mark
- Excreta
- Pressure sore.

CONTUSION / BRUISE ↱ Caused by trauma d/t Blunt object (Fist; Lathi; stick; whip boot etc)

- Extravasation of blood in Surrounding tissue & intact epitheli
- ECTOPIC BRUISE ⇒ Seen away from impact.

Racoon's sign ⇓
⇒ Anterior cranial fossa
contusion ⇒ Periorbital Region

Battle's sign ⇓
⇒ Middle cranial fossa
contusion ⇒ Mastoid

- Patterned Bruise ⇒ Pattern of the object as Bruise
  - ↳ TRAMLINE Bruise ⇒ Two Pale Line
  - ↳ SIX PENNY Bruise ⇒ contusion Resembling the finger tips of the Murderer.
    eg ⇒ Throttling.
  - ↳ Tyre Mark ⇒ can cause Patterned Bruise

Q: Which place contusion is better felt than seen?

Ans ⇒ Scalp.

Age of Bruise

- 1-2 hrs ⇒ Red ⇒ d/t OxyHb
- 3 hr. – 3 days ⇒ Blue ⇒ d/t Deoxy Hb
- 4th day ⇒ Bluish black ⇒ d/t Hemosiderin
- 5-6 days ⇒ Greenish ⇒ d/t Hemotoidin
- 7-12 days ⇒ Yellow ⇒ d/t bilirubin
- 2 wks ⇒ Normal

"Eye" (Subconjunctival Hemorrhage) doesn't show colour change

↓↓

b'coz d/t Sufficient O_2; OxyHb never convert into Deoxy Hb

LACERATION	INCISED WOUND
Blunt weapon	Sharp weapon
Margins Irregular	Margins Regular
↓	↑
Tissues Bridges ⇒ ⊕	⊖
↳ Intact fibres & Nerves	

Hemorrhage

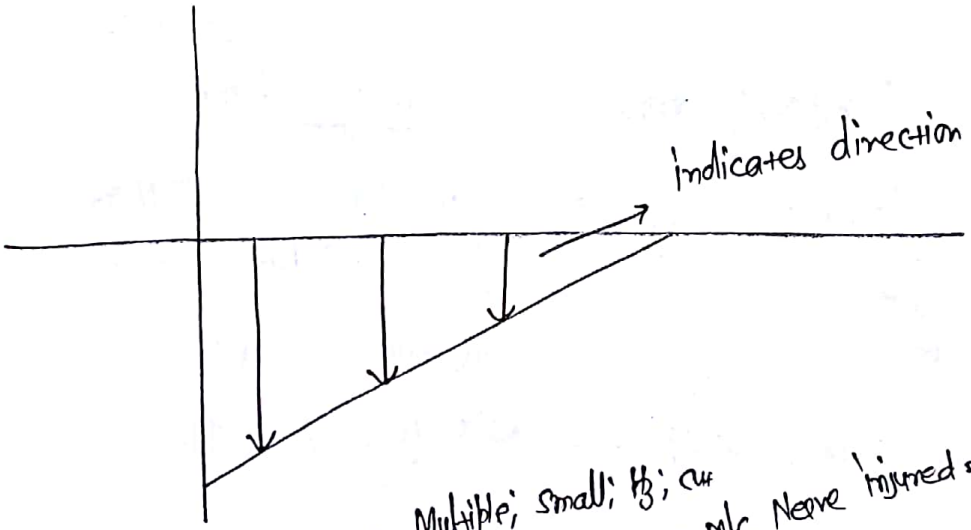
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

- INCISED LOOKING LACERATED WOUND ⇒ Over Bony Prominence
  - Appear incised; but actually Lacerated, (eg: Jaw | tibia | etc.

- LACERATED LOOKING INCISED WOUND ⇒ at Scrotum; Axilla
  - Appear Lacerated; but actually Incised.

- In Lacerated wound ⇒ Swallow tails (Y)

- TAILING OF INCISED WOUND ⇒



- Hesitation | Tentative cuts ⇒ Suicide (Rt. handed → Left sided cuts)
  - Multiple; small; Hz; cut
  - M/C Nerve injured ⇒ Median N.
  - opposite to dominant side

- Defence wounds ⇒ Indicate Homicide
  - Homicidal in Nature
  - Seen in "extensor surface of Forearm on Ulnar side"

- FLAYING | Degloving injury | Avulsion Laceration ⇒ Complete separation of skin
  - skin goes ∈ type of cause
  - Type of Avulsion (Shearing Laceration); In which shearing & grinding force by weight produces.

* Hilt contusion ⇒ (1) Indicates complete penetration;
(2) helps to know the time since injury,
(3) indicates the amount of force applied,
(4) Direction can't be assessed.

NEET'16 Q.* In Penetrating Abdominal trauma d/t stab wound ; the M/c injured organ :- (1) Liver ⇓ 40% ; (2) Small Bowel ⇓ 30% ; (3) Diaphragm ⇓ 20% ; (4) colon ⇓ 15%

• SKULL # • Frontal & Parietal bone ⇒ 6-10 mm
• occipital bone ⇒ 15 mm

Temporal bone — Thinnest bone ⇓ 4mm

Intact Scalp ⇒ 400 - 600 psi ⇒ 65 N-m
↓ Pound square inch

Force → Require # → Out Scalp ⇒ 25 psi

• Types of Skull # ⇒

1. Lineal or Fissure # | Polar # ⇒ M/c type of # (skull)
2. Depressed # | Signature # ⇒ 2nd M/c type of # (skull)
3. Ponds # | Indented # ⇒ Seen in Infants.
↳ Looks like "Ping pong ball" ⇒ so; K/a "Ping-pong #".
4. Gutter # | Bullet injuries

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

5. Comminuted # ⇒ Spider web Appearance

6. Diastatic / Sutural # ⇒ Common in Young Adult

↳ M/c suture to separate ⇒ Saggital suture

7. Motorcyclist # / Hinge # ⇒ Involves Base of skull (A/P)

8. Ring # ⇒ Seen in Fall from height

↳ # along foramen Magnum

9. Bursting # ⇒ Occurs same distance Away from site of impact

Viva: Skull # Heals w/out visible callus.

Extradural hemorrhage

- Always Traumatic
- Middle Meningeal Artery
- 100ml of Loss is fatal
- Lucid interval. can be present
  - ↳ Period of Normal b/w two Insane
- Dural hemorrhage seen in EDH
- M/c site ⇒ Parieto-occipital Region

- M/c cause of death ⇒ Respiratory Failure

also seen in ⇒ (a) Insanity; (b) Subacute / chronic epidural hemorrhage (EDH).

In Lucid interval; the person can:
(a) Make a valid will;
(b) can give valid evidence;
(c) is Legally Responsible for Act done (civil/criminal).

* Lucid interval is seen in ⇒ EDH > SDH

SUBDURAL HEMORRAGE

- Traumatic | Spontaneous
- M/c cause – Damage to Bridging vein
  - ↳ Running from cerebral cortex to dural sinuses
- seen in Boxer; called as "Punch drunk hemorrhage"
  - ↳ but different from "Boxer hemorrhage"
    - ↳ Pontine Hemorrhage

- Kernchan's Notch ⇒ U/L grooving of cerebral peduncle
- Duret's Hemorrhage ⇒ Hemorrhage in Mid brain & pones.
- Plaques Jaune ⇒ old cortical contusion after heal.

Coup injury ⇒ Injury @ the site of impact.

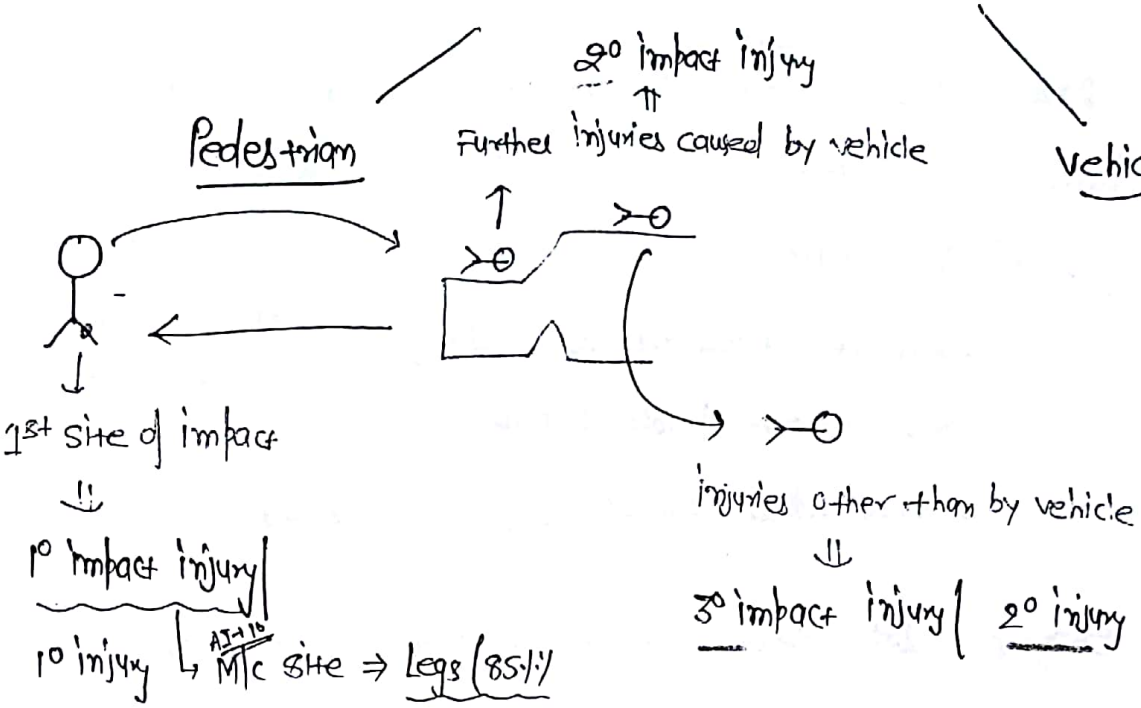
counter coup injury ⇒ away from the site of Impact
- ↳ Uncommon in occipital Region

Stationery head causes only coup injury; but Mobile head can cause both

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

TRAFFIC ACCIDENT

- Death c/in 30 days of Accident is attributed to RTA.



Whiplash injury ⇒ Hyperflexion b/b Hyperextension

Hyperextension b/b Hyperflexion. (M/c)

↳ More dangerous

↳ Stationary car hits by behind Moving car

- No damage to vertebral bodies.
- Spinal cord damaged c Anterior Longitudinal Ligament damage.

Windshield glass injury ⇒ "Sparrow feet Appearance"

↳ Causing Multiple Laceration. on face d/t impact of Face c glass & piece of glass

Seat belt Syndrome ⇒ M/c involved organ ⇒ Mesentry

if Not in option

On Driver ⇒ M/cly injured ⇒ Splen

Co-passenger ⇒ M/cly injured ⇒ Liver

- Tailgaiting ⇒ Decapitation of Motorcyclist d/t Posterior impact into heavy vehicle.

Q. RTA – 2 bodies found outside vehicle. From which of the following finding we can't differentiate b/w a driver & a co-passenger?

1. Whiplash injuries
2. Sparrow feet appearance ⇒ Passenger
3. Lineal abrasion of left shoulder ⇒ co-passenger
4. Steering wheel impact injury ⇒ Driver

Q. Enzyme 1st elevated in tissue injury ⇒ Cathepsin

Q. Ladder tear seen in usually ⇒ Driver.

Q. Rolling injuries Mainly by ⇒ hit by a vehicle of Low chassis.

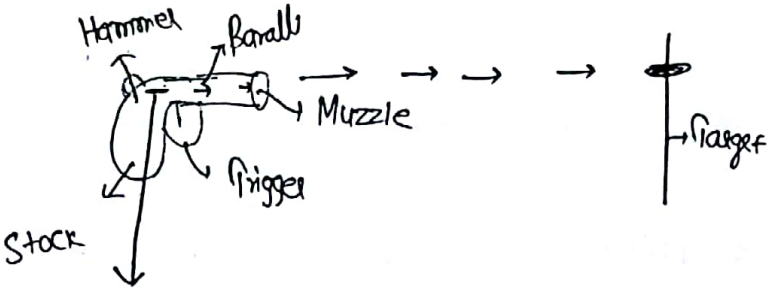
Q. Diffuse axonal injuries May show ⇒ Retraction balls.
Retrograde Amnesia;
Immediate loss of consciousness

Q. A Pedestrian is hit by a car Resulting in # of tibia. The Autopsy surgeon says that he is able to determine the direction of Impact by the apex of #. The apex of # of tibia is?

a. opposite of direction of Impact;
b. Along the direction of Impact;
c. perpendicular to the direction of Impact;
d. Not Related to direction of Impact.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

FORENSIC BALLISTICS



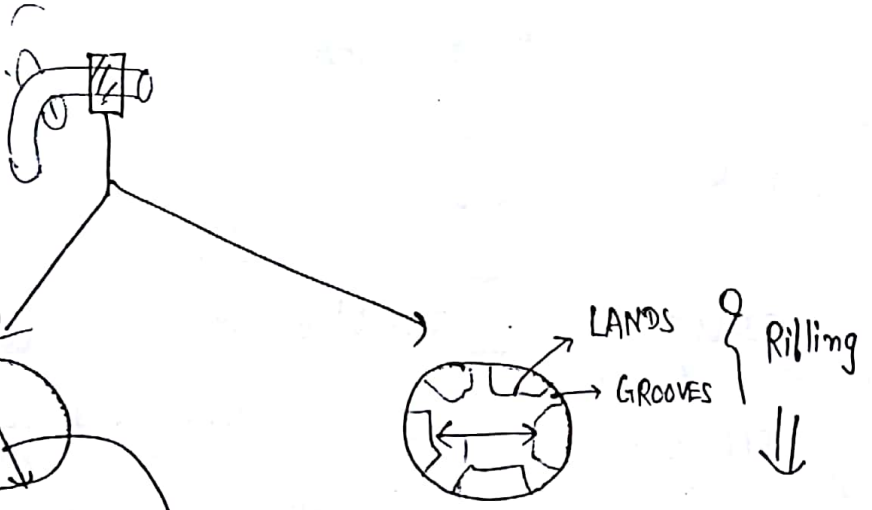
Projectile

⇓

When it is in the Barrel

⇓

Internal Ballastics | External Ballastics / Intermediate Ballastics | Terminal / Wound Ballastics



Smooth Bored weapon

eg ⇒ Shot gun

RIFLED WEAPONS

eg ⇒ Revolver;
Pistol;
Rifle.

GAUGE

⇓

Internal measure of a shotgun

CALIBRE ⇒ Distance b/w 2 Lands

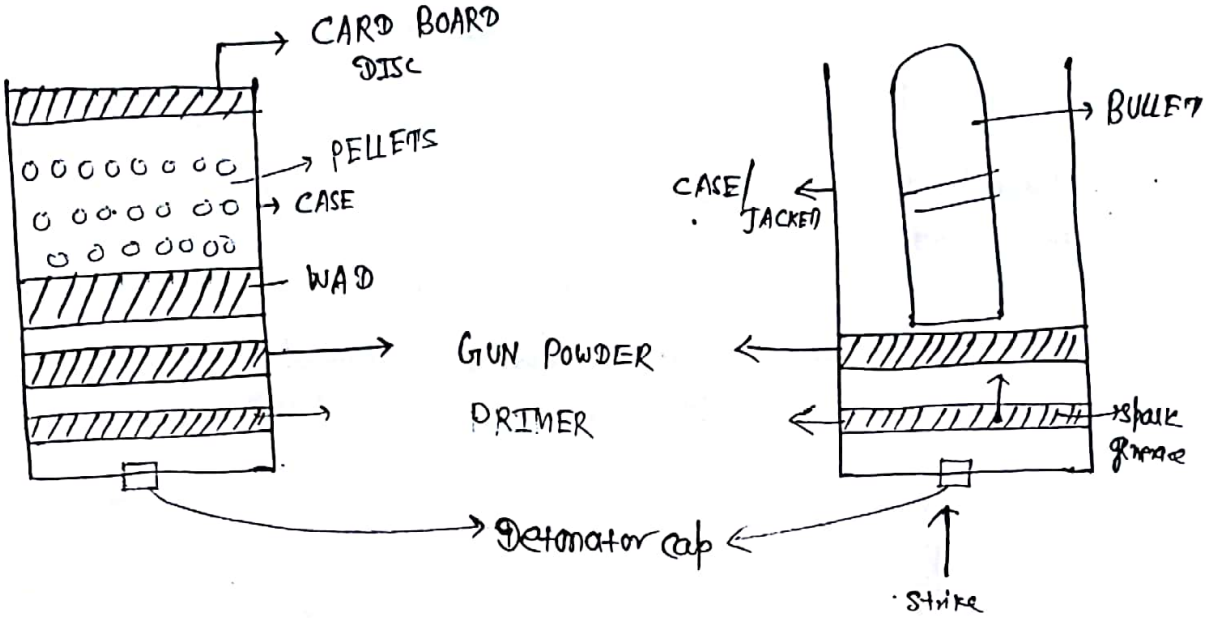
↳ Internal Measure of a Rifled weapon.

↳ Measured by "Helixometer"

PROJECTILE

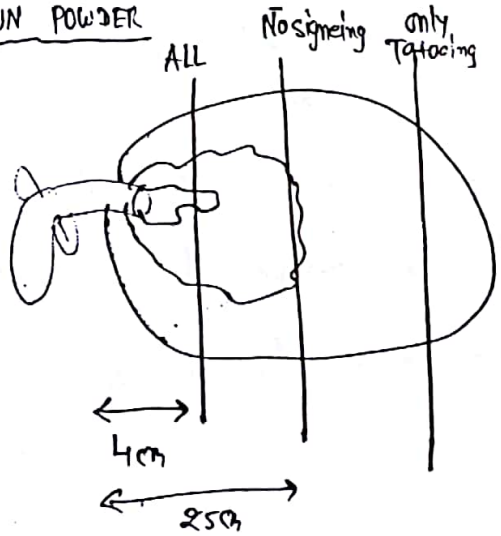
Shot gun → CATRIDGE

Rilled weapon → BULLET



effect of Gun powder

		Shot gun	Rilled weapon
FLAME	SINGEING	Seen upto 15 cm	8 cm
SMOKE	BLACKENING	30 cm	
UNBURNT PARTICLES OF GUN POWDER	TATOOING	60–90 cm	



Nothing can be seen

S/B/T helps to determine →

1. Dist. of Target from Muzzle;
2. Entry wound (Never seen as exit wound)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

ENTRY WOUND

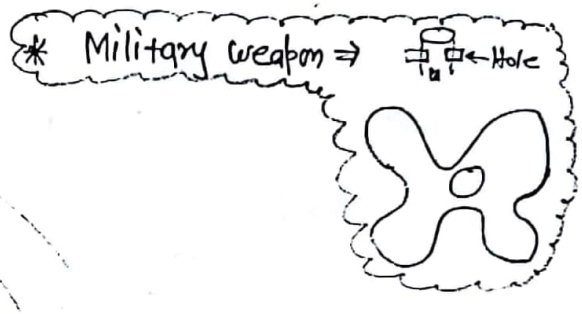
① S/B/T ⇒ ⊕

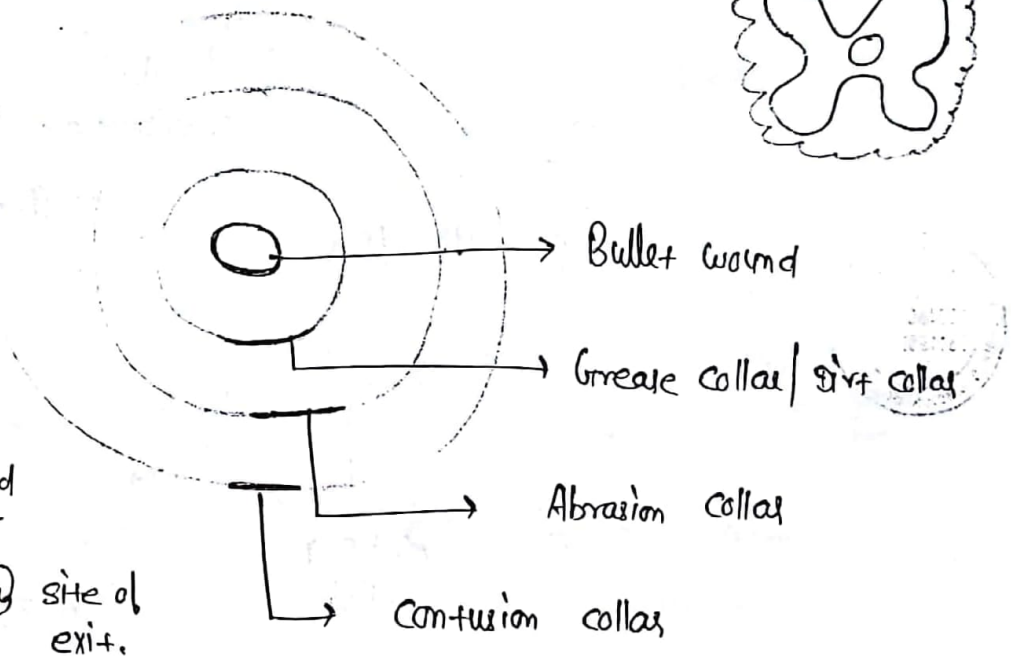
② Cherry Red colour of tissue (d/t Carboxy Hb)

→ d/t Gun Powder (so; seen in both Rifled weapon & shotgun)

Entry wound in RIFLED WEAPON

Mnemonic ⇒ CAGE





Shored exit wound
⇓
Abrasion collar @ site of exit.

Entry wound d/t shotgun

Shape of wound

CONTACT SHOT → Cruciate / Stellate shape

CLOSE SHOT (< 30cm) → oval shape

NEAR SHOT (30 cm – 1m) → Rat hole shape

< 2m → Wad

< 4m → Satellite wound

> 4m → Individual bullet wound

BACK SPATTER ⇒ Seen in Contact Shot

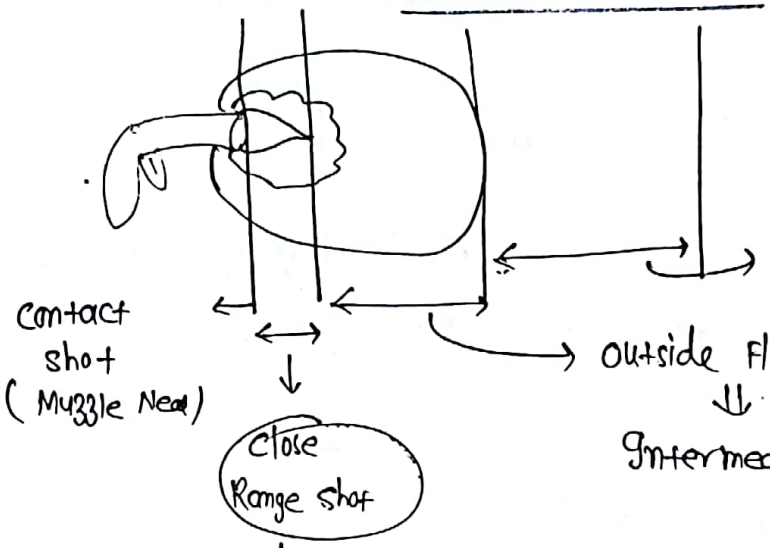
↳ gases Re-enter the Muzzle of weapon.

* S|B|T can also seen in contact shot (Loose contact Shot)

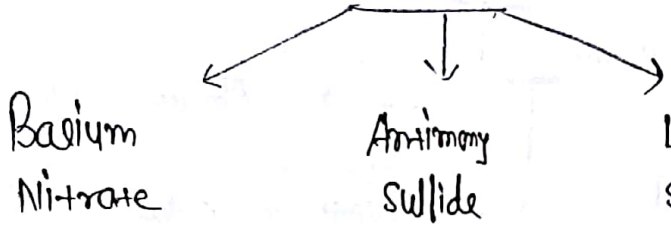
⇓

Gases have space to come out.

RANGE OF FIREARM



PRIMER ⇒ Mnemonic ⇒ BAL



GUN POWDER

BLACK POWDER

SMOKELESS POWDER

KNO_3 ⇒ 75% (supply O_2 for burning)

S ⇒ 10% (Density compound)

Charcol ⇒ 15% (Fuel)

- Designated as Fg ; FFg ; FFFg etc

Fine granules

↳ Less No. of Unburnt particle ; Min^m fattening ; Max^m gas production

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

SMOKELESS POWDER

Single Base	Double Base	Triple Base
Nitro-cellulose	Nitro-cellulose + Nitro-glycerine	Nitro-cellulose + Nitro-glycerine + Nitro-guanidine

- produce 12000 - 13000 cc/gm
- it doesn't mean No gas/smoke; Amount of Blackening is Less

Test - detect Recently fired FA

① Dermal Nitrate test / Parallin wax test
↳ Useful for determining the Nitro group base

② Harrison & Gilroy test
↳ (BAL) Primer detection

③ Neutron Activation Analysis

④ Atomic Absorption Spectroscopy (AAS);

⑤ Flameless AAS;

} + Any Metal detection

⑥ Scanning Electron Microscopy - Energy Dispersive X-rays
(Best test)
↳ Not in option; Move upward from below

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

BULLET

→ LEAD (Made of) → May Combine Antimony to make it hard.

K.E. = $\frac{1}{2}mv^2$ (Tes velocity is preferable)

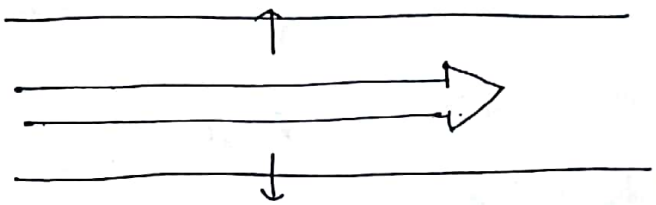
Cavitation :- Lateral displacement of tissues by projectile passes into the tissue

Seen in Rifle

→ HVP ⇒ High Velocity Projectile

⇓

b/c the more the velocity — More chance of cavitation.

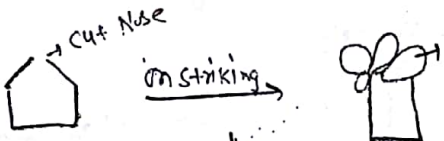


TYPES OF BULLETS

DUM-DUM BULLET ⇒ expands on striking

↳ cut @ Nose

↳ Banned b/c of Maxm damage



DMB's Producing Larger diameter wounds of limited Penetration.

SOUVENIER BULLET ⇒ prt. in body for Long time

↳ causes / complication ⇒ Pb poisoning

↳ Also "Retained bullet"

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

③ Tandem / Piggyback Bullet :⇒ one behind other

↳ Single entry by both

Distant shot May cause two entry wounds.

④ Incendrary Bullet :⇒ Contain "Phosphorus"

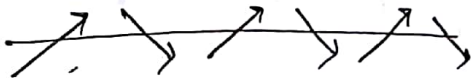
⑤ Explosive Bullet :⇒ Contain "Lead azide".

⑥ Richochet / Deflected Bullet :⇒

Bullet who stumbles (लड़खड़ाना) along his axis

⇓

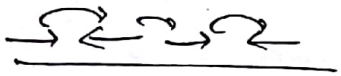
"Yawning Bullet"



Rotate around the axis

⇓

"Tumbling bullet"



"Key hole entry"

* By Single bullet we can't tell about weapon correctly.

MARKING OF BULLETS

1° ⇓ Manufacturer Marking / class Marking; → Similar for all weapons produced in same company.

2° ⇓ Individual Gun character / specific Marking.

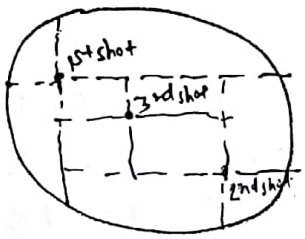
2° Markings are more specific about the weapon from which fire.

- Recovery of Bullet should always done by ⇒ HANDS ⇓ Never ∈ blunt object

→ These Markings are Not seen in shot gun as it doesn't have Lands & grooves

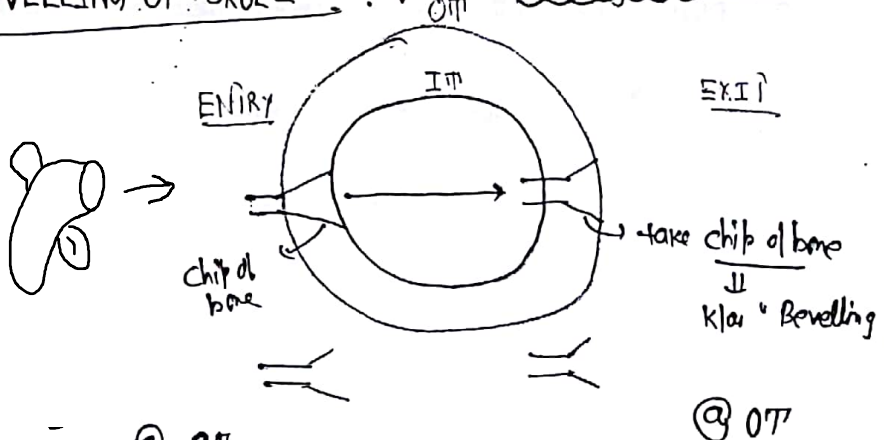
BULLET INJURIES TO SKULL

1. GUTTER's # ;
2. PUPPE's RULE
   ↳ useful to know sequence of Shots fired.



⇒ Newly formed # Lines never crossed previously # lines.

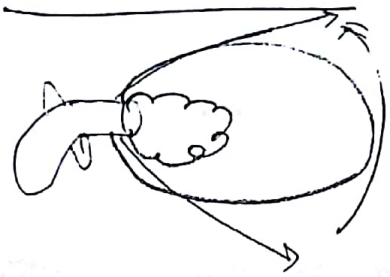
3. BEVELLING OF SKULL ⇒ Chipping of skull.



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

4. KENNEDY'S PHENOMENON :⇒ Surgical Artifacts that prevents distinguishing b/w Entry & Exit wound.
   ↳ direction of fire is assessed after knowing about Entry & exit wound

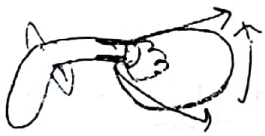
5. CHOKING OF SHOTGUN :⇒ Constriction of Muzzle End



* choking Reduce the Dispersion. In Unchoked shotgun there is full dispersion of pellets.

Full choke ⇒ Constriction of 1 mm

Half choke ⇒ Constriction of 0.5mm



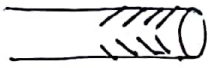
Cylinder Bore weapon ⇒ 0 mm

$$\text{Spread} = \text{Range} \times \frac{3}{2} \quad (\text{for Cylinder Bore weapon})$$

$$\text{Range} \times \frac{3}{3} \quad (\text{for Half choke weapon})$$

$$\text{Range} \times \frac{3}{4} \quad (\text{for Full choke weapon})$$

6. PARADOX GUN :⇒ Smooth Bore weapon c rifling @ the end.
   ↳ combination gun that can fire both pellets like a shotgun & paradox bullets Like a Rifle.



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

BLAST INJURY

- 1° Blast injury ⇓ Caused by "Shock wave" ⇓ M/c damage organ ⇓
  1. Ear / Tympanic Membrane
  2. Lungs

  M/c in Underwater Blast ⇓
  1. GIT

  M/c Head Immersed ⇒ Ear

- 2° Blast injury ⇓ Projectiles ⇓ M/c ⇒ Skin organ
- 3° Blast injury ⇓ Blast winds
- 4° Blast injury ⇓ M/c. factors Like Fire / Flood etc.

* Homogenous solid organs like Liver & Muscle are usually Not affected

* Shock wave ⊕ Projectile ⇒ Return by Negative pressure suction.

is Not a part of Marshall △

MARSHALL'S TRIAD

PUNCTATE

- Abrasion
- Contusion
- Laceration

MOLOTOV'S COCKTAIL

- Home Made Bomb
- Incendiary Bomb
- Petrol Bomb we; Not Kerosine

Q. Stability of the bullet is given by ⇒ Rifling.

Q. A tyre passes over the leg of a person resulting in Tyre Mark. What is the injury?

a) Pressure abrasion
b) Imprint abrasion
c) Patterned abrasion
d) Bruise

a) Pressure Abrasion
b) Imprint "
c) Patterned Bruise
d) Bruise

Q. Ladder tears are usually seen in → (a) Driver;
(b) Front Seat Passenger;
(c) Pedestrian;
(d) Rear seat Passenger.

Q. Agonal Artifact ⇒ Perimortem Artifact.

Q. Which of the following is Not a Manifestation of shaken baby syndrome?
a) Burns; b) Retinal hemorrhage; c) Rib #; d) SDH

Q. Not a feature of Post Mortem clot?
(a) Yellow chicken fat appearance; b) Adherence to wall; c) Red currant jelly appearance
(d) Friable

Q. Pyrogallol test is used to differentiate ⇒ Air embolism from putrefactive gas.

Q. Pink teeth in decomposed bodies is seen in death d/t ⇒
(a) Asphyxia; (b) Co Poisoning; (c) CN Poisoning (d) None of the above

Q. In water; Putrefactive changes are 1st seen in ⇒
(a) Face; (b) chest; (c) Upper limbs; (d) Abdomen

Q. After tooth injury; in how much time the Socket is completly filled c organise clot?
(a) 1-2 days; (b) 1wk; (c) 2-3mth; (d) 6mth

Q. Affiliation cases Refer to?
(a) Legitimacy; (b) Atavism; (c) Supposititious child; (d) Suits for Adoption

Q. In Advanced decomposition which one of the following can be detected
(a) valvular lesion of heart;
(b) Thrombus in coronary vessels;
(c) Ligature Mark of hanging;
(d) Laceration of brain

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Thermal Injuries

Cold

Dry

* Frost Lip;
* Frost Bite → Seen at -20°C

Wet

* Chilblains / Perniosis
* Trench foot → Seen at 5°+0 8°C

Heat

* Sequence of event in Frost bite ⇒
  - Erythematous patches ⇒ Few hours
  - Soft blisters ⇒ 24-36 hours
  - Hard & black ⇒ 2 weeks
  - Deep upto the Bone ⇒ 1 Month.

* Hypothermia < 35°C
* Hypothalamus stop functioning < 32°C
* <26°C ⇒ Death occurs.

⇓

Thermoregulation Stops working

⇓

** "Vasodilation Peripheral"

⇓

Person feels hot & Removes cloth; so;

** "PARADOXICAL UNDRESSING"

⇓

Subsequently Hide behind Chair, Sofa

⇓

Mental confusion

⇓

Found dead over there ⇒ Hide & die Syndrome a/w hypothermia

THERMAL INJURIES

Caused by heat

Heat Syncope also k/as "Heat exhaustation / Heat collapse / Heat Prostration".

- Localised effect of Heat
- Systemic effect of Heat
  - also k/a "Firemen's cramp"
  - Heat cramp | Miner's cramp | Stoked cramp
  - Heat Syncope
  - Heat hyperpyrexia / Sun stroke
  - Heat Stroke / Thermic fever

Heat cramp & Heat Syncope → Body temp. (N)

Heat Syncope → caused predominently by vasodilation

Compensatory Mechanism by Hypothalamus

↳ By Sweating & vasodilation

↓

both are seen in cramp & syncope both.

caused by predominent Sweating

Temperature ⇒ Normal

Seen when body temp >41.5°C / 106°F

⇓

Hypothalmus stop functioning

Elevated → Rise Temp.

No Sweating

Pin-point pupil seen (< 1mm size)

↳ also seen in ⇒ Pontine hemorrhage
Morphine poisoning
OP Poisoning

Ⓐ Sweating

↓

Loss of H_2O, electrolyte

↓

Dehydration; Dyselectrolytemia

↓

Heat cramps

Ⓑ Vasodilatation

↓

- Predominent

↓

Peripheral pulling

↓

↓ venous Return

↓

Cerebral hypoxia

↓

Syncope (Heat Syncope)

Localised effect of Heat

1. **Burns** – Minm temp. ⇒ 44°C for → 6 hr.
   45–51°C ⟶ time ↓ by $\frac{1}{2}$ on 1°C ↑
   65°C ⟶ 2 sec.

Classification

Dupytren's – divide into six degree

- 1° – Limited to epidermis → Wilson's Epidermal
- 2° – Reaching upto upper part of dermis
- 3° – Reach upto lower dermis → Dermo-epidermal
- 4° – upper part of Muscle
- 5° – → Deep burns
- 6° – Muscle & bone / Bone → Painless burns (N. endings are also destroyed)

2° burns are More Painful
3° burns are Painless

- **Calculation of Burnt area**

Ⓐ **Lund & Browder chart** :- Used in Age < 15 yr.
Best Method to calculating Burnt Area

Genitalia = 1% Total body surface Area

Face ⇒ 7%
Neck ⇒ 2%
Head ⇒ 10%
Front & Back of Trunk = 13% Each
Each upper Limb – 10%
Buttock – 2.5% each
Lower Limb – 24% each

Area of Body	In children (Lund & Browder chart)			In Adults (Wallace's formula)
	1-4	5-9 yr	10-14 yr	Adult
Head & Neck	19	15	13	9
Trunk (Front)	16	16	16	18
Trunk (Back)	16	16	16	18
Upper Limbs	19	19	19	18
Lower Limbs	30	34	35	36
Genitals	0	0	1	1

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(B) Wallace's Rule of Nine :⇒ Used in Age > 15yr

Genitalia = 1% TBSA

(C) Palmer's Rule :⇒ Patchy burns

Palm = 1% TBSA.

ANTEMORTEM BURNS

- Presence of soot in trachea
- Measure Level of COHb > 5% in Non-Smokes
  > 10% in Smokes
- Tes cyanide (Nylon burn → cyanide)
- Crow feet appearance
- Signs of healing (Yellow coloured contusion)
- Vital Reaction = sign of healing

POST MORTEM BURNS

- Heat Hematoma
  - Honey comb appearance
  - Light chocolate colour
  - Resembles EDH

- Heat Rupture
  → Resembles Laceration (irregular Margin)
  - No Bleeding seen
  - Blood vessels intact

- Heat Fracture
  → Crosses over Suture line

- Cause of death :-

M/c immediately CCD ⇒ Neurogenic Shock
CO Poisoning

< 48 hr ⇒ Shock (Hypovolemic Shock)

> 48 hr ⇒ Sepsis (Septicemic shock)

Q. Minm % of Coth Req. to give cherry Red colour
— 20%.

2. SCALDS :- Caused by Moist heat
temp. > 60°C

3 CHEMICAL BURNS :- Prn in → Trickling
Splashing
Never seen → Singeing of Hair
Blisters

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

4. ELECTROCUTION ⇒ "Joule burn" seen

↳ Endogenous burn

⇊

Normal burn is exogenous burn

central depressed Area

⇊

Elevated peripheral Margin.

HPE ⇒ Streaming of Nuclei.

Most Resistant part to electric current :→

Dry Skin >>> Bone >> Moist skin

COD ⇒ Ventricular fibrillation (M/c) ⇒ if path is through heart

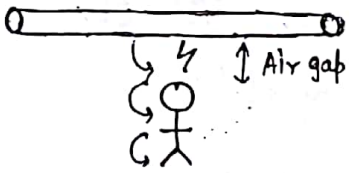
⇊

follow Route of electric current. Medullary paralysis ⇐ if path is through Brain

5. FLASH / SPARK BURN ⇒ Arching of current

⇊ Result in

Crocodile skin appearance



* Most Dangerous path of electric current ⇒ From Left hand to Right foot.

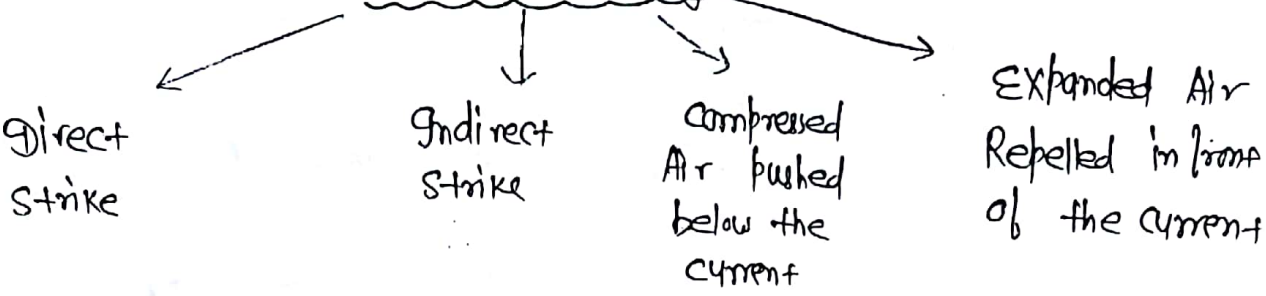
* Judicial electrocution carried out ⇒ In U.S. (United state)

5. Lightening ⇒ Filigree | Arborescent burns | Lichtenberg's flowers

↳ M/c site ⇒ Shoulder | Flanks.

Inverted fir tree appearance

Mechanism of Injury



⇒ Lightening bolt can cause injury Resembles to Blunt Trauma.

Q. Which of the following is Not suggestive of Inhalational Burn injury?

a) Yellow sputum;
b) Singeing of hair;
c) Facial Burns:
d) Hoarseness of voice.

STARVATION

- Feeling of Intense hunger lasts for ⇒ 30-48 hr
- Gall bladder distended, d/t accumulation of bile from Lack of stimulation.
- Food & water Stopped → death — 10 days
- Food Stopped — death — 60 days.
- Urinary Ketones — Time of Intervention
  ↳ to forcefully feed the person

* Hunger Pangs ⇒ when hunger contractions start to occur in the stomach; they are informally referred to as "hunger pangs".
- GI usually don't begin until 12 to 24 hours after last ingestion of food.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

ASPHYXIA

↳ i.e Pulselessness

SMOTHERING ⇒ External compression of Nose & Mouth
↳ Lips; Gums; Tongue; Inner side of Nose May show bruising or Laceration

GAGGING ⇒ Obstruction of oro-Nasopharynx by Any imprevious object.
i.e filling piece of cloth in Mouth

CHOKING ⇒ Internal obstruction of the upper Respiratory tract

POSTURAL ASPHYXIA ⇒ Wt of self compresses the chest
↳ seen in "JACK-KNIFE" Position

TRAUMATIC ASPHYXIA ⇒ Wt. of other compress the chest
↳ characteristic finding ⇒ Mosaic ecchymotosis (DNB + 15)

BURKING ⇒ Homicidal Smothering & Traumatic asphyxia

* Smothering Resembles endotracheal Intubation injury.
↳ if Not in option; Throttling ties

HANGING ⇒ Constricting Force ⇒ Wt of body

Typical
Knot → occiput (@ Nape of Neck)

Atypical
Knot → Anywhere else
Judicial hanging ⇒ Left Angle of Mandible
C_2-C_3 #
↳ Hangman's #
Jalleson's # ⇒ C_1 #
Undertaker's # ⇒ C_6-C_7 #

Hanging also of

- Complete
- Incomplete / Partial
  - Some parts of body touches the Ground
  - ⇓
  - constricting force ⇒ weight of the head (5-6 kg).

- Most characteristic sign of Hanging
  - ⇓
  - Ligature Mark ⇒ > 80% above thyroid cartilage

- Most characteristic sign of Ante-mortem Hanging
  - ⇓
  1. Dribbling of saliva
  2. La facies sympathetique
     - ⇓
     - compression of cervical sympathetic chain
       - Same side
         - Eyelid open
         - Pupil dilates

Pressure of		Compresses		COD
2 kg	⇒	Jugular vein	→ M/c damage →	Venous congestion
5 kg	⇒	Carotid artery	→	Cerebral Anemia
15 kg	⇒	Trachea	→	Asphyxia (M/c COD)
20 kg	⇒	Vertebral artery		

Amussat's sign
⇓
Tear in intima of carotid Artery

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

STRANGULATION

CONSTRICTING FORCE ⇒ Other than wt. of Body.

Ligature ⇒ Ligature strangulation

Manually ⇒ Manual strangulation / Throttling

Bamboo sticks ⇒ Banadola

Elbow ⇒ Mugging

Judicial strangulation ⇒ Garrotting

↓

"Spanish windlass technique"

↳ Practice in spain.

	# Hyoid	# Thyroid	#cricoid
Hanging →	15-20%	--	--
Strangulation →	30-40%	+	Rare
Throttling →	40-50%	+	+

Throttling
- ① Adduction / Inward compression # of Hyoid
  Junction of Inner 2/3rd & outer 1/3rd of greter corny
- ② # cricoid cartilage

Highly suggestive of Throttling

Lynching ⟶ Homicidal hanging by Mob.

Cafe Coronary ⇒ Dr. R. Haughen ; Intoxicated individual & following Large dose of tranquillizers.

↓

Gag Reflex suppressed

↳ COD → Cardiac arrest

↓

→ Asphyxia → Choking

M/c by "chicken food"

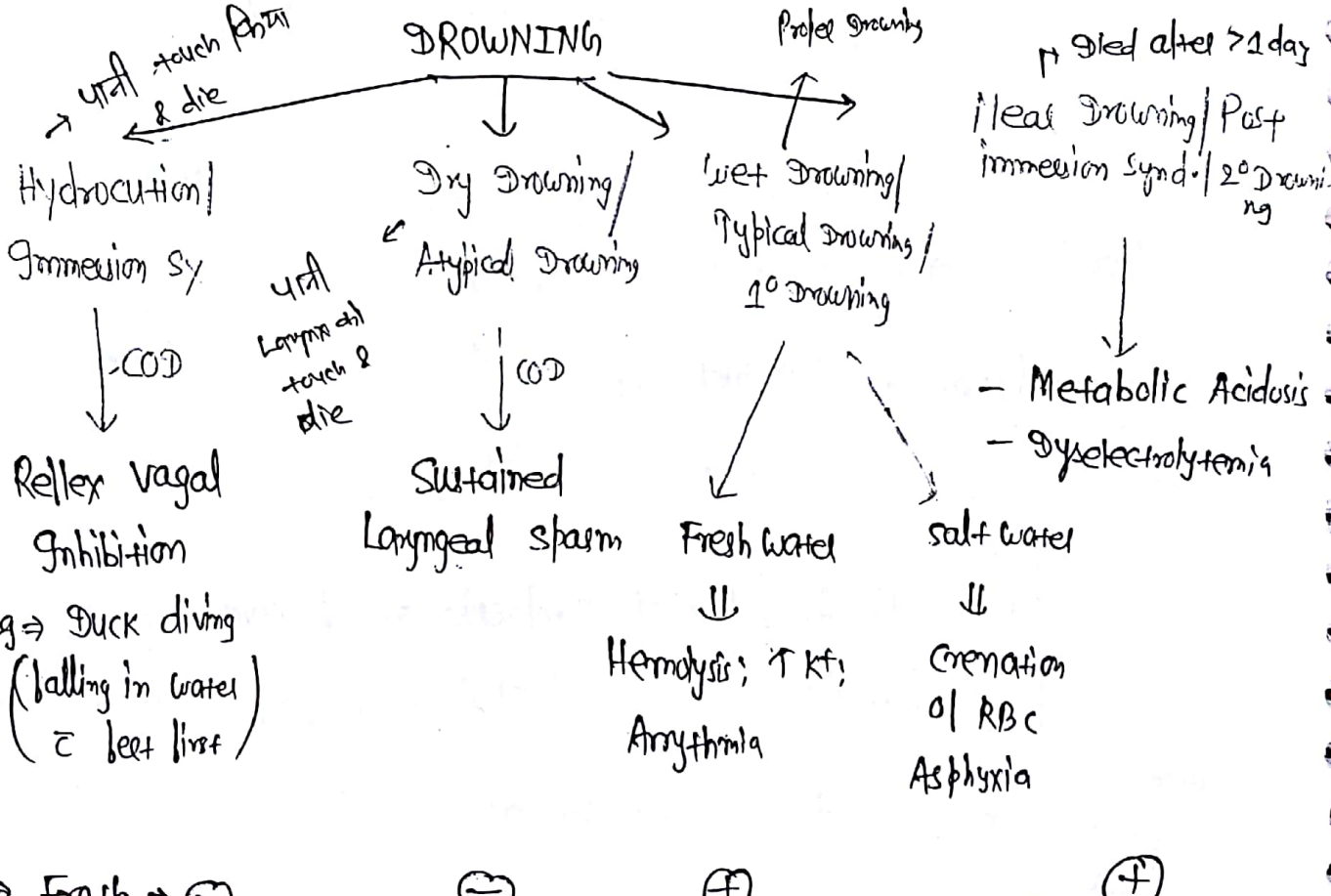
Rx ⇒ Heimlich Manoeuvre

↓

Modified Heimlich Manoeuvre for Infants

↳ Also "Choking Rescue Procedure"

↳ It is external choking by bolus of Food obstructing Larynx.



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Froth ⇒ Contain of Respiratory Passage + Aspirated water.
(Mucus + Air + Surfactant)

Pathology of Drowning ⇒

Fresh water Drowning ⇒ Hypotonic → Cells loose H_2O → Hemolysis d/t Swelling & Bursting

Salt water Drowning ⇒ Hypertonic → plasma conc^n ↑ → R.B.C Looses water
↓
Crenation of R.B.C
↓
Asphyxia ← Can't take O_2

Dangerous ? Fresh water : Dies in 3-4 min
Salt water : Dies in 8-12 min.

PM appearance of Drowning ⇒

Grass & weeds in hands
⇓
Cadaveric spasm
⇓
Seen in AM

Washerwoman's hands & feet
⇓
≥ 24 hr (Body in water)
⇓
Seen in both AM/PM

Cutis Anserina / Goose flesh
↓
AM/PM
↳ d/t Riger Mortis

PM appearance of Lung ⇒ Alive & conscious (in AM Drowning)

Found only in wet drowning ← Emphysema aquosum (water logged: heavy voluminous Lungs)
Not in dry drowning
↓
Lungs became bulky
Paltaulk hemorrhage — Subpleural hemorrhage
Emphysema

DIATOMS ⇒ Microscopic Algae

↳ Shell Made of Silica ⇒ Frustule

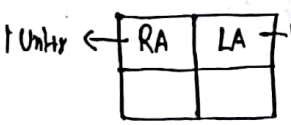
- Diatoms of < 60 microns enter Pulmonary circulation
- ⊕ of diatoms in systemic circulation ⇒ Confirm AM Drowning
- Maxm Diatoms are seen in ⇒ BM of Femur
  but for preservation used "Sternum"
  Best organ to detect Diatom ⇒ Kidney
  Test ⇒ Acid Digestion test
  ⇓
  Concn HNO_3.
- Most characteristic Signs of AM Drowning ⇒

Grass & weeds in Hands > Emphysema aquosum > Palataul's Hemorrhage > Diatoms in systemic circulation > Froth.

* Strontium Rise ⇒ Suggestive of AM Drowning

* Intimal damage to Carotid Artery ⇒ Hanging ∈ a Drop

GETTLER'S TEST : Used to determine Salt / Fresh water death.
if the difference of Cl⁻ b/w two Atria ≥ 25% ⇒ ⊕

eg ⇒ 

⇒ 90% ⇒ ⊕

* Normally the chloride content is equal in the Rt & Lt. chambers of heart (600mg / 100ml).

* if Cl⁻ ↑ in LA ⇒ Salt water Drowning;
* if Cl⁻ ↓ in LA compared to RA ⇒ Fresh water Drowning;

exceptions ⇒ a) In ASD
b) Decomposed body
c) Brackish water (Isotonic H_2O)

} Gettler's test is Not useful

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

IMPOTENCE & STERILITY

IMPOTENCE → Inability to perform Intercourse ⇓ ground for divorce

STERILITY → Inability to beget children ⇓ No Ground for divorce

Frigidity ⇒ Female Impotence

- Vaginismus → Spasm of Adductor of thigh.
- Vagina is abi

Anti Rape Muscle ⇒ Gracilis (Adductor of thigh).

* M/c cause of

Impotence ⇒ Vasculogenic

Temporary Impotence ⇒ Psychogenic

* QUOAD HANC – Selective impotence

	CONSENT OF SPOUSE
MTP ⟶	✗
Steilization ⟶	✗
Artificial Insemination ⟶	✓

SURROGACY REGULATION BILL, 2016

- No Law Regulating Surrogacy in India

Commercial surrogacy – Not allowed

- only the patients who are infertile (after 5 yr of unprotected intercourse)

Surrogate — close Relative

- Should have one child of his own
- only once (excluding failed attempts)

♀

Virgin
↓
Never experience sexual intercourse

Defloration
↓
Loss of virginity
↓ Sign
Dilatation of vagina

False virgin
↓
Have Intercourse but hymen intact

Hymen
(Mucosal Fold)

Not Ruptured in
- Riding
- Jumping
- Dancing

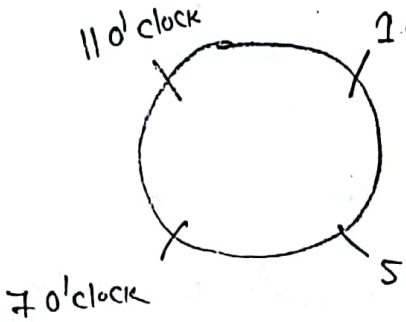
In children — deep seated; so; Not Ruptured

is Ruptured in
- Sexual Intercourse
- Masturbation
- Sanitary tampons
- Trauma
- Sola pith
  ↳ used to Make PV for sexual intercourse

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Mc site of Rupture of Hymen :→

Anterolaterally ⇒ On Mastubation/Fingering



5 o'clock ⇒ On Sexual intercourse

Postero-Laterally

Glaister Keene Rod :→

↳ Instrument used to inspect hymen.

Type of hymen :→ Crescenteric hymen (Mlc).

↳ Also "semilunar hymen"

↳ Fimbricated hymen Resembles torn hymens.

Carunculae Myrtiformes ⇒ Remnants of hymen seen after child birth.

	Nulliparous Uterus	Paras uterus
Cavity ⇒	Wall convex from Inside	Concave
External os ⇒	Circular	Slit like

	True virgin	False virgin
Intactness ⇒	Hymen intact & Inelastic	Hymen intact but elastic
Hymen opening ⇒	Barely admit tip of little finger	Admits two fingers easily
Edges ⇒	Distinct	Undulated.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Artificial Insemination

A·I· HUSBAND (A·I·H) → 1st Best

A·I· HUSBAND DONAR (A·I·H·D) → 2nd Best

A·I· DONAR (A·I·D) → 3rd Best.

* APTAE VIRIS ⇒ Making a female fit for sexual act/intercourse

* NONAPTAE VIRIS ⇒ A female Not fit for sexual intercourse

BATTERED BABY SYNDROME

*

→ Known as "Caffey's syndrome"

– Non-accidental injury of childhood

Features – a) Repeatedly came for Rx ;
↳ But came Late

b) Inconsistant history & examination;

c) Different age of injury are found.

Most imp. clinical features – a) Oblique # / Spiral #

(b) SDH can be seen ← Shaken Baby Syndrome / Infantile whiplash Sx

(c) String of beads appearance : seen on chest

(d) Six penny bruises

MENTAL HEALTH ACT, 1987

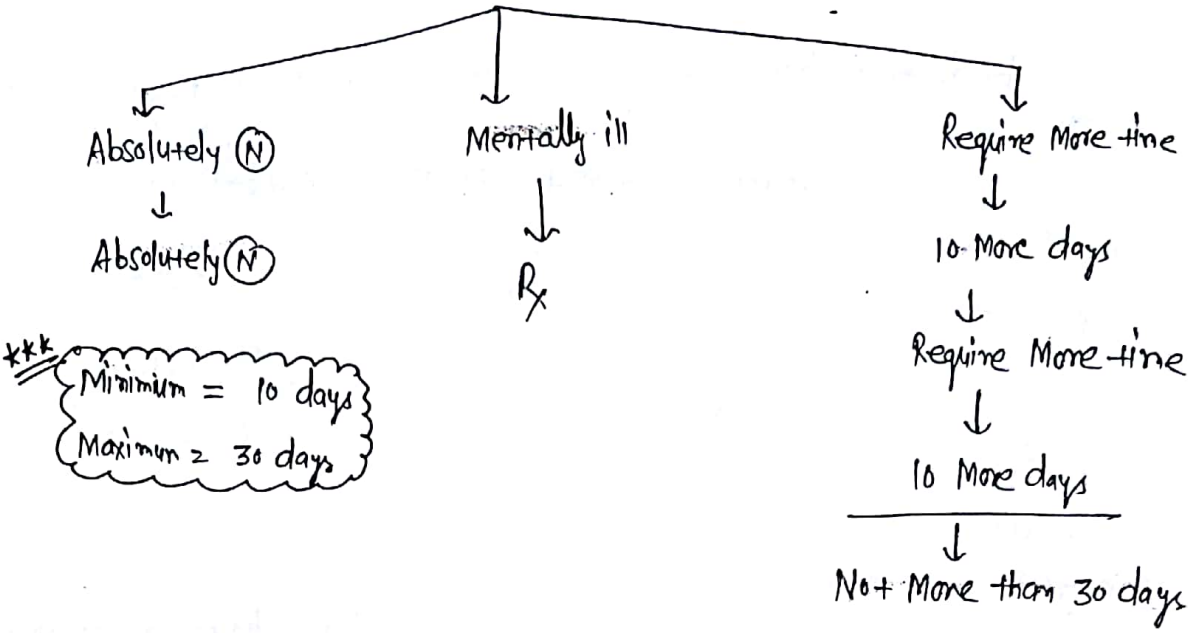
• Before this: In India there was "Indian Lunacy Act 1912"
↓ Replaced by
Mental health act, 1987

Mental health care Act, 2017 ← Replaced by

* "Mentally ill Person" is to be addressed (by) Should produce → Magistrate in front of → Passes → Receptionist
Admitted to Mental

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* On these 10 days ; 2 doctors Examine thrice
  2 Doctors
  3 examination



*** Minimum = 10 days
Maximum = 30 days

* MTP ACT, 1971

. Last Amended ⇒ 2003

. Based on Declaration of OSLO : (Therapeutic Abortion)
- Humanitarian – Rape
- Eugenic ground – Chromosomal Anomalies
- Social ground – Failure of contraception
  Poor Socio-economic cond^{n} of Parents
- Therapeutic ground – if Mother's Life is Endangered

* < 12 wks : 1 Doctors
  12-20 wks : 2 Doctors
  > 20 wks : Under therapeutic grounds only (irrespective No. of doctors ; irrespective of experience; irrespective of Knowledge)

* Consent of Husband is Not Required;
* Consent of only women is Required (if she is over 18 yrs & sane) & Consent of Parents/guardian is Required if she is below 18 yrs or above 18 yrs but insane

MTP (Amendent) Bill, 2014 (Not Act)

* Should be increased till ≤ 24 wks
* Not only Allopathic; but also Elite doctors should be allowed (BHMS / Ayurvedic / Unani)

http://mbbshelp.com . WhatsApp: +1 (402) 235-1397

THANATOLOGY

- Study of death in all aspects
- Bichat | Bishop ⇒ Tripod of Life

Modes of death | Atria Mortis

- Brain — Stop functioning → Coma
- Heart ——————→ Syncope
- Lung ——————→ Asphyxia ✗

Not Mention in Death certificate

Somatic | clinical death ⇒ Some cells are died; Some are alive

↓ (1-2 hrs) → Supravital period

Cellular | Molecular death

After death (0.5-1 hr) → Topically instill 1% Atropine in eye

⇓

??? Pupil

↳ Irregular dilatation of Pupil

‖

b/c only Live cells are Responding; dead cells are also ⊖

Tsako's Phenomenon → About 1 hr of death

- Knee jerk (elicit)

⇓

Contraction of Quadriceps.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Post Mortem changes

Immediate (Somatic death)

1. Insensibility & loss of voluntary power (earliest sign of death)
2. cessation of Respiration
3. cessation of circulation

Early (cellular death)

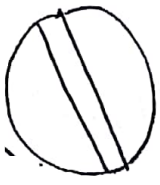
1. Pallor & Loss of elasticity of skin
2. Eye changes
3. Algor Mortis
4. Livor Mortis
5. Rigor Mortis

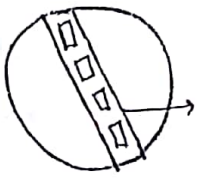
Late

1. Putrefaction – Surest sign of death
2. Adipocere formation
3. Mummification

Eye changes

- ↓es in IOT ⇒ Earliest
  1½ @ death
  Zero in 2 hrs.
- Rise of Potassium in vitreous humous (MIDEA's FORMULA / STURNER's Equation)
- Cornea ⇒ Hazy in 2 hrs.
- Kevorkian sign / Cattle trucking ⇒ Trucking of blood in blood vessels
  ↳ Seen in Minutes ; by Ophthalmoscope.





→ Trucking of blood d/t cessation of circulation

Sign seen Maxm upto 2 hrs. (till cornea became hazy).

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

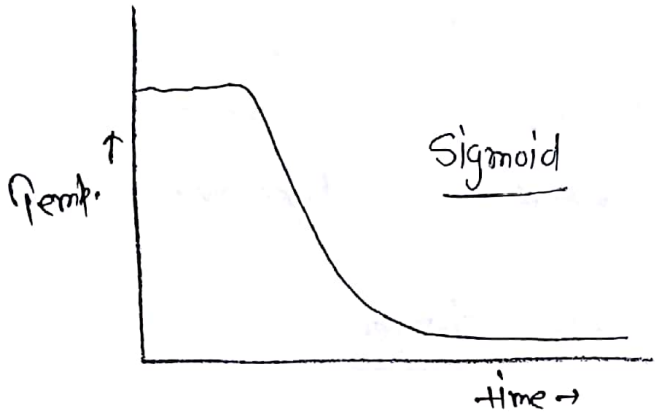
Tache Noir ⇒ Accumulation of Debris on Sclera

⇒ Eyelids – open after death

⇒ About 3 hrs.

↳ Resembles to Pterygium.

ALGOR MORTIS → Cooling of body After death



- temp. doesn't fall till 30-60 min. after death.

- Recording body temp. ⇒ ⓐ Rectum

↳ but in Sodomy

⇓

Inferior surface of Liver

⇓

by " Thanatometer "

⇓

Length ⇒ 25cm

ⓑ Tympanic Membrane

ⓒ Intranasal = cribriform plate

- Rate of Cooling ⇒ 0.5 – 1.5°C/hr. OR 1.5°/hr

↓ Summer ↓ Winter

Q* on 25th June 7am; R/T = 31°C. Time since death?

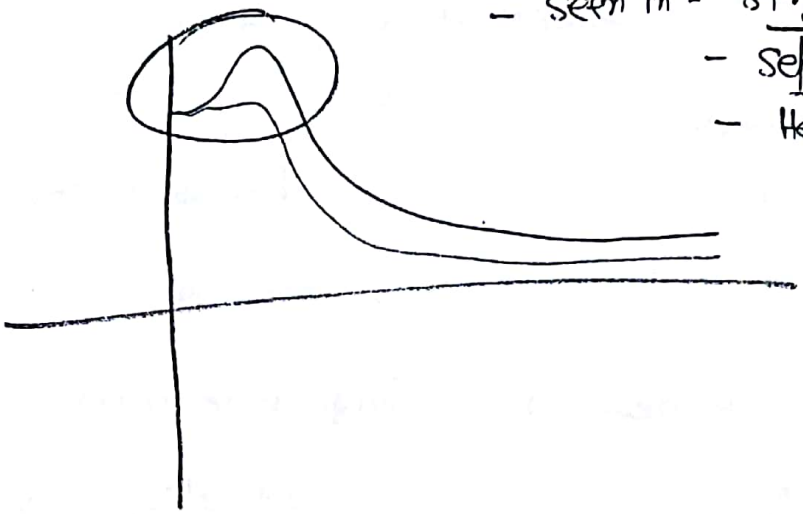
1. 23/6, 7PM
2. 24/6, 7AM
3. 24/6, 7PM
5. 25/6, 7PM

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Post Mortem caloricity

Rise of Body temp. 1-2 hr of death.

- Seen in - Strychnine Poisoning
  - Septicemia
  - Heat Stroke



Hypostasis | Liver Mortis | PM staining | cadaveric Lividity | Suggilations | vibices | Darkening of death.

- Gravitation of blood in dependent parts
- Area of Surface Flattening | contact flattening
- Uses - 1. Posture of body

1st seen over Neck - Supine position

Glove & Stocking position of Hypostasis ⇒ Hanging

If body is continous flowing in water ⇒ No Hypostasis

2. Time Since death

- Starts in 1/2 - 1 hr in patches
- 2-4 hr coalesce together
- 4-6 hr well developed
- > 6 hr Fixed

3. Cause of death :⇒ a> colour changes in hypostasis;

See in Forensic Medicine simplified on bb page

b> Indices for determining gender;
c> different declarations;
d> Torture;
e> smell in different poisonings

⇓

(N) colour after death ⇒ Bluish-purple colour.

Poisoning		colour
i>	CO	Cherry Red
ii>	CN	Bright/Brick Red
iii>	Nitrates/Kt chlorate	Reddish Brown
iv>	Aniline	Reddish Brown > Blue
v>	Phosphorus	Dark Brown
vi>	Hydrogen Sulphide (H_2S)	Bluish green
vii>	KCN	Deep blue
viii>	opium	Black
ix>	Hypothermia	Pink

DIFFERENT DECLARATIONS

AIIMS 05, 17

① Declaration of Tokyo :⇒ Says about "Torture & Medicine"
(1975) ↳ says A doctor can't use his Medical knowledge for torture.
↳ It pertains to offences commited to board Aircraft (DNB)

② Istanbul Protocol :⇒ deals ≈ documentation of torture in torture victim.
How to document TORTURE.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(3) Declaration of Istanbul :⇒ Deals ē organ trafficking.

(4) Declaration of OSLO :⇒ Deals ē Therapeutic Abortion;

(5) Declaration of Geneva :⇒ Modernization of Hippocratic oath;

(6) Declaration of Helsinki :⇒ Deals ē Human experimentation & clinical trials;

(7) Declaration of Lisbon :⇒ Deals ē Patient Rights;

(8) Declaration of sydney :⇒ Deals ē Brain death,

(9) Declaration of Malta :⇒ Deals ē Role of doctor in Hunger strike

⇓

- Can't interfere to one's hunger strike
- Forceful feeding is Not allowed,

⇓

but if any govt. offices (eg= Narender Modi) told to break the strike

↳ then by Article 21 we can force people on hunger strike to eat,

(10) Declaration of Hamburg :⇒ Support for doctors refusing to participate in or other form of cruel; inhuman or degrading treatment

(11) Declaration of Munich :⇒ Racial; Political discrimination in Medicine.

(12) Declaration of Venice :⇒ Terminal illness

(13) Declaration of Seoul :⇒ Deals ē Professional Autonomy & clinical Independence

(14) Declaration of Madrid :⇒ Deals ē Professional Autonomy & self Regulation.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

INDICES FOR DETERMINING GENDER

Indices	♀	♂
1. Ischiopubic index (Washburn's Index) $\left(\frac{\text{Pubic Length}}{\text{Ischial Length}} \times 100\right)$	⇒ 91 to 115	73–94
2. Pubic Ramus Ratio	⇒ 2:1 or greter	1:1
3. Sternal Index $\left(\frac{\text{Length of Manubrium}}{\text{Length of Body}} \times 100\right)$	⇒ 54.3	46.2
4. Corporo-basal Index $\left(\frac{\text{Breadth of 1st Sacral vertebra}}{\text{Breadth of base of Sacrum}} \times 100\right)$	⇒ 40.5	45
5. Sciatic-Notch Index $\left(\frac{\text{Width of Sciatic Notch}}{\text{Depth of Sciatic Notch}} \times 100\right)$	⇒ 5 to 6	4 to 5
6. Sacral Index $\left(\frac{\text{Transverse Diameter or Breadth of base of Sacrum}}{\text{Length of Sacrum}} \times 100\right)$	⇒ 116	112

INDICES TO DETERMINE RACE

INDICES	EUROPEANS	NEGROES
7. Crural Index $\left(\frac{\text{Length of Tibia}}{\text{Length of Femur}} \times 100\right)$	⇒ 83.3	86.2
8. Brachial Index $\left(\frac{\text{Length of Radius}}{\text{Length of Humerus}} \times 100\right)$	⇒ 74.5	78.5

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

9. Intermembral Index ⇒ EUROPEANS .70 — NEGROES 70 (45)

$$\left(\frac{\text{Length of Humerus + Radius}}{\text{Length of Femur + Tibia}} \times 100\right)$$

TORTURE

* M/c Form of torture : Beating. ON SOLES → FALANGA; ON EARS → TELEFONO

* Dry Submarine ⇒ Tying a plastic bag over the head Until Suffocation.
  - Can we tell A.M. or P.M. death ? Yes

* Wet Submarine (Latina) ⇒ Forced immersion of head in water contaminated ± Urine or feces.

* Picana ⇒ Electric torture.

* LA PARILLA ⇒ Tie a person to electrometallic grill.

* PLANTON ⇒ Torture by prolong standing;

* STRAPPEDO ⇒ Tie hand behind person & Suspend (Aka La Bandera)

* PARROT'S PEARCH :-

* CATTLE PROD : Electric Shock over genitals,

* CHAPUCA :

* GHOTNA :

* DUNKING : Victim immersed into water, taken out after Some time and given chance to confess.

* SHAM EXECUTION : आँख बंद करके शीड पर गाड़ी के सामने दौड़ देना।

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

RIGOR MORTIS / CADAVERIC RIGIDITY

- Stiffness of the Muscle after death.
- Initially ⇒ 100% ATP @ death (assumed) → Relaxed
- ↓
- 85% ATP → RM starts (No. of bonds Making > No. of bonds breaking)
- ↓
- 15% ATP → RM Maxm ; Stiffness Maxm
- ↓
- 2° Flaccidity [Decomposition, Autolytic enzymes] → Relaxed condition

- Relaxation immediately after death ⇒ 1° Flaccidity.
- It affects firstly in involuntary Muscle
  - Involuntary ⇓ 1st Muscle ⇒ Heart affected
  - Voluntary Muscle ⇓ 1st Muscle ⇒ eyelid

RM not seen in ⇒ Fetus of Less than 7 Months

PM changes in RM ⇒ Heart → Eyelid → face → Neck → Lower Jaw → Chest → Upper Limbs → Abdomen → Lower Limbs (Nysten's Rule)

Passes all in same Manner ↓ Head to Toe

K/a "Shapiro's proximodistal Progression theory"

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Duration of Rigor Mortis ⇒

Death
- 1–2 hrs → Starts
- 12 hrs → Fully developed
- 12 hrs → Maximum
- 12 hrs → Passes off

RULE OF "12"

Total duration = 36 hr.

Differential diagnosis of Rigor Mortis ⇒

- **Heat (> 65°C)** ⇓ coagulation of Muscle protein ⇓ Pugilistic attitude / Boxing attitude
- **Cold** ⇓ Cold Stiffening
- **Gas** ⇓ Gas Stiffening
  - Caused d/t "Putrefaction"
- **Cadaveric spasm**
  - Also "cataleptic Rigidity" OR "Instantaneous Rigor"
  - ↓ P Flaccidity Not seen in it.
  - Voluntary gp of Muscles affected
  - Antemortem phenomenon

(N) Death → 1°F — R.M. — 2°F

Cadaveric spasm → 1°F — R.M. — 2°F

↳ 1°F abt. in cadaveric spasm

* Differentiate b/w Rigor & cadaveric spasm ⇒

Cadaveric spasm	Rigor Mortis
Cellular death ⇒ ⊗	cellular death ⇒ ✓
In Survival period	
Electrical Stimulus ⇒ ++	−
Medico legal Importance ⇒ Indicates circumstances & Mode of death.	Indicates time since death.

*

PUTREFACTION

M/c organism Responsible for Putrefaction ⇒ Cl. welchii

⇓

Produce "Lecithinase"

Colour changes | Gases | Liquifactive Necrosis

Colour changes

- 1st Internal sign ⇓ Reddish discolouration of Aortic Intima
- H_2S + Hb (Produced by Metabolism of substance produced in Intestine)
  - Sulph Meth Hb ⇓ 2nd Internal sign: Greenish discolouration on inferior surf. of Liver
  - Sulph Hb ⇓ Greenish discolouration of walls of Blood vessels ⇒ Kjeldahl's MARBLING ⇓ Seen in 36–48 hr after death
  - 1st external sign ⇓ Greenish discolouration of R+ iliac fossa
    - Caecum = 12–18 hr

Changes d/t gases

- **Bloating** → Distension d/t gases
- **Post Mortem Purge** → Fluid blood at Nostril & oral orifice
- **Liver** → Honey combed appearance
- **Skin** → @ Dermo-epidermal junction → Result in Blister → False-Ai (Resemblance of Blister)
  - Slipping of skin
  - Loosening of skin/hair
    - 72 hrs of death

NEEFIC

* 3 conditions are Necessary for Putrefaction :⇒

1. Warmth (10-45°)
2. Moisture (Humidity)
3. Air

Liquefactive Necrosis

⇓

Seen in 5 to 10 days

* 1st organ to Putrify ⇒ Larynx & Trachea → Spleen → Brain → Heart; kidney

Temp. optimal for Putrefaction- ⇓ 21°C - 38°C

Last organ to Putrify ⇒ Bone → Tendon → skin

- ♂ Prostate
- ♀ Non-gravid uterus

Post Mortem Luminiscence (Glowing of body after death).

d/t Photobacterium

d/t Armillaria

Casper dictum ⇒ Fast in Air; then water & then after soil.

- Rate of decomposition

Air : water : Earth
1 : 2 : 8

ADIPOCERE

- On Absence of Air
- Colour ⇒ Greyish white - OR - Tan (NEEFIL)
- Saponification of Fats
- M/c ⇒ Palmitic acid
  - ↳ Produce Glycerine; who helps Saponification: Soil moist atm. Remove Glycerine
- Require warm & Moist Atmosphere
- Ammoniacle odour
  - cheesy
  - Sweet
- takes about 3 months - 6 months
- On India → 3 days

MUMMIFICATION

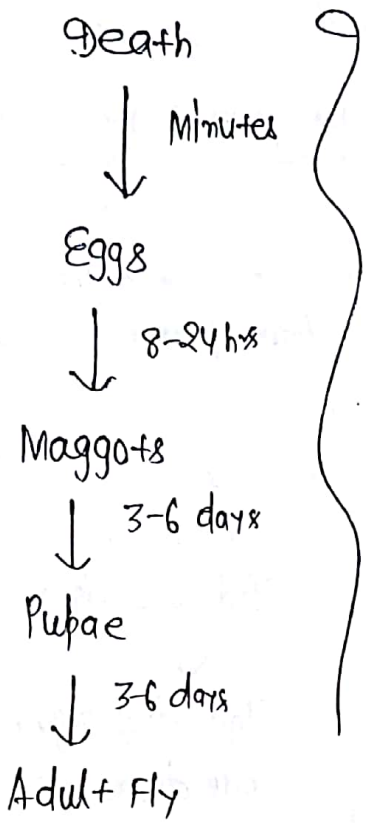
- On Absence of Moisture
- Colour = Rusty Brown to Black
- Dessication / Drying of tissues
- Dry & hot atmosphere
- odourless
- takes about 1 yr. to develop
- Chronic As & Antimony Poisoning ⇓ Favours Mummification

- Useful in → COD, Time since death, Identification (Facial features are preserved only in early stages)
- Useful in

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

ENTOMOLOGY ⇒ Delayed In Rainy seasons

Study of Insects



* Pink teeth In decomposed bodies is seen in death d/t seepage of Hb In dentinal tubules.

NEET PG * 1st organ to be Involved In Mummification ⇒ Skin of exposed body parts like Lips; Nose tip; Hands (Fingers) & Feet (toes)

Q. Which of the following is Not Suggestive of Inhalational burn injury?
(a) Yellow Sputum; (b) Singeing of hair; (c) Facial burns; (d) Hoarseness of voice

Q. The causative electrode of electric injury can be identified by :-
(a) Acid Rxn;
(b) current Pearl;
(c) Bone Pearl;
(d) wax dripping

ROUTINE AUTOPSY

Incision :→

"I" SHAPED ⇒ (M/C) Start from chin goes in Midline upto Pubic symphysis

"Y" SHAPED ⇒ Start from Mastoid; goes to Midsternal Notch → Pubic symphysis

"MODIFIED Y" SHAPED ⇒ Start from Suprasternal Notch.

* In case of Suspected torture the skin incision used ⇒ "X" SHAPED.
  - from Tip of shoulder → Angle of Lewis → Pubic symphysis

Techniques to examine Internal organ

Rokitansky	Ghon	Virchow	Letulle's
In situ	En Bloc	Individual organ	En Masse
⇓	⇓	⇓	⇓
Organs cut & Left Inside body	organs are removed in Blocks	Individual organ are dissected	All or everything at once from tongue till Rectum

Cavity opened first

Head
⇓
Head Injury
Poisoning → Head (Smell of Poison) (Qa)
Asphyxia
No COD Mentioned
Lastly opened
Neck

Abdomen
⇓
Infanticide

Thorax
↓
Air emboli

Viscera preserve In Routine Autopsy

1. Stomach : ⊂ all contents ;
2. Intestine : 30 cm of proximal Intestine ;
3. Blood : 30 ml of blood (taken from Femoral vein; Min^m 10 ml should be preserved) (QQ)
4. Liver : 1/2 kg of Liver ; should be preserved;
5. Kidney : 1/2 of each kidney should be preserved;

7 Spleen : Full spleen should be preserved

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Heart Dissection

- Inflow outflow technique
- RA → RV → LA → LV ⇒ Sequence of chamber opened.

Spinal cord

Posterior	Anterior
Best	M/c

Poisoning

During Post mortem we preserve viscera ; b/c of some Poison have specific character

Digoxin ⇒ Heart is preserved

Strychnine ⇒ Brain / spinal cord

Alcohol ⇒ CSF / vitreous / blood / urine / stomach / Liver

Anesthetic volatile agent poisoning ⇒ a) Lungs in Nylon bag → Non-absorbable
b) Mesenteric Fat → also in opc poisoning

I.m. Injection ⇒ Site of injection preserved

Bile / gall bladder ⇒ Morphine / Barbiturates

Cocaine poisoning ⇒ Nasal swab

Best Preservative ⇒ Rectified spirit (90% alcohol)

Not used Rectified spirit ; we Nacl

- Phosphorus
- Alcohol → Best preservative → NaF (100 mg / 10 ml) → Inhibits glycolysis → Envelope
- Phenol
- Paraldehyde
- Acetic acid

also in Ch. CN. Cocaine Poisoning

* M/c Preservative ⇒ Nacl

⇓

Not used in

— Corrosive
— Aconite
— Corrosive sublimate

* Urine ⇒ Toluene > Thymol

Formalin

⇓

Used as preservative in HPE.

* Rotten fruit @ crime scene ⇒ Na Meta bisulfite
* Uric acid crystal ⇒ Alcohol
* Virological examn ⇒ 80% glycerol
* DNA ⇒ Nucleated

Blood → EDTA vials
Hair → Plucked
Spleen
Muscle

Blood for culture

⇓

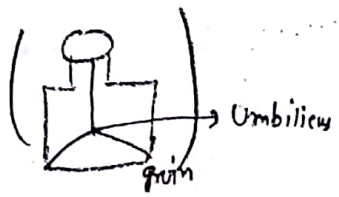
SPS

(Sodium Polyanethole Sulfonate)

FETAL AUTOPSY

Incision :- M/c ⇒ "I" shaped

Preferred ⇒ Inverted "Y" shaped



technique for opening fetal skull :-

Reneke's technique ⇒ 2 Flaps

Baar's technique ⇒ 4 Flaps

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Age of Fetus

Haase's Rule

Upto 5 mths

CHL = 25 cm → Crown Heel Length

$$\text{Age (Mths)} = \sqrt{\text{Length (cm)}}$$

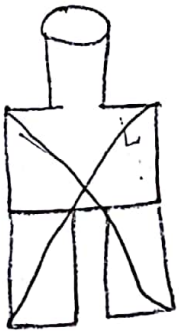
Morrison's Rule

6-10 mths

$$\text{Age} = \frac{\text{Length}}{5}$$

$$\text{Crown Rump Length} = \frac{9}{3} \text{ Crown heel Length}$$

* **X-Shaped Incision** :- done in Torture
- Kept the body in Prone position



Q. Pseudocyesis is usually observed in :-
(a) Childless wife Nearing Menopause;
(b) Males who are impotent to a particular woman;
(c) Unmarried woman in whom contraceptive has failed;
(d) Young Married woman c illicit sexual Relation c colleague

Q. Initial damage to carotid A. is a/w deaths d/t :-
(a) Hanging c a drop; (b) Ligature strangulation; (c) Manual strangulation;
(d) Traumatic asphyxia

Q. Following are the characteristics of Ligature Mark of fixed Noose in hanging Except that they :- (a) Are oblique; (b) Are continous; (c) Are high up on the Neck;
(d) Show Parchmentization

Q. Ion in what is suggestive of Antemortem drowning
(a) Strontium; (b) Mg; (c) K; (d) Ca

Problem is with	Still Born	Live Born
1) Position of Diaphragm :- (That's why we open abdomen 1st in Infanticide)	3-4th Rib	6-7th Rib
2) Fodere's test / static test :- (Weight of Lungs)	30-40 gm	60-70 gm Why? b/c of blood
3) Ploucquet's test :- (Ratio of wt of Lungs : wt of body)	1:70	1:35
4) Breslau's 2nd Life test :- (Air in Stomach)	⊖ (Not prt.)	⊕ (Air is prt.)
5) Werdin's test :- (Air in Middle ear)	⊖	⊕
Hydrostatic Flotation test	⊖	⊕

(Ka) Raygat's test
"liver" as CONTROL)
3+ for Residual Air

(SIB) False ⊕ Raygat's test
- Artificial ventilation
- Decomposition

(LIB) False ⊖ Raygat's test
- Feeble Respiration
- Alveolar Membrane (prevented Air entry into alveoli)
- ARDS
- Atelectasis

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Stains

Blood

Screening test

Benzidine (Alder's test)
- give deep blue colour
- Most ↑ sensitive
- Not used now a days
  - ↳ b/c of carcinogenic Nature
    - ⇓
    - Bladder cancer
- old blood stains (used for)

Confirmatory test

Microchemical test

Hemin / Teichman
- ⇓
- Brown Rhombic crystal
  - Glacetic Acid + NaCl → ie Glacial acetic Acid

Hemochromogen / Takayama
- ⇓
- Pink feathery crystals

Phenolphthalein
- Kastle Meyer's
  - ↳ M/c used
  - ↳ give Pink colour

Luminol
- Blue colour Luminiscence
- given in spray form
- washed stain even can detect
- M/c ⇒ in crime scene investigation

Spectroscopy
- ⇓
- Best & Most sensitive test

Seminal

Seminal stain

a) On UV Light ⇒ Blue/white coloured Fluorescence
→ d/t choline in semen

b) Chemical test

- Florence ⇓ Brown Rhombic crystal of choline per Iodide
- Barberio's ⇓ Needle shape / Rhombic crystal of spermine picrate
- Acid Phosphatase ⇓ Best test

c) Microscopy (Best)
↳ b/c even a single chromatozoa can be seen.
- Confirmatory test
- Christmas tree stain

d) LDH isoenzyme assay
- 2nd Best

e) P30 / PSA

f) MHS-5

g) CPK – old seminal stains – upto 6 months old.

Vagitus Vaginalis ⇒ Cry of Unborn child in vagina
↳ Not say child is Live birth; b/c child Not coming out.

* Under which section Infanticide Punish ⇒ Sec. 302; Sec. 315

Vagitus Uterinus ⇒ cry of child in Uterus.

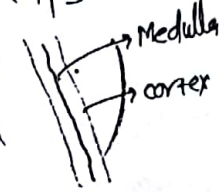
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

HAIR

- Examination of Hair can tell :⇒ i) Identification ⇒ of Individual (accused; victim);

ii) Source of origin :⇒ whether is of Human OR Animal

Human Hair	Animal Hair
• Fine & thin	• Coarse & thick
• Medullary Index < 1/3 ⇓ (Width of Medulla / Width of cortex)	> 1/2
• Evenly distributed Pigment	• ⊕ Near the Medulla



iii) Sexual offences;

iv) Crime;

v) Hit & Run case;

vi) Identification of Race by hair;

INDIAN	CHINESE & JAPANESE	EUROPEANS	NEGROES
• Straight; black; Long & fine	• Straight; black, Long & thick	• Straight; Light Brown; Raddish or grey & short	Wooly; curly; black; short & thick

LEGITIMACY

Ⓐ Superfecundation :⇒ Two ova Released in same cycle; Fertilized; either during same act of coitus or during the separate acts,

- Possibility of twin having two fathers

Ⓑ Superfoetation :⇒ During the continuation of development of Fetus; Another ova Released in subsequent cycle get fertilized & starts developing as a second fetus,

Can Result in ⇒ Twin having two fathers;
Two children being born together ≅ different Stages of development;
Female May deliver twice ≅ in 1-3 Months

Ⓒ Suppositious child :⇒ Fictious claim of child

Ⓓ Posthomus child :⇒ child born after the death of his biological father

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

TOXICOLOGY → Father ⇒ Paracelsus (NEET)

- Drugs & cosmetics Act, 1940 (AI+14 Yrs Main aim is to control quality, Purity & strength of drug).

↓

Drugs & cosmetics Rule ; 1945 AI+14 Father of Modern toxicology

⇓ ⇓

Schedules Mathieu orfila.

C	E	F	H	S (JIPMER)
Biological agents	Poisonous Substance	Vaccines & sera	Prescription drugs	Standard of cosmetics

Best Emetics to vomit the ingested Poisonous

⇓

Syp. of Ipecac ⇒ 30ml

Best Purgative ⇒ Sorbitol

↳ Loosen stools & ↑es bowel Movements

- Best Diaphoretic ⇒ Pilocarpine

↳ ↑es sweating & eliminated Poison by sweat

Antidotes

Physical / Mechanical

1. Bulky food
   ↳ for Glass / Metal
2. Demulcent
   ↳ Acids
3. Activated charcoal
   ↳ MoA = Adsorption

Chemical

1. KMnO4 ⇒ Opium ; Phosphorus :
2. MgO ⇒ Acids

Physiological

1. Receptor
   Dhatura ⇒ Physostigmine
   Opium ⇒ Naloxone

Chelating agent

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Universal Antidote

- Activated Charcoal — 2
- MgO / Acids: — 1
- Tannic acid / ppt. alkaloids — 1

Activated charcoal formed after passing steam over charcoal; by which pores ↑ & Adsorption ↑

C/I ⇒ Corrosive, Alcohol; Heavy Metals ⇒ except Hg

Gastric Lavage Tube

Children: Ryle's tube

Adults: Ewald / Boas / Edlich / Lavacuator tube

MLC: Ewald

Best: Lavacuator tube

Best Position to do Gastric Lavage ⇒ Left Lateral

Best Fluid to start Gastric Lavage ⇒ Plain water

MLC Fluid used in Gastric Lavage ⇒ Normal saline

$KMnO_4$ used in 1:5,000 dilution
↳ In alkaloid Poisoning

Golden Period for doing Gastric Lavage ⇒ < 3 hrs

→ C/I ⇒ Corrosive ⇒ cause Perforation ⇒ except ⇒ Phenol / Carbolic acid

Leathery / thickened ←

Relative CI ⇒ Kerosene

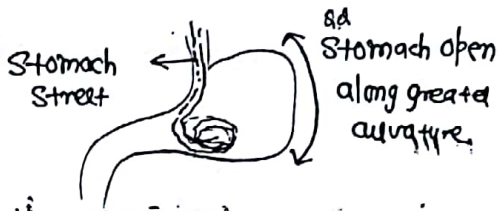
Convulsant | Anticonvulsant

Coma

Hypothermia

Lower esophageal varices

Magenstrasse ⇒ Stomach Street



↳ Path taken by poison in the stomach.

As Poisoning

As_2O_3 — White As ; Sankhya

King of Poisons → Fatal dose — 0.1–0.2 gm

Fatal Period → 1–2 days

Poison of king → Napoleon dies due to As Poisoning

Arsenophagists ⇒ tolerate As upto – 0.3 gm

Clinical feature

Fulminant

3–5 gm As consume

Death within 3 hrs

Acute

Death <24hrs

Chronic

Gastroenteric form

Cholera

Sequence of symptom → As ↓ Throat Pain, vomiting, purging ↑ Cholera

Narcotic form

convulsion; coma

Liver ⇒ M/c organ has As (Max conc)

Kidney

Brain has least amount of As.

Chronic

Hair
Golden hair
↓
Alopecia

Skin
Hyperkeratosis
↓
Bowen's disease
↓
Basal cell carcinoma
(Rain drop pigmentation)
↳ Resembles Fading Measles Rash / Addison's disease

Nail
Aldrich Mees Line
– Transverse

Bones
– Pancytopenia
– Burnt bones
⇓
can be detect in burnt bones

– also causes Fatty Liver ; Symmetric peripheral sensorimotor Neuropathy ;

– Catarrhal sign ⊕ (Resembles Common cold i.e conjunctivitis ; Running Noses & eyes ; coughing etc)

– Black foot disease ⇒ As Poisoning

– Viscera preserve in As Poisoning ⇒ Hair, Skin ; Nail ; bone + Routine

– Test ⇒ Reinsch > - Marsh > Gutzeit

– Rx ⇒ Gastric lavage by freshly prepared hydrated Ferric oxide (PGI → gv)

DOC ⇒ BAL / Dimercaprol
↳ Deep i.m. (Not I.V.) ↳ bcz cause Fat embolism
↳ C/I in ⇒ Fe, cd ; selenium

– PM appearance ⇒ Stomach - Red Velvety ;
Heart - Subendocardial Hemorrhage
↳ also in Aluminium phosphide poisoning

Ideal Homicidal Poison

Thallium

↳ Resembles "Guillian – Barre Syndrome"

↳ Peripheral Neuropathy
Alopecia
Skin Rash

M/c Homicidal Poison ⇒ As

Ideal Suicidal Poison ⇒ CN ↳ Painless death ;

M/c Suicidal Poison ⇒ OPC

M/c Method of Suicide ⇒ Hanging

Para – Suicide ⇒ M/c ⇒ Drug ingestion
↳ मरना नहीं, सिर्फ डराना

MERCURY

Organic Mercury

- Methyl Mercury
  ↳ Most Poision
- Gn Minimata disease

Gn-organic Mercury

$HgCl_2$ – 1-4 gm
↳ Fatal dose

Mercurialism :- i.v. mercury inj.
Thrombophlebitis
Granuloma
Pulmonary emboli

C|F ⇒ Hydargyrism → Chronic Use of Mercury

- Erethism → Neuro-Psychiatric Manifestation
  - Personality disturbance
  - Shyness, Insomnia, Mad hatter.
  - Classical Triad
- Gingivostomatitis
- Tremors | Danbury tremors | → Coarse tremor
  Hatter's shake | Glass blowers shake.
- Mercuria Lentis — Fumes of Hg → Deposits of Ant. capsule of Lens → Earliest Malt Brown Reflex
  ↓
  Not affecting visual acuity.

- Strawberry tongue
- Diphtheria like colitis
- Acrodynia | Pink ds | (Idiosyncratic HSN Rxn)
- affects Proximal convulated tubules
  - other drugs ⇒ Phenol
    CCl4
    Oxalic acid
    Cadmium
    - also cause Bone Pain & Muscular Pain
      ↓
      - cause "ouch-ouch ds"
      - Golden Yellow staining of teeth
      - Rx ⇒ N-acetyl Penicillamine

Viscera Preserve ⇒ R|V (Routine viscera) + Hair

Rx ⇒ G|L ⇒ Sodium formaldehyde sulphoxylate

Agent of choice ⇒ BAL

* EDTA is CI of Hg bcoz EDTA is also Nephrotoxic.

LEAD ⇒ No heavy Metal is Poisonous in Native form except ⇒ Lead

- Lead acetate (Sugar of Lead) ⇒ Fatal dose ⇒ 20 gm
- Lead carbonate ⇒ Fatal dose ⇒ 40 gm
- C/F ⇒
  - Anemia
  - Eosinophilia
  - Basophilic stippling
  - earliest sign ⇒ Facial Pallor
- Lead lines in Metaphyseal plate ⇒ Recurrent Gouty Arthritis
- (Chronic poisoning ⇒ Plumbism / saturnism)
- Burtonian Lines ⇒ Blue Lines @ teeth & gum junction
  - Seen also in ⇒ Hg; Bi; Ag; Fe; Cu
    - k/as "Clapton Lines"
- Cabot's Ring
- Colic (i.e Abdominal Pain) & constipation seen; very Rarely diarrhoea
  - ↳ dry belly ache
- Encephalopathy ⇒ M/c in children
  - ↳ Mainly d/t Tetra ethyl Lead
- Pure Motor Neuropathy ⇒ Least complication of Lead Poisoning
- Sterility ⇒ In both sex
- Wrist & foot drop ⇒ Lead palsy
  - ↳ d/t peripheral Neuropathy
  - only in 10% of cases

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Diagnosis ⇒ By Measure

Blood Lead level > 10 µg/dl

- Urine test ⇒ Tes coproporphyrin (CPU) Levels ; of 0.25 mg/L of Lead is diagnostic

Rx ⇒ 1. Succimer / DMSA

↳ Given orally ; Least Nephrotoxic ; useful in G6PD deficiency

V

2. Ca_2 EDTA + BAL

V

3. Ca_2 EDTA

↳ Gn Lead encephalopathy ; it is TOC

Least toxic compound of Lead ⇒ Lead Sulphide

Most toxic compound of Lead ⇒ Lead Acetate

Zinc (Metal Fume Fever)

- Resembling Malarial chills ; No wheezing
- Self-Limiting Influenza-like syndrome

Mn (Manganese)

- Parkinson's Like disease

Iodine

- Painful Parotitis resembling Mumps

Rx ⇒ BAL → Penicillamine

Copper ⇒ As a Metal Non-poisonous.

Copper Subacetate ⇒ FD : 15 gm | FP ⇒ 1-3 days

Copper Sulphate ⇒ FD : 30 gm | • Blue-green vomitus ; Purple (blue-grey) line

Non-Metallic Poisoning

Lethal dose ⇒ 60-120mg ← PHOSPHORUS ⇒ Protoplasmic poison

Red

- Not toxic
- used in Match boxes

White/yellow

- toxic
- Spontaneous combustion (> 34°C)
  - Stored under water
  - Diwali poison ⇓ also Hg
    - ↳ Pharaoh's serpent ⇒ Mercury thiocyanate (पटाखा सांप की तरह जलता है)
  - Arson ⇓ Burning of house in old days.

- **Acute Phosphorus poisoning :-**

C/F ⇒ Luminiscent Vomitus, Smoky Stool syndrome, Acute yellow atrophy of Liver

- **Chronic Phosphorous poisoning :-**

C/F ⇒ Phossy jaw / Glassy jaw
- ↳ Osteonecrosis of jaw
  - L M/C ⇒ Mandible involved
- ↳ Fumes of phosphorus ⇒ White Phosphorus

Rx :- No specific Antidote

KMnO4, vit. K.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Vegetative Irritants

Abrus Precatorius (Ratti)

Seeds - wt ⇒ 108 mg ↳ K/a "Gunchi; crab eye; Rosary pea".

Active principle ⇒ Abrin ⇒ it is Toxalbumin ; Ricin; crotin

↳ Resembles Viper venom

↳ Vasculotoxic

Medico-legal importance ⇒ Making "suis"

↳ used to look like viper bite (••)

Artificial Bruise ⇒ used to cheat falsely

⇓

Ⓐ Semicarpous Anacardium ; Ⓑ calotropis; Ⓒ Plumbego ; Ⓓ Dithrinol

(Marking Nut) ⇓ ↳ Active Principle ⇒ Semecarpol & Bhilawanol

Used by washerman to Mark clothes.

Calotropis ⇒ A/P ⇒ Gigantin (NEET 16)

Spanish Fly | Canthardes | Blister beetle

Active Principle ⇒ Cantharidin (Aphrodisiac)

⇓

Tes the sexual desire

C/F ⇒ Priapism - Persistent painful Penile erection

↳ also seen in Scorpion sting

Blisters → Spanish Fly

Barbiturates

CO

Carbon Monoxide (CO)

Anemic Anoxia (b/c it Reacts 200 times More tightly c Hb than O_2 & causes Anemic type of hypoxia). AI-14

C/F ⇒ 1st (4 y.) - Headache

* 40-50 % CO - A/C. Intoxication (symptom Resemblance)
* 80 % CO - Death d/t Respiratory arrest.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Dx ⇒ Kunkel's test (Tannic Acid) ;; Hoppe-Seyler's test (10% NaOH)

Rx ⇒ Hyperbaric oxygen.

PM ⇒ examination — Degeneration of Globus Pallidus ; Fine froth @ Mouth & Nose ; Bright-cherry Red discolouration.

* Upper Limit of safety of CO in Air ⇒ 0.01%.

BARBITURATES

- Hypothermia , Coma ; Non Reactive pupil

Rx :- Forced Alkaline diuresis qq

- Automatism ⇒ ~~Accidental Self Poisoning~~
- Golden Urine ⇒ Urine is golden in colour

Liquid gold

↳ Urine of Amphetamine Abuses

↳ 40% Unchanged pass in Urine

∥

after selling it ; we can earn Money.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

SNAKES

ELAPIDAE
- COBRA (Naja naja)
- COMMON KRAIT (Bungarus caeruleus)

VIPERIDAE
- RUSSEL's VIPER (Viperia Russelli)
- SAW SCALED VIPER (Echis carinatus)

℞ :- Anti-Snake venom

↳ Not used in "Hypnale hypnale" bited

↳ "Hump Nose viper"

COBRA, COMMON KRAIT → Neurotoxic

RUSSEL's VIPER, SAW SCALED VIPER → Vasculotoxic

Sea Snakes (Hydrophidae) ⇒ Myotoxic

Poisonous Snake

2 fangs ± ~~Multiple teeth~~

Nocturnal habits

→ Head scales - Small

→ Body scales - Large

→ Tail → compressed

OPIUM ⇒ dried juice obtained by Incision of the Unripe capsule (NEET).

- AFIM | MADAK | CHANDU
- Unripe fruit of Papaver Somniferum
- Bhuki

⇓

Drug obtain from "POPPY HUSK"

Lancing

⇓

Longitudinal incision on fruit for opium

- C/F ⇒ Drowsiness; Resp. disorder; Pin point pupil; Coma
- Withdrawl feature ⇒ Drowsiness; Rhinorrhea; Lacrimation; Goose flesh, Mydriasis (dilated pupil); Insomnia; Yawning; Muscle cramp & body pain; Rise in BP.
- Fatal dose ⇒ Opium – 2 gm
  Morphine – 0.2 gm
- Dx ⇒ Marquis test
- Rx ⇒ G/L – $KMnO_4$ – 1:500
  - Doc ⇒ Naloxone (i.v.) l/b oral Naltrexone
    - for Maintainence therapy.
- Rx of withdrawl ⇒ Methadone (Doc)

HEROIN (M/c abused opioid).

SMACK; JUNK; DOPE; BROWN SUGAR

- Diacetyl Morphine
- Designer drugs
- Shooting galaxy ⇒ Authorised place where to administrate the drug

⇓

i.v. ⇒ Mainlined; shot

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

- HOT SHOT ⇒ HEROIN + STRYCHNINE
- Chasing of the dragon

℞ → clonidine;
Buprenorphine;
Pentazocine.

A/P ⇒ Levohyoscyamine; Hyoscine (scopolamine) & Atropine.

STUPEFYING AGENTS

Dhatura ⇒ earliest symptom ⇓ Bitter taste in the Mouth.

- Roadside Poison
- Dhatura Stramonium ⇒ Thorn Apple
- Fatal dose ⇒ 100 seeds
- Resembles ≅ chilli seeds
  Human's hand
- Embryo of Dhatura ⇒ curved outwards (ↄ)
- Embryo of chilli ⇒ curved inwards (6)
- C/F ⇒ Dilated Pupil ⇒ Diplopia
  Dry Hot skin ⇒ Hyperthermia
  Delirium ⇒ Muttering
  Pill Rolling Movement
  Carphologia
- ℞ ⇒ Physostigmine

Cocaine

- Coke, Snow; Cardillac; White lady
- Snorting
- Half-Life of cocaine ⇒ 1 hr.
- Cocaine + Heroine ⇒ Speed ball
- C/F ⇒ Black tongue & teeth
  Perforated Nasal septum
  Excited delirium
  Hallucinations (Visual > Tactile)
  ⇓
  Magnan's symptoms / cocaine bugs
- Formication ⇒ Any Hallucination who involve insects
  Also seen in
  (A) Ergot Poisoning ⇒ St. Anthony Fires
  (B) As poisoning
  (C) Amphetamine poisoning
  ℞ ⇒ Amyl Nitrate; ...
  ⇓
  Resembling Sciatica

Cannabis

Smoke
⇓
CRACK
↳ Max^m S|E of cocaine d/t smoke

CANNABIS / MARIJUANA / INDIAN HEMP

Active Principle ⇒ Δ^9 – Tetra hydro cannabinol

Odour Smell ⇒ Burnt Rope Smell

Marijuana cigratte / Reefers / weed / joint ⇒ 1-6 hrs

Preparation from cannabis

			Active Principle
Bhang	⇒	Dried leaves	⇒ 15%
Majoon	⇒	Sweet (Bhang)	
Ganja	⇒	Flowers (Female)	⇒ 25%
charas / Hashish	⇒	Resin (stem)	⇒ 40%

C/F ⇒ i) Run Amok ⇒ Impulse to kill

↳ Person is Responsible for crime

↳ b/c insight = ⊕

ii) Amotivational Syndrome ⇒ Apathy ; Loss of interest ; Reduced drive.

iii) Flashback phenomenon ⇒ Person experience the feature of cannabis use even without actually using it.

* Least toxic : Bhang : Fatal dose : 10 gm / kg Body wt.

* Most toxic : Charas : Fatal dose : 2 gm.

http://mbbshelp.com ·WhatsApp: +1 (402) 235-1397

HALLUCINOGENS

1. LSD ⇒ Purple heart; Mind expander; Golden dragon
   - Pt. hear the colour? - Synesthesia
     - Mixing of sensation
   - taking a trip
   - Flashback phenomenon
     - also in Cannabis.

2. Angel dust ⇒ PCP / Phencyclidine

3. Rave drugs ⇒ M/C ⇒ Ecstasy (MDMA)
   - GHB
   - LSD
   - Amphetamine
   - Methcathinone ⇒ cheaper & alternative to ecstasy
     - (Meow - Meow)
   - Ketamine

4. Predator drugs / Date Rape drugs ⇒ M/C ⇒ Alcohol
   - ↓
   - Barbiturates
   - ↓
   - Rohypnol (Flunitrazepam)
   - Chloral hydrate (Knock out drops / Mickey Finn)
     - ⇓
     - Combination of Alcohol & chloral hydrate

***5. Japense detergent Suicide ⇒ H_2S gas

JIPMER 6. Hair dye Poisoning ⇒ d/t p-phenylenediamine
- ⇓
- Cause Allergic Rxn; Renal failure

H_2S gas
- ⇓
- Sewer gas
- ⇓
- $H_2S + CO_2 + CH_4$.

Cardiac Poisons

- In all cardiac Manifestation · Rate/Rhythm
  ⇓
  Rx ⇒ Atropine | symptomatic

- but in Amblyopia
  ⇓
  Tobacco ⇒ Smoker's heart

- Respiratory Symp ⇒ cyanide Inhibits 2 enzymes → Cyt a a3, Carbonic Anhydrase
  ↳ Histotoxic Anoxia
  Achlorhydric Individuals - Immune
  Double salts are Non-toxic
  KCN - PD - 0.2-0.3 g.;
  FP - 2-10 min
  Rx ⇒ Inhalational Amyl Nitrite, Sodium thiosulfate, Hydroxocobalamin, Dicobalt EDTA } ELI LILY KIT

"Lee Jones Test"
⇓
used for cyanide Poisoning; to differentiate it from Salicylate Poisoning.

→ Gynaecomastia; Trigeminal Neuralgia ⇒ Digoxin Poisoning

→ Hippus ⇒ Aconite Poisoning
↳ Also " MONKS HOOD/ Mitha bish (MH12)/ Blue Rocket".
↳ Tingling sensation → Around Perioral Region
Chest Pain
Hypersalivation
Hypotension
↳ Roots is most potent t/t Seed.
↳ FP ⇒ 2-6 hr qq
↳ death d/t paralysis of Respiratory center

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

OLEANDER

White Neriam Nerin ← A/P → Yellow Cerebra Thevetia Thevetin ↓ Causes = Hyperkalemia

Q. Asphyxial death ∴ black colour Mucosa ⇒ Cyanide Poisoning

SPINAL POISONS

Strychnous Nux vomica | KUCHILA

A/P ⇒ Strychnine ; Brucine

Fatal dose ⇒ 1 crushed seed (Uncrushed seed is Not digested

MOA ⇒ AHC (Anterior Horn cell) of Spinal cord
↓ ⊖
Inhibitory Interneuron (Glycine)
↓
Reflex excitation

C/F ⇒ All muscles are affected @ same time
Consciousness – clear b/w convulsions (GTC)

Spinal postures ⇒ A. Opisthotonus ( )
↳ Backward Arching of spine

B. Emprosthotonus
↳ Forward Bending

C Pleurosthotonus
↳ sideways Bending

℞ ⇒ Diazepam ; closed dark Room

Antidote for strychnine Poisoning ⇒ Short Acting Barbiturates
⇊
Phenobarbitol.

Aluminium Phosphide (Alphos / celphos)

Each tab - wt ⇒ 3gm (3 gm of Aluminium phosphide liberates 1 gm of phosphine).
↳ Aluminium phosphide = 56%
↓
Phosphine gas ⇒ 1gm FD

- MoA ⇒ Inhibits cyto-c oxidase
- C/F ⇒ esophageal stricture ; Myocardial Necrosis
- ℞ ⇒ Symptomatic hypomagnesemia
- Dx ⇒ Silver Nitrate Paper test
↳ give Black colour
- PM ⇒ Subendocardial Hemorrhage
Flame shape Hemorrhages

→ M/c cause of death ⇒ Cardiogenic shock

* Aluminium phosphite & hypophosphite are Non-toxic Salts

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

CORROSIVE

Acid

?? More dangerous

Alkali

Coagulative Necrosis

Stomach

M/c damage organ

Liquilactive Necrosis

Esophagus

doesn't cause by "HF"

↳ damage by "Liquelactive Necrosis"

Vitriolage (Acid Attack)

326(A) IPC

⇓

Acid attack

10yrs to Life imprisonment

326(B) IPC

⇓

Attempt to acid attack

5yr to 7yr Punishment.

SULPHURIC ACID (oil of vitriol)

everything black except ∓ teeth ⇒ Chalky white

FD ⇒ 5-10ml

FP ⇒ 12-24hr

Gastric Perforation – Common wet blotting paper like consistency

Rx :⇒ Weak alkali; Mgo

Steroids ↳ b/c we can't Neutralize strong acid & strong alkali (as it is Exothermic).

↳ Prevents Long term complication Like Esophageal stricture

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

COD In Adults ⇒ Gastric Perforation

COD esp. children ⇒ Reflex vocal spasm

Nitric Acid

- Stains all the GIT & tissue ∈ Yellow colour
  ⇓
  "Xanthoproteic Reactions"
- Brown discolouration of Urine.
- Inhalation of Fumes ⇒ Lacrimation
  Photophobia

Boric Acid

- A/w "Boiled Lobster syndrome".

Oxalic Acid (Salt of Sorrel)

- Used to Remove Ink for forgery.

C/F ⇒ PCT damage,
Hypocalcemia,
Oxaluria ⇒ Enveloped shape crystals

Rx ⇒ 10% Ca gluconate 10 ml i.v.

C/I ⇒ Large Amount of water

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

CARBOLIC ACID / PHENOL

- Miosis
- Lock jaw
- Delay Putrefactions
  - ↳ also by Antimony; zinc
- Carboluria
  - ↳ Colourless $\xrightarrow[\text{standing}]{\text{on}}$ Green
    - ⇊
    - d/t hydroquinone; Pyrocatechol ⇒ oxidized in Air

- Ochronosis (Blackish pigmentation of cartilage)

Chronic - Phenol Marasmus

$R_x \Rightarrow$ Hemodialysis

⇊

Also indicated in

- B Barbiturate
- L/A Lithium / Alcohol
- S Strychnine
- T Theophylline

C/I in

- K Kerosene
- B Benzodiazepine
- C Copper sulfate

* Colour of Stomach Mucosa in different Acid poisoning :⇒

- Black → H_2SO_4
- Yellow → HNO_3
- White → HCl
- Brown / Leathery → Phenol

All these damage caused by coagulative Necrosis

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Methyl Alcohol

- Wood Alcohol
- Formic Acid

Accumulation of Formic Acid
⇓
Lactic Acidosis / High Anion gap Metabolic Acidosis

C/F – Abd. cramps
optic Neuritis (irreversible)

FD – 60–200 ml
Hooch tragedy

℞ ⇒ • Fomepizole ⇒ 4-Methyl Pyrazole
⇓
Inhibits alcohol dehydrogenase

• Ethanol ⇒ given both as i.v / oral
(il doesn't work)
→ Bc it competitively inhibits the conversion of Methanol to formic Acid.

• Hemodialysis

Folic Acid or Folinic acid enhances the Metabolism of Formic Acid to CO_2.

* Methanol conc^n is high in "Illicit Alcohol". Illicit ⇒ Forbidden by Law; Rules or custom.

ALCOHOL ⇒ Rectified alcohol ⇒ 90+ Alcohol

• Absolute alcohol ⇒ 99.5 % alcohol

• Max^m alcohol content is prt. in which hard drink ⇒ Vodka (60-70 %)

• Absorption ⇒ Stomach → 20 %
Intestine → 80 %

• Metabolisation ⇒ Liver → 90 %

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Stages

Excitement | ↓ | Gn Co-ordination | | COMA

↓ Blood Alcohol content

- BAC < 150 mg./.
- Alcohol gaze Nystagmus
- 40–80 mg /.
- Under the influence
  - ↳ 80–100 mg /.

150–400 mg /.

> 400 mg /

* 510 I.P.C

↳ Creating Public Nuisance under Intoxication is Punishable

↳ 24 hr. Jail + 10/- Fine

- Windmark's Formula

$a = prc$

a = Amount of alcohol in drink

p = body weight

R = constant

C = conc^n of alcohol in blood

* Gn Stage ① & ② : Pupil is dilated

Stage ③ : Pupil is constricted

↳ There is "MacEwans si

↓

Stimulation of person causes pupil to dilate & Return to constricted pupil.

Q. Where do you expect higher Amount / conc^n of Alcohol?

Blood / ~~Urine~~ (3:4) OR (1:1.33)

- FD : 150 ml of absolute alcohol.

Alcoholic Blackout = 80 – 100 mg % of BAC

Tests

Kozelka & Hine

Cavett's

Breath Analyser (Drunkometer)

↓

- Henry's Law (Based on)
- Potassium dichromate

Gas chromatogra

↓

Best.

Legal

Limit while driving ⇒ < 30 mg %.
↳ 45-60mL

Legal age of drinking ⇒ 25 yrs.

- Alcohol tends to follow zero order kinetics
- Rate of Metabolism : 15 mg | 100ml | hr

Q 6PM ⟶ 9PM
?
⇓
145 mg %. 100 mg %.

ORGANOPHOSPHORUS COMPOUNDS

Alkyl phosphatase
- Malathione
- HEPP (Hexa ethyl tetra phosphate)
- TEPP (Tetra ethyl pyro phosphate)

Aryl phosphatase
- Parathion (Follidol/Nitrostigmine)
- Paraoxon
- Diazinon (TIK 20)

⇓

Irreversible inhibitors of enzyme cholinesterase; by phosphorylating the Catalytic site of enzyme.
⇓
It hydrolyze "Ach".

C|F ⇒ Chromolacryorrhea ⇒ Shedding of Red colour tear d/t Abnormal porphyrin Metabolism.

Lacrimation; Miosis (pinpoint Pupil); Pulmonary edema
Salivation; Muscular fasciculation;
Sweating; Tremor

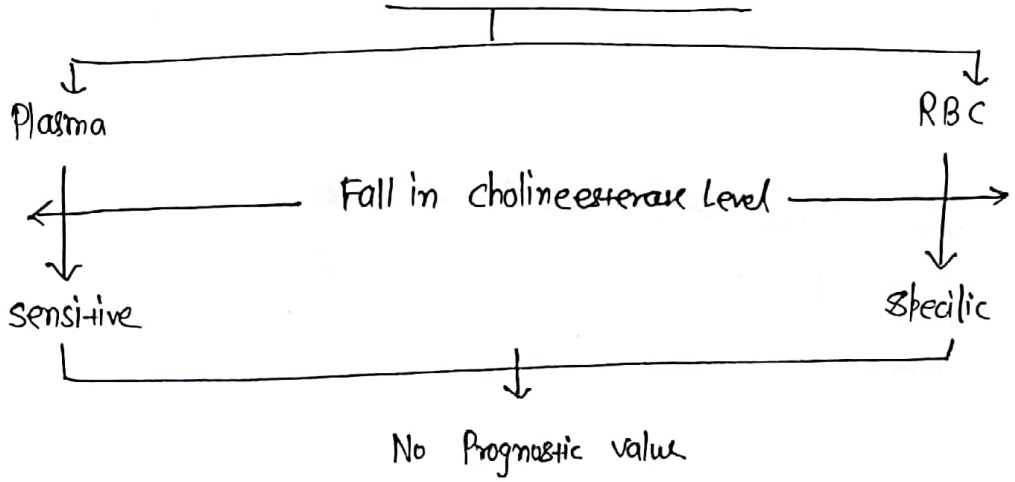
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* chronic exposure to OP eg (Triothocresyl phosphate)
  ⇓
  Additive in Lubricating oil

Delayed Neuropathy
(1-2 weeks after exposure)
⇓
- a/w Demyelination of Axons
- Not caused by cholinesterase inhibition but Rather by Neuropathy Target esterase (NTE) Inhibition

Intermediate Syndrome
(after 1-4 days),
- Muscle weakness
- Caused by Cholinesterase inhibition
- doesn't Respond to oximes or Atropines.

Dx ⇒ Choline esterase Level



Rx ⇒
1. Activated charcoal;
2. TTT of choice ⇒ Atropine Sulfate
   ↳ causes Resp. depression.
3. Oximes (Pralidoximes)

CARBAMATES

- Reversible Inhibitor of cholinesterase
- eg ⇒ Physostigmine; Neostigmine; Edrophonium; Carbaryl; Proposur.

⇒ Rx ⇒ Atropine; ~~Oxime~~ → Not useful.

ORGANOCHLORINES (Chlorinated hydrocarbons)

- DDT
- Benzene Hexachloride (Lindane)
- Toxaphenes
- Cyclodienes
  - eg ⇒ Aldrin; Dieldrein; endrin (Plant penicillin); Mirex; Heptachlor; endosulfan; Chlordane.

endrin is also known as "Plant penicillin" b/c of its broad spectrum activity against Insect pests

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

NDPS ACT, 1985

- Narcotic Drugs Psychotrophic Substance ACT, 1985.
- It covers only Narcotic & Psychotic drugs.
- Nicotine is Not Cover under NDPS Act.

NDPS ACT :- (1) Embezzlement of opium is an offences.
(ग़बन)

Embezzlement of Any other is Not offence (only opium is an offences).

(2) This act prefers Rehabilitation of Drug Abuses (Not only Punishment; but also)

DRUG TRAFFEKING

Body Packer @ Body Bag : Person who transport the drug;

Pusher : Person who distributes the drug (distributes to clients)

Stuffer : Consume the drug for the fear of being caught.

Client/ Abuser : Consume the drug for satisfaction.

COMA COCKTAIL

- Given to pt. who comes ∈ coma ∈ Unknown history.
- Consist of - Dextrose — Hypoglycemia
  Naloxone — opioid Induced coma
  Vit. B_1 / Thiamine — Alcohol Induced coma

DRUGS & COSMETIC ACT, 1940

- Amended by Drugs Act 1964 to "include Ayurvedic & Unani drugs". (AIIMS).
  → The Label or container of Medicine should display the formula or a list of ingredients contained in the drug.

SMELL OF POISONS

CN (cyanide) ⟹ Bitter Almonds

Arsenic ⟹ Garlic Like

OPC (Organophosphates) ⟹ Kerosene Like

H_2S ⟹ Rotten egg

ZnP (Zinc Phosphide) ⟹ Fishy

Cannabis ⟹ Burnt Rope

Nitrobenzene ⟹ Shoe Polish

Paraldehyde / chloral hydrate ⟹ Acid / Peas

⇓

K/a "DRY WINE"

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Microbiology

Handwritten Note

MBBS Help

http://mbbshelp.com

http://www.youtube.com/mbbshelp

http://www.facebook.com/mbbshelp.com

Name: _____

Subject: Microbiology

BLANK PAGE

BACTERIAL VIRULENCE FACTORS

17/2/18

Responsible for pathogenesis

Vaccine product is also by virulence factors

Q. smooth → virulent strain → so these are used for vaccines
rough → avirulent strain

Q. All of the following can be used as vaccine to prevent E.coli diarrhoea except

a) CS2
b) K88
c) CFA
d) P_1

All are fimbriae

a, b, c show adhesion to intestinal epithelial cells

d shows adhesion to uroepithelial cells.

FIMBRIAE (PILI)

- They are Glycoprotein
- Antigenic
- agglutinate RBC
- Nomenclature is based on the RBC agglutinated by RBC.

Function:-

1> Adhesion (Gram -ve)

In Gram +ve → adhesion is due to **Teichoic Acid**

2> Conjugation.

Mechanism of transfer of genetic material

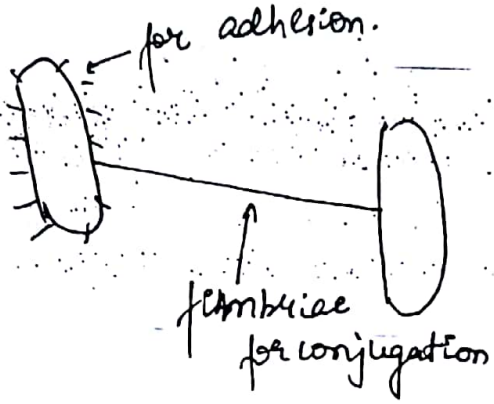
They are **Plasmid** encoded.

F⊖ bacteria can't initiate conjugation

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Enterococcus conjugates thru fimbriae.

Plasmid encoded fimbriae
- Mannose resistant fimbriae
- CFA (colonising Factor antigen) [ETEC]
- Type 1 fimbriae



FLAGELLA

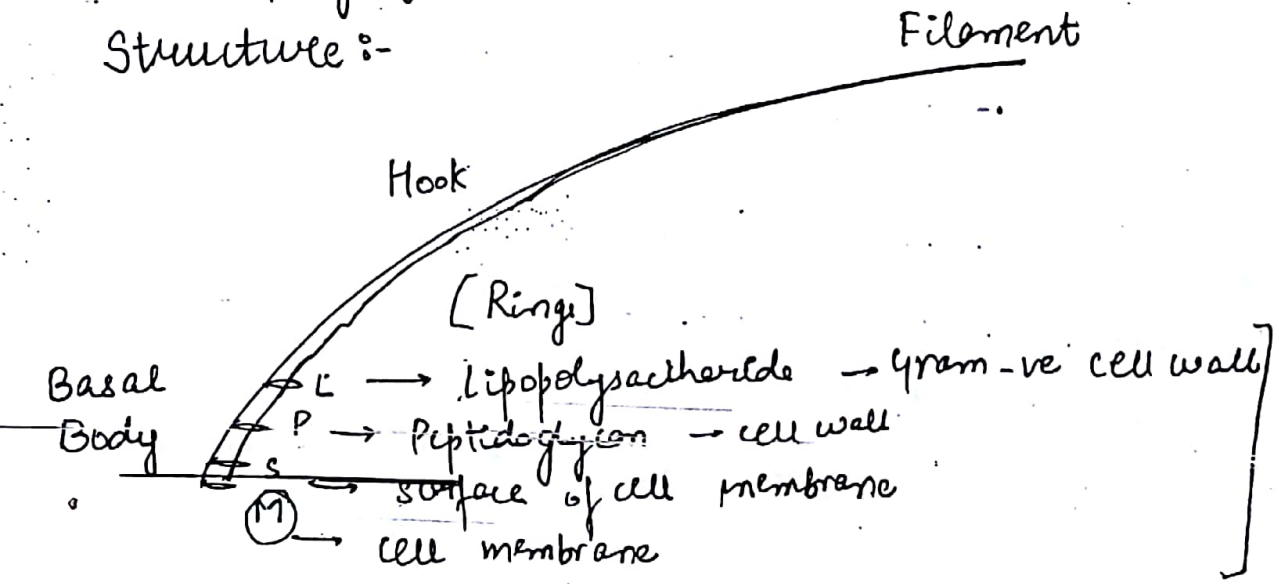
- Protein
- antigenic 'H' Ag
- Thin < 0.02 μm.

Function :-

1) Motility - due to rotation of M Ring

2) Antiphagocytosis

Structure :-



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

In Gram -ve → all flag are found

In Gram +ve → only S.M. flag
↓
only cell membrane attachment

Motility helps in identification of bacteria

Flag

Resolution Power

naked eye → 200 μm

Light microscope → $\frac{200}{1000}$ μm = 0.2 μm
= 200 nm.

Electron microscope = $\frac{200nm}{1000}$ = 0.2 nm.

Flagella can't be seen by light microscope.

Demonstration of Flagella/Motility :-

→ Electron microscope

→ Ryu stain
silver based stain.
not sensitive

→ Serology. 'H' antigen.

→ Hanging Drop (for vibrio only)

→ Dark ground microscope (spirochaetes)

Best method → Growth in semisolid agar (Motility medium)
↓
0.2 to 0.5% agar

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Peritrichous Flagella-
flagella all round
Enterobacteriaceae

Lophotrichous Flagella- Lophar camp me Halla
tuft of flagella at one end.
~~Car~~ campylobacter
Heliobacter

Single polar
Vibrio
pseudomonas.

Swarming can be inhibited by all expect ——
a) 6% agar
b) phenol agar
c) blood agar
d) Mc Conkey agar

Culture Media

Liquid ↓ Basal media → Nutrient broth
Peptone
Meat extract
~~NaCl~~ } 0.85N
H_2O }
Buffers

solid ← agar 1-2%
solidifying temp 42°c
⊖ flagellin
except
Proteus } swarming
Cl. Tetani
B cereus

Inhibition of swarming → 6% agar
Phenol
Boric Acid
Bile salts (+nt in Mc Conkey)

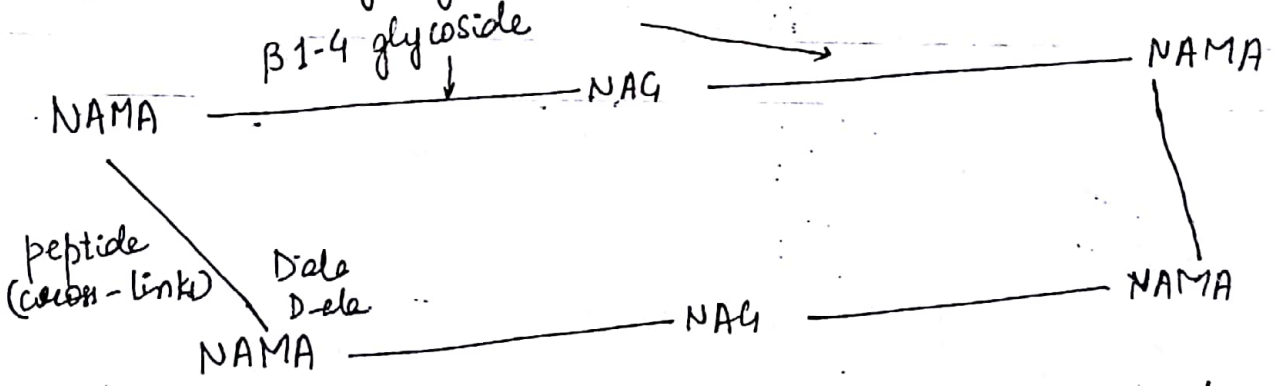
Craigh's tube contain semisolid media but ~~doesn't~~ is not much used for motility.
But in case of solid, semisolid media, it can be preferred for motility.

CELL WALL

Peptidoglycan

Structure

NAMA → N-acetyl muramic acid
NAG → N acetyl glucosamine



COO^- terminal in NAMA has unsaturated end, so form bond while NAG doesn't have this.

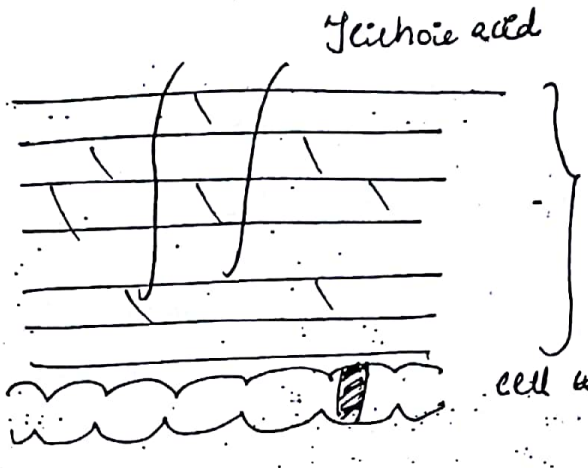
Synthesis :-
Peptidoglycan is synthesised by PBP (penicillin Binding protein)
↓
located in cell membrane

Non-linking (4th Phase → last phase)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Types of cell wall

Gram +ve



Gram -ve

outer membrane
↓
Porins

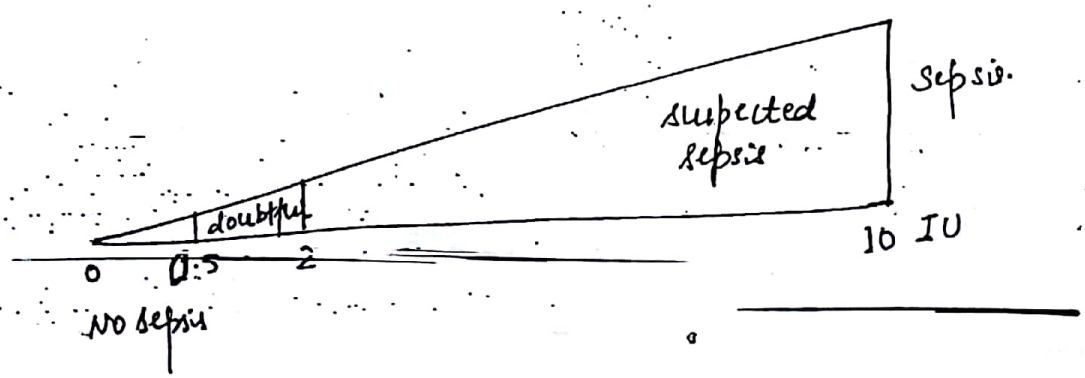
Region-I (outer polysaccharide)
Region-II (core ")
Region-III (lipid A) → most toxic
} LPS
Endotoxin

Thin peptidoglycan.

Periplasmic space

Lipid A → bind to Toll like Receptor 4 on macrophages.
(most toxic)

Best marker of Sepsis = Pro calcitonin



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

LPS → Hydrophobic

Porin helps in passive diffusion of hydrophilic agents

Region I (outer polysaccharide) is antigenic

It is called as O antigen

'O' Antigen

- useful for diagnosis (~~im~~ immugen)
- → Serological ⇒ Serotyping (variability of 'O' antigen)

⇓

epidemiology Q.

Cholera endotoxin doesn't cause virulence

Acid Fast Cell Wall :-

Gram +ve cell wall ≈ Mycolic acid

Function :-

Rigidity (cell wall)

CAPSULE

- Polysaccharide.

except B. anthracis → made up of polypeptide (D-Glutamic acid) Q.

- Polysaccharides are not stained. ~~exc~~

But capsule of B. anthracis can be stained by Polychromic Methylene Blue (Mc Fadyean Reaction)

Function:

Antiphagocytosis Q.

Demonstration of capsule

1> M/I ⇒ Negative stain → India Ink
or
Nigrosin

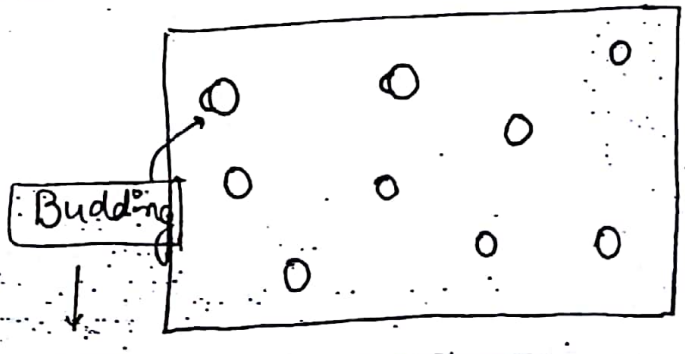
2> Serology → a) Quelling Rx
swelling of capsule using capsular Ab.
↓
Microscope

b) Capsular Ag detection by Latex agglutination
↓
Reverse passive agglutination
↓ when Ag is detected.. then it is called reverse passive.
↓ when particles are used for Ab detect. eg. Latex RBCs

Q. A pt. presented c headache, projectile vomiting along c altered sensorium. Image of indie ink.

Δ

(a) cryptococcus
(b) Pneumococci
(c) Histoplasma
(d) coccidioides



seen in Cryptococcus.

pneumococcus show Lancelet shaped.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Diplococci

Gram -ve → Neisseria

Gram +ve → Pneumococci

Neisseria (Intracellular Diplococci)

Meningococci — capsulated

Gonococci — uncapsulated, kidney shaped

serological assay on microscope slides are not done except VDRL

Quelleng Reac.

↓

non-specific test

Polyvalent antepolysaccharide serum

Capsulated Organisms

Yes the PM Cook Very ~~Nice~~ Fine Chicken to keep his BBB healthy

- Yersinia
- Pneumococcus
- Meningococcus
- Cryptococcus
- Vibrio parahaemolyticus
  Vibrio cholerae O_{139} Q
- Fifth strains of E.Coli, Staph, Strep. pseudomonas

↓

Nosocomial (HAI)

- Clostridium perfringes & Butyricum

Website: http://mbbshelp.com WhatsApp-http://mbbshelp.com/whatsapp

- Klebsiella
- B. anthracis
- Bordetta
- Bacteroid
- Burkholderia pseudomallei
- Haemophilus influenzae

---

* Histoplasma capsulatum
  - Non-capsulated.
  - intracellular yeast & appear as capsulated

ENZYMES & TOXINS

Secreted by Secretion System.

→ Seven Pathways - type I to VII

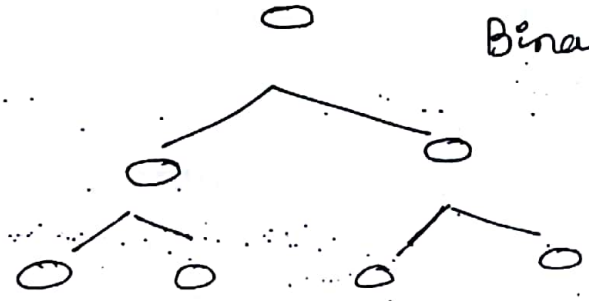
Type I & IV → Both in Gram +ve & Gram -ve

Type II, III, V, VI → only in Gram -ve

Type VII → M. TB.

→ Proteins secreted by Type I, II, & VI pathways -- transverse inner membrane & outer membrane in one step (sec independent - Do not involve amino terminal processing of secreted protein

Growth Curve



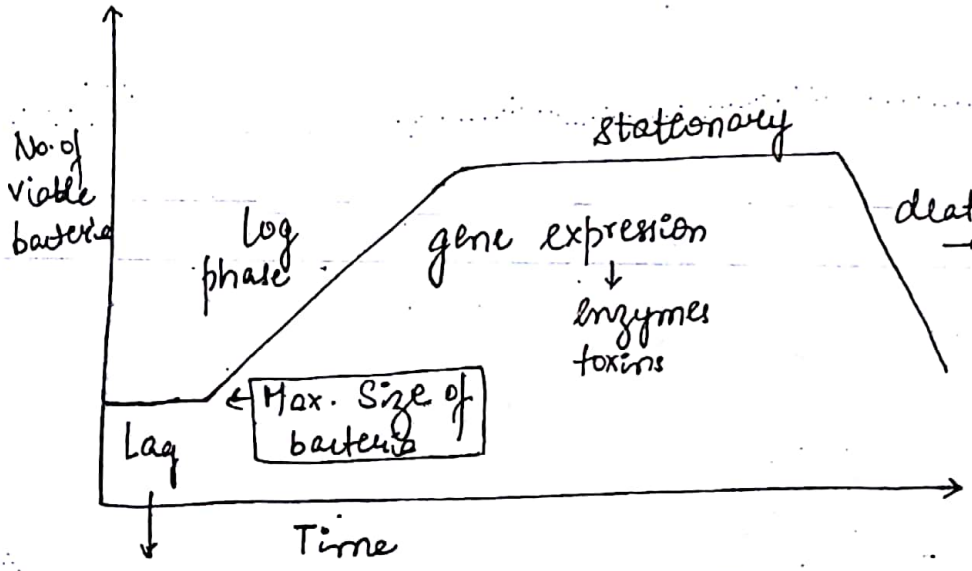
Binary fission (asexual)

Doubling Time is called Generation Time

Max generation Time seen in M. Leprae - 13-14 days

M. Tb → 16 hrs

other bacteria → 20 min. H/C



preparatory phase

↓

enzymes are released

[Metabolic Phase]

~~Anti microbial susceptibility~~ is done by Phenotype Method

↓

~~in log phase~~

→ Stationary phase is due to toxic metabolic products
→ bacterial colony form" → exhaustion of nutrients.
on solid medium

* Sporulation is seen in Stationary phase. * this is for survival.
They are highly resistant becoz they have
Ca dipicholinic acid synthetase
⇓
↓ absorption of water
⇓
↑ Resistance

Δ - 0.5% H_2SO_4 → Zn stain

L forms -
- No cell wall
- Mycoplasma
- Spheroplast → Gram -ve organisms
incomplete destruc" of cell wall.
⇓
Reversible

- Protoplast → Gram +ve organism
complete destruc" of cell wall
⇓
Irreversible

P → +ve

- L-forms are virulent

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Q. A 25 year old lady presents c ↑ frequency & dysuria c from ⊖ bacilli in urine?
After 2 weeks of penicillin t/t she comes back c out resolution of her complaints?

c Gram -ve cocci.

a) β lactamase producing strain
b) Gonococci
c) Spheroplast
d) protoplast

Rx- Discontinue Rx for 24-48hrs. ~~tel the doctor~~
Start the drug c proper dosage

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

BACTERIAL GENETICS

Prokaryotes

↳ No membrane bound organelle.
(no nu, mitochondria, no ER golgi complex)
↓
Respiratory func^n → misosome.
(invagination of cell membrane)

No histone proteins.
↓
packaging of DNA → supercoiling

Genes are located in chromosome
Plasmid,
Transposon.

Chromose, Plasmid → ds DNA
circular
self replicating
↓
DNA polymerase.

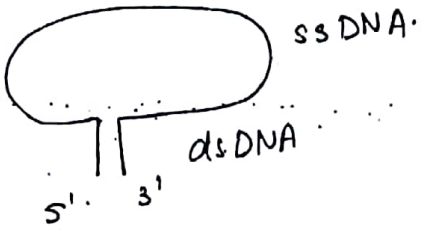
Plasmid are extra-chromosal.
⇓
No metabolic func^n

~~Mobile~~

Mobile Genetic ~~Transposon~~ Elements

① **Transposon**

oligonucleotide strained ē complementary ends.



carry gene → impart new character

Transposons move in cut & paste manner bind to tRNA

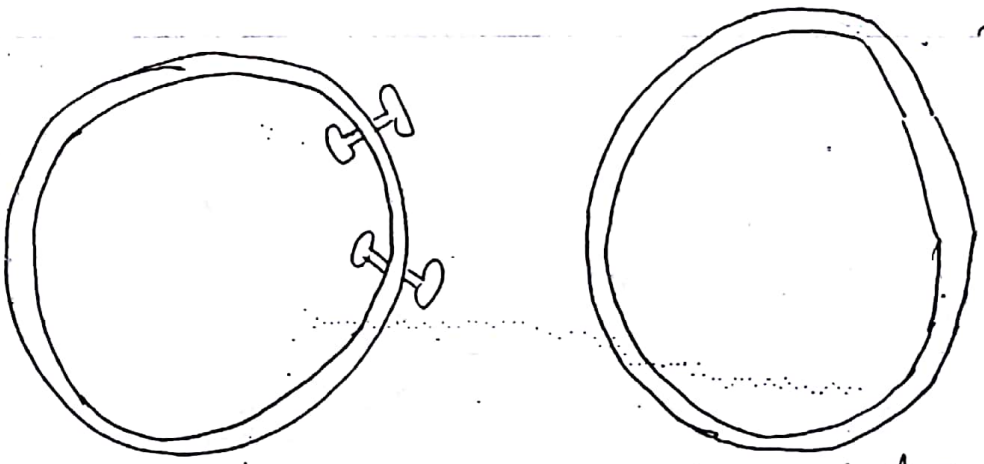
↓

Jumping Gene

Insertion is ē out complimentation.

↓

insert directly between nucleotides. → Repeat sequence formation



Plasmid mediated drug resistence is due to insertion of Transposons.

② **Insertion Sequence** (IS)

Similar to transposon (smaller)

No genes (phenotypic silence) Q.

⇓

Using this **Genotyping** can be done

Gold std for MTB for genotyping is **IS 6110** typing

This is not for M. Bovis

M. Bovis → Spoligotyping

(spacer oligonucleotide) → we see here repeats

TRANSFER OF GENE

Seen in bacteria

- Transformation.
- Transduction
- Conjugation

TRANSFORMATION

Transfer of genes from 1 bacteria to another by naked DNA

↓

fragment of DNA after lysis of bacteria

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Homologous Recombination

Replacement of a part of 1 strand in bacterial genome by (ss) naked DNA fragment at similar genes or alleles

Griffith - Live type II non-capsulated Pneumococci (R)

↓

injected into mice → no pathogenecity

(+)

Killed Type I capsulated Pneumococci (S)

↓

injected into mice

↓

no pathogenicity

When both were mixed together & injected into mice

↓

Death

↓

Bacteria is cultured

↓

Live Type I capsulated pneumococci

↓

He coined the term **Transformation.**

This was called ~~Boi~~ Pioneering experiment in genetics

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Transformation is used in Recombinant DNA Technology
- → antigens
- → vaccines

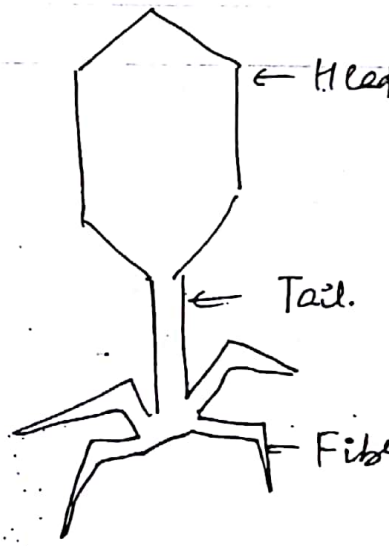
Drug resistance
Transformation may lead to drug Resistance

TRANSDUCTION

M/c method of gene transfer

Transfer of genes from 1 bacteria to another by

Bacteriophage
↓
virus infecting bacteria



RNA phage
↓
filamentous

DNA phage can be used for bacteriophage typing

Q C phage do not carry out transduction?

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

a) Lytic

b) Lysogenic

c) temperate

d) lambda

Q. ε phage shows lysogenic to lytic phase conversion?

∞ ⓒ Temperate phage : lambda

Q. ε phage do not show lysogenic to lytic phase conversion?

Lysogenic phage

Q. Genes associated ε Galactose metabolism is transferred by ε phage

Lambda phage

Q. Seroconversion in salmonella is

a) transformation

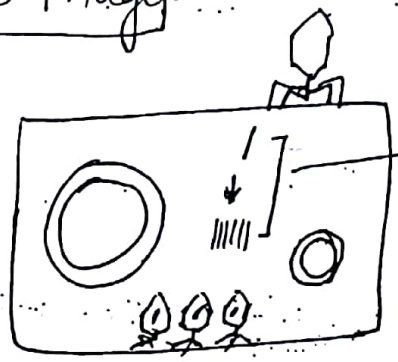
b) transduction

c) Lysogenic

d) conjugation

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Lytic Phage:-



→ Transcripton [from 1 genome to multiple genome]

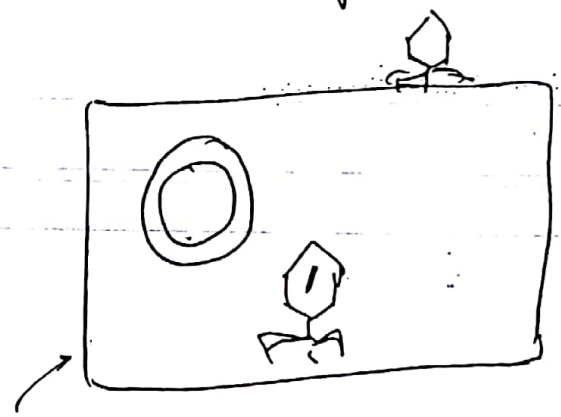
- protein synthesis.
- packaging

No transduction occur normally → if error is not there

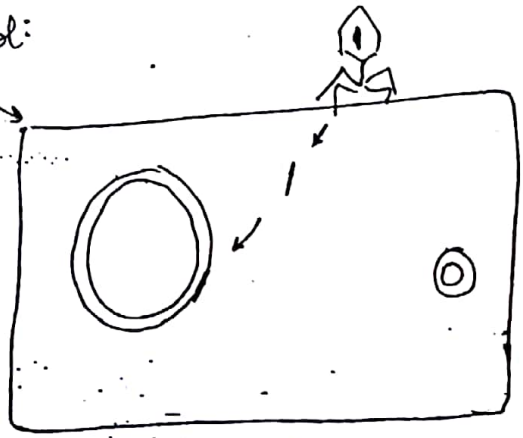
In case of error while packaging, if bacterial genome enters ~~viral~~ viral —

↓

It goes to other bacteria. → ~~inserts the~~ transfer the gene to this bacteria.



E.Coli:



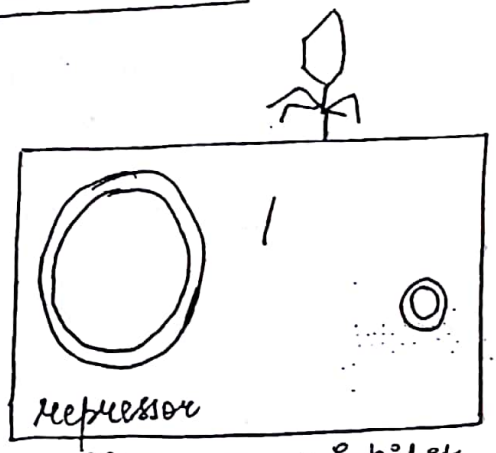
Generalized Transduction :-

- lytic phage
- error in packaging
- Homologous recombination
- every gene has equal chance of transfer.

Lysogenic Phage :- No Transduction

- Incorporation of phage DNA into bacterial genome by homologous recombination
  ↓
  Lysogeny [Transfer from viral to bacteria]

- Rare phenomenon
- Seen in certain bacterias
- Imparts new character to the bacteria
- No lysogenic to lytic phase conversion.
  ↓
- **No transduction.**



→ inhibits lysogenic to lytic conversion

Repressor gene is stimulated by lysogenic

Eg:-

1) **Seroconversion in salmonella**

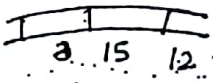
S. Anatum $O_{3,10,12}$ $H_{6,e}$.

↑ Phage 15

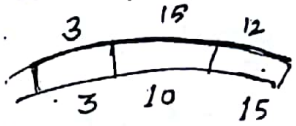
S. Newington $O_{3,15,12}$, $H_{6,e}$

↑ phage 34

S. Minneopolis $O_{3,15,34,12}$ $H_{6,e}$.



ANM



for Serotyping → use monovalent 'O' antisera.

~~for~~ Polyvalent is used for identification of bacteria as a whole (eg. salmonella)

2) **Corynaebacterium Diphtheriae**

β phage → tox gene

↓

'toxin'

due to lysogenic phase, β phage imparts tox gene into corynaebacterium leading to toxin produc". Then it ~~gets~~ released toxin, hence "pathogenic."

⇓

Hence we do Toxigenicity test in Lab Δ of corynaebacterium.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

3> Gp. A Streptococcus (S. pyogenes)

Pyrogenic exotoxin (erythrogenic toxin)

↓

Super Ag → cause TSS.

3 types → (A) → M/c common & dangerous

B - chromosomal

C

Phage coded

Scarlet fever.

TSS in Group A streptococcus leads to scarlet fever.

If lysogeny occurs → ~~Serious~~ Sever scarlet fever

Scarlet fever without lysogeny → mild

4> V. Cholerae
5> Shigella
6> Cl. botulenum
} exotoxins.

Temperate Phage ⇒ Transduction (+)

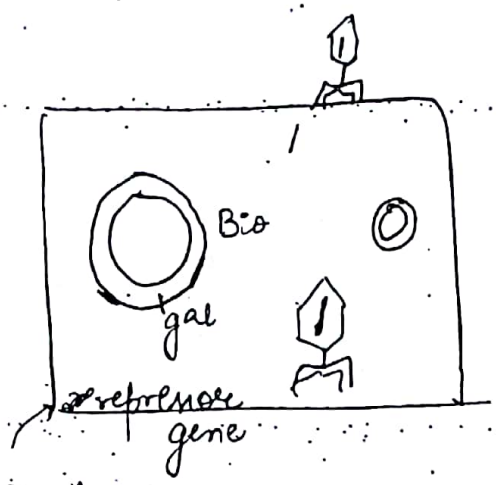
They show Lysogenic to Lytic conversion

eg. Lambda phage → insert phage DNA bet^n gal + bio genes

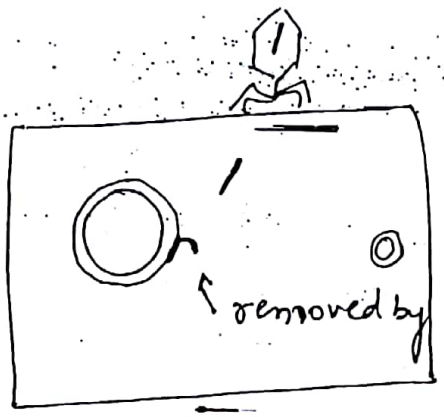
↓

Galactose metabolism

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp



E.coli



Specialized or restrictive transduction -

- Temperate phage
- Error in excision
- Homologous recombination seen
- Specific genes transferred

↓

Lambda → gene associated in galactose metabolism

when bacteria starts dying (repressor gene stops acting)

↓

Phage protein are formed, genetic material is taken out

↓

due to error bacterial gene are also detached along in viral genome (error in excision)

↓

~~Virus~~ Phage infects other E.coli

↓

But due to more similarity to bacterial genome only bacterial genome is inserted into this bacteria, viral genome is removed by enzyme

⇓

Transduction

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Transduction also can lead to Drug Resistance

CONJUGATION

Transfer of gene from 1 bacteria to another by Plasmid

Q. Transfer of chromosal gene by conjugation is seen in-

a) F+

b) F-

c) Hfr — PGI - Hfr, F'

d) F1 — NBE - Hfr.

If 1 Hfr (cell 1) having A, B, C, D gene after the plasmid conjugate ~~c~~ 100 F- bacteria. (cell 2) then predominant genotype would be

a) cell 1 c A, B, C, D

b) cell 1 c A

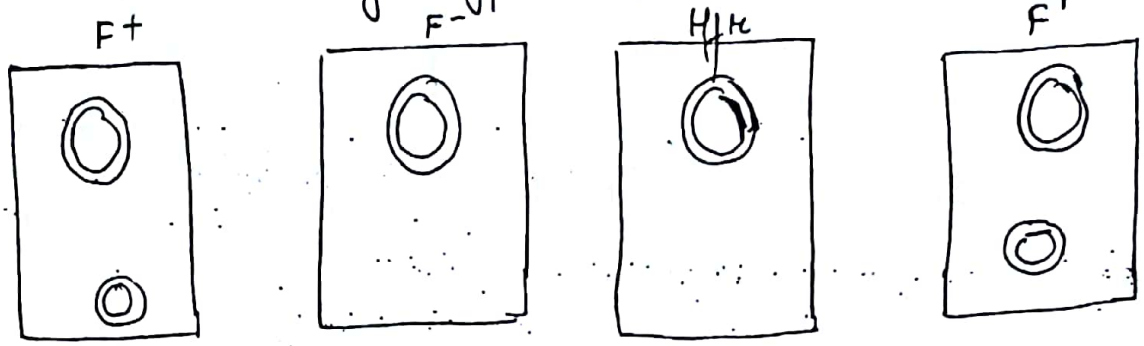
c) cell 2 c A, B, C, D

d) cell 2 c A

[Since no change in genotype

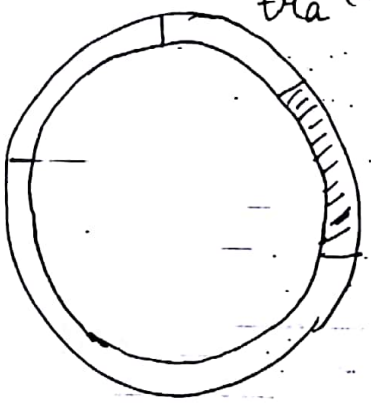
[F- remains the same].

There are 4 genotype in baiterie



F' is the baiterie where plasmid contain chromosal material

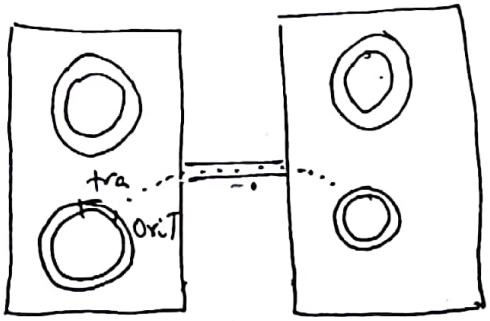
F plasmid



tra ← transfer factor
↓
conjugation tube or pili

OriT → origin of transfer
↓
cuts outer strand after the tra gene.
⇓
LINEAR.

F+ X F-



⇒ - change in genotype.
- No. Homologous recombination is not seen. Q.
⇓
No transfer of chromosal genes

Plasmid is self replicating hence 1 strand form the other

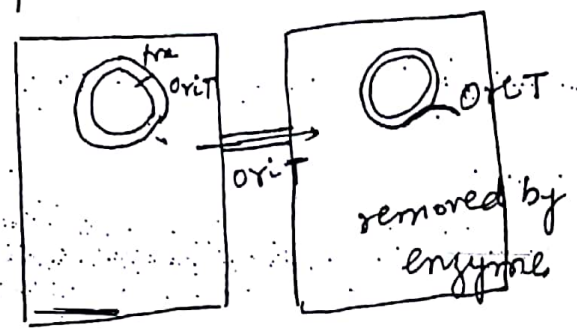
- Horizontal Transfer.
- Rapid

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Plasmid mediated Drug Resistance.

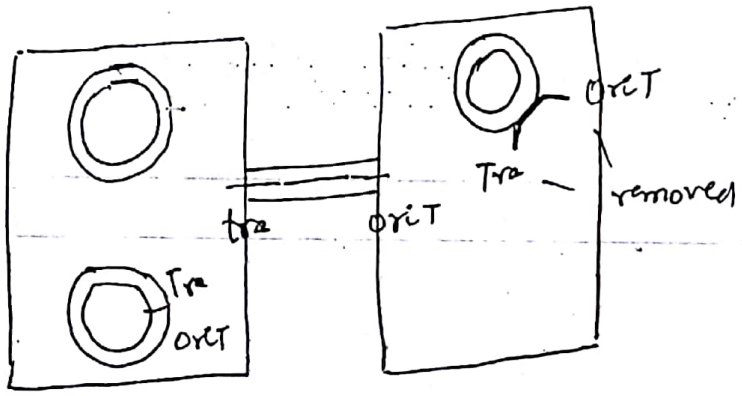
Hfr x F⁻

conjugation tube is stable ≈ 10 min



⇒ No change in genotype
⇒ Homologous recombination is seen
⇒ Transfer of chr. genes
⇒ Horizontal → not rapid

F' x F⁻ - Sex duction.



⇒ No change in genotype
- Homologous recombination is seen
- Transfer of chromosome genes
- ↓ frequent

$F^+ \times F^+$
Hfr $\times F^+$
} conjugation (X)

STERILIZATION & DISINFECTION

Killing of all organisms including spores.

⇓

Biological Indicators (BI)] Quality control
10^6 spores of Bacillus sp.]

STEAM STERILISER (AUTOCLAVE)

121°c for 15 min at 15 lb pressure

- Surgical equipments.
- dress material
- bandages
- culture media except LJ.
  Loeffler's Serum slope] ⇓

By **Inspissation**
80°c for 1hr x 3days.

⇓

fractional Sterilization.

Tyndallisation
100°c for 1hr x 3 days.

Sugar media → Heat at 100°c

BI → **B. stearothermophilus**
once a week.

BEST
Bowie Dick Test or Vacuum leak Test
Chemical indicator → every min.
measure the penetration of steam.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Browns tube - chemical

HOT AIR OVEN

160°c for 2hrs.

→ glassware
→ Liquid
→ sharp equipments. ——→ chemical disinfectant can also be used for sharps
↳ autoclave (X)

BI → B. Subtilis subspecies NIGER
↓
B. atrophaeus (new name)

ETHYLENE OXIDE

Warm cycle → 50°c ± 5°c
cold cycle → 37°c ± 5°c

{ plastic ware (syringe, IV tube, catheter, urine bag)
{ gloves
↳ Gamma wave are preferred.

ETO → Heart Lung Machine

BI - Bacillus Subtilis GLOBIGII

IONISING RADIATIONS (cold Sterilization)

γ rays - plastic
glover
catgut sutures

BI → B. pumilus.

UV rays → Biosafety cabinets

⇓

HEPA filter Highly efficient particulate air (0.3 μm)

ULPA filter (ultra low particulate air (0.12μm)

FILTERATION

- Vaccines & anti-sera
- Membrane filters → 0.22 μm.

BI → Brevundimunous diminita (pseudomonas)

Bubble point Testing.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

GAS PLASMA STERILIZATION

Argon or H_2O_2 —(electric field)→ Ionised —→ Plasma state

Plasma state → Kill organism.

BI - B. atrophaeus

DISINFECTION

Reduction of no. of pathogens including spores

ANTISEPTIC

Chlorhexidine

SPAUL DING CLASSIFICATION

It classifies equipments

Critical → tissue contact → surgical equipments → Sterilisation.

Semicritical → mucous membrane → endoscopes / colonoscopes (heat sensitive)

↓

2% Glutaraldehyde for 20 min (CIDEX)

Laparoscope (critical) → 2% Glutaraldehyde for 2hrs

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Non-Critical → Skin → Thermometere
↓
intermediate level disinfectant
Ethanol.

CLASSIFICATION OF DISINFECTANTS

Level	Sporicidal	Virucidal Non-enve	enveloped	Others
High	+	+	+	+
Intermediate	−	+	+	+
Low	−	−	+	+

High → • 2% Glutaraldehyde
• formaldehyde
↓
fumigation ←
Peracetic acid + H_2O_2

Intermediate → alcohol
Phenol
Cl_2 releasing agent

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Low → Quarternary ammonia
Lysol (cresol + soap)

EFFICACY OF DISINFECTANT

1) Concentration
2) pH
3) Contact time
4) Organic compound → ↓ efficacy except phenol

Sputum, Stool } 5% phenol. 18 hrs
↓
RNTCP

TESTING OF EFFICACY

→ Phenol co-efficient
- Reidel Walker
- Chick Martin (organic matter)

} not used nowadays

→ In use Test (MIC)
- Kelsey sykes capacity test

In case of organic matter, this test can be done.

Endoscopes → 1st rinsed with H_2O to remove organic matter
↓
disinfectant

Complication
↳ M. chelonei abscess

PRIONS → autoclave at 134°c for 5hrs.

or

✓ 2N NaOH.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

IMMUNE SYSTEM

Attribute	Innate	Adaptive
① Repone Time	min/hour	Days.
② Specificity	Low (for str. shared by group of microbes)	High (for specific Ag of microbes. Every epitope
③ Diversity	Limited	High. 10^8 to 10^{10} idiotype
④ Memory	Low (only in NK cells)	High
⑤ Self/non self Discrimination	Yes	Yes
⑥ Anatomic + physical barriers 1st barrier → low pH	Skin, mucosa, chemical (lysozome, IFN α + β, temp. + pH)	L.N, spleen, MALT
⑦ Blood protein	Complement	Antibodies
⑧ Cells	Phagocytes, monocytes, macrophages, neutrophils) NK cells, other leukocytes, epithelial + endothelial cells	Lymphocytes other than NK cells

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Innate + adaptive Immune Response are interedependent & not independent.

MATURATION OF CELLS

occur in **1° Lymphoid organs**

↓

Bone Marrow

Thymus

Antigenic Exposure

↳ **2° Lymphoid organs**

↓

Spleen → blood borne

L.N. → Lymphatic draining tissue.

MALT (mucosa associated lymphoid tissue)

CALT (cut. associated " ")

↓

Intestinal pathogens

↓

Skin.

Bone marrow act as 2° lymphoid organs in few case

eg. Salmonella

* Organ : act as both 1° & 2° Lymphoid organ. Bone Marrow.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

B CELL MATURATION

occurs in Bone Marrow.

Pro B cell → Pre B cells —(Tyrosine kinase)→ (surface IgM) Immatured B cells → Mature B cells (Surface IgM + IgD)

- Pro B cell → CD_{90}, $CD_{19,20,21}$
- Pre B cells → additional cytoplasmic μ heavy chain

Follicular cell of Bone marrow
↳ carries out +ve ~~feedback~~ selection, -ve ~~feedback~~ selection.

- NO MHC
- They check the maturation ⇒ +ve selection.

↓

sent to 2° lymphoid organs

Few B cells → autoAb. — killed by apoptosis → -ve selection

prevents autoimmunity

antigen exposure

Hence B cell, has both +ve & -ve selection.

Differential RNA splicing

Memory B cells
- long lived
- have ~~IgM~~ Surface Ab
  - IgM (Monomer)
  - IgG or IgA or IgE

Plasma cells
- No surface Ab
- Secrete Ab in blood
  - short lived
  - IgM (pentamer) / IgD [Not class-switching]
  - IgG or IgA or IgE [class-switching]

1 plasma cell → 2000 Ig/sec.
↳ short lived

Q. One B cell (mature) → 1.5 to 3 lakhs surface Ig
- IgM & IgD
1 : 1000

→ Surface Ab are monomeric.

Peak Repone Time in 1° Immune Reponse = 7-10 days
Secondary " " = 3-4 days

I CELL MATURATION

- occur in Bone Marrow & Thymus

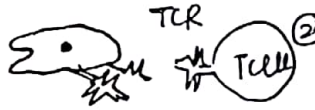
Lymphoid cells.

Bone Marrow

Bcell ← CD^{7-} ← Notch 1 gene → CD^{7+} cells expressing CD^{7+} go to thymus

$CD_1^+, CD_2^+, CD_3^+, CD_7^+ TCR^+, CD_4^+, CD_8^+$

Cortex



Positive selection → ① maturation
② Self MHC recognition.

$CD_1^+ CD_2^+ CD_3^+ CD_7^+ TR^+$ < $CD_4^+ CD_8^-$: T_H
$CD_4^- CD_8^+$ T_C

Medulla

95% → Negative selection → few Tcells have TCR ↑ affinity for self MHC. → killed by apoptosis

2° Lymphoid organs → prevents autoimmunity

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

APC → MHC II & MHC I (nucleated cells)

Professional → [Dendritic cells] → specialised

→ Macrophages

→ B cell

Non-Professional

→ Microglial cell (brain)
→ fibroblast on skin
→ pancreatic β cells
→ vascular endothelial cells
→ epithelial cells — N cells
Thymic epithelial etc.

All nucleated cells or platelets have MHC I

MHC-I → has 1 chain
MHC-II → has 2 chain.

If affinity of T cell is quite more towards self MHC
↓
It may act as autoantigen
↓
Hence undergoes apoptosis

occurs in medulla

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

LYMPHOCYTIC HOMING

	Thymus Dependent area	Thymus Independent area
Spleen	Periarteriolar Lymphoid Sheath	cortical medullary follicular germinal centre
Lymph node	Paracortical area	

T cell zone — **B cell zone**

In a person undergoing thymectomy (neonatal) at / adolescence / LN Biopsy

↓

Paracortical area undergoes atrophy

↓

as T cells are not formed.

TOLL LIKE RECEPTORS

TLR1 → Mycobacteria + Gram -ve bacteria

TLR2 → Gram +ve bacteria
Trypanosoma
Mycobacteria
Yeast + other fungi
Schistosomes

TLR3 → Virus

TLR4 → Gram -ve bacteria
RSV
Fungi

TLR5 → Bacteria

TLR6 → Mycobacteria
Gram +ve bacteria
Yeast & other fungi

TLR7 → Viruses

TLR8 → Viruses

TLR9 → Bacterial DNA
Herpes virus
Malaria parasite heme byproduct

TLR10 → Unknown

TLR11 → Uropathogenic bact
Toxoplasma

TLR12 → Unknown

TLR13 → Vesicular stomatitis virus

ANTIGENS

Epitopes are found in antigen

↓

They are separately immunogenic

Antigenic Determinents

1) **Size** < 10k Dalton → Hapten

10-100k Dalton → Hapten or Immunogen

>100k Dalton → Immunogen

All antigens are not immunogens but all immunogens are antigens.

2) **Chemical Nature**

Protein > polysaccharide > Lepid > Nucleic Acid

3) **Susceptibility to tissue enzymes**

4) **Foreignness**

directly proportional

Sequestered Ag → lens protein
sperms

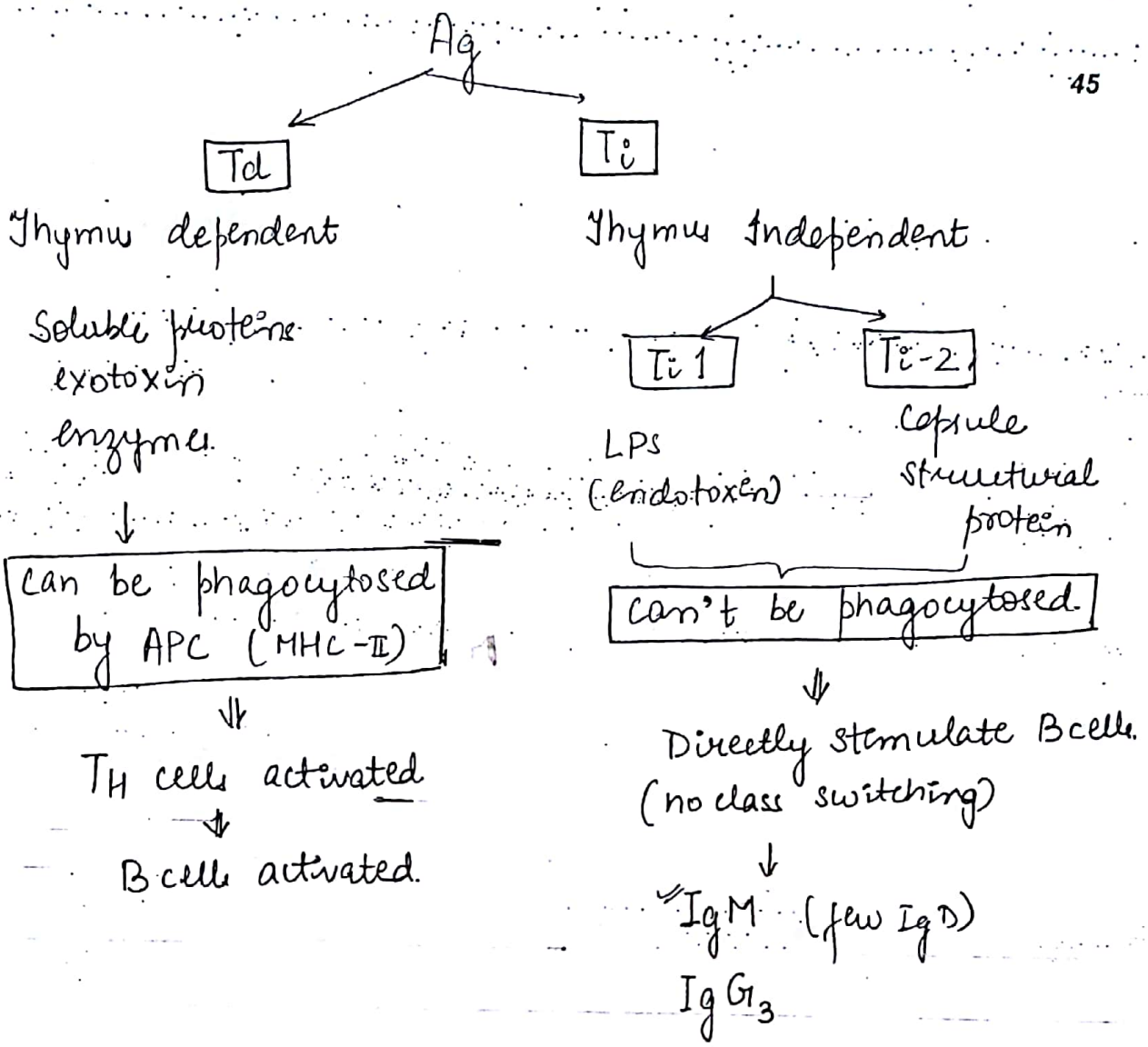
↓

can lead to autoimmunity

5) **Immunoprivileged sites**

Cornea
Uterus
testis
Brain
} No immune response.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

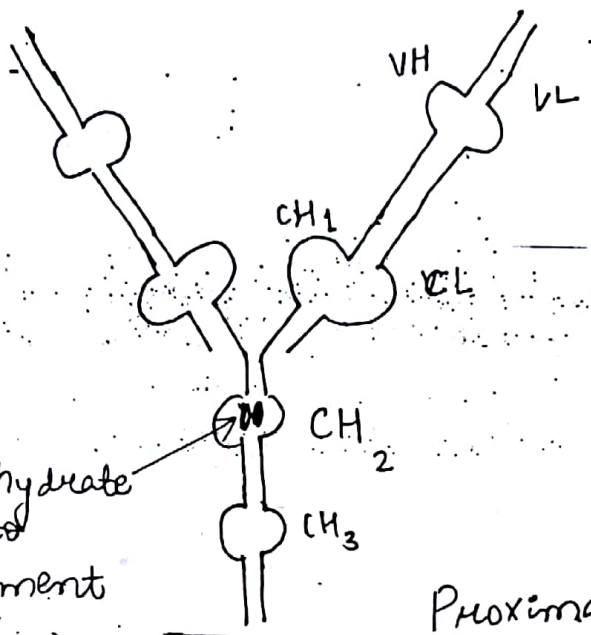


	Td	Ti
Class switching	⊕	⊖
Ab diversity	⊕	⊖
Affinity maturation	⊕	⊖
Memory response	⊕	⊖
Phagocytosis	⊕	⊖
Complement activation	⊖	⊕

ANTIBODY

distal (NH_2 terminal)

F_{ab} → idiotype



Proximal (COO^- terminal)

F_c → isotype

IgM & IgE → additional CH_4 domain.

Carbohydrate → CH_3

Molecular wt

IgM → 900 kDa (millionare)

IgA → 365 "

IgE → 190

IgD → 180

IgG → 150

Max Carbohydrate content ⇒ IgE - 12%

IgD - 13%

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

* **Idiotype** is determined by Variable domain of both H & L chain.

⇓

Hypervariable region

[Complementarity Determining Region]

⇓

Each Domain has 3 CDR.

3 Domain CDR

Paratope is the portion of Ab where Ag comes & bind.

2 similar Ags can bind to both side.

Func" of Idiotype - Antigen Binding.

* **Isotype** is determined by contant region of mainly

(H chain) & L chain

Func" ⇒ IgM → complement activation

IgG → opsonisation &.

ADCC (antibody dependent cell mediated cytotoxicity)

IgE → degranulation of mast cells basophils, eosinophils

⇓

destroy cell membrane of helminthes

IgA → mucosal immunity

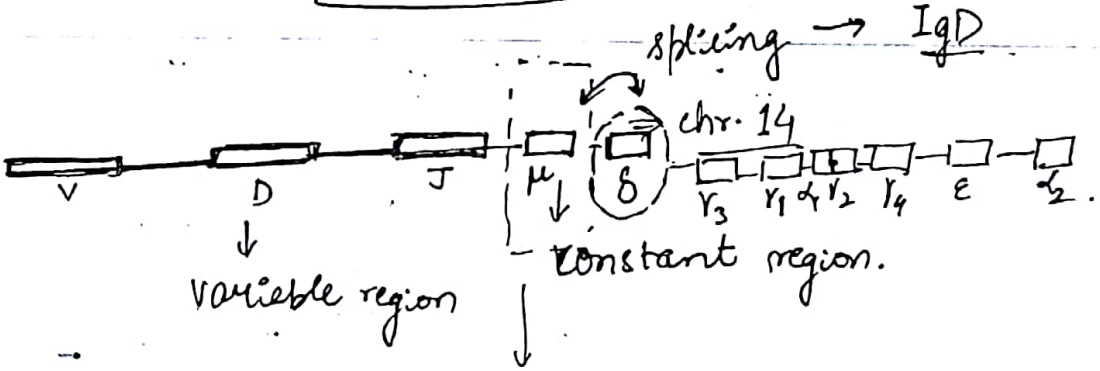
IgD → no biological func^n.

MECHANISM OF ISOTYPE FORMATION :-

- Splicing → IgD
- Class switching → IgG or IgA or IgE

Genes encoding	Located on
H chain	— chr 14
L chain (kappa)	— chr 2
(Lambda)	— chr 22.

K : λ = 2 : 1



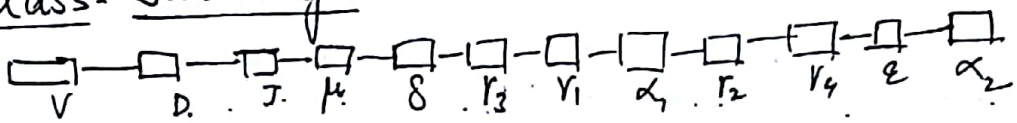
- Hence IgM is the 1st Ab formed
- Marker of acute infn.
- whenever B cell stimulated.

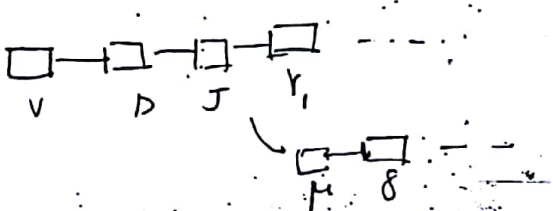
IgM is always formed

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Class-switching occurs in B cell only once.

Class-Switching :-





⇒ Ig Cr.

1) enzymatic removal of isotype determining gene
↓
gene rearrangement

2) irreversible

3) occurs only once in one B cell

4) TH_2 (CD_{40L}) ⟷ (CD_{40}) B cell.
↓
B cell get activated.

5) Germinal centre of 2° lymphoid organs.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Nude Mice [natural Strain]

- No hair
- Chr 11 defect on Fox N_1 gene
- vestigeal thymus
  ↓
  selective T cell deficient
- Gnotobiotic environment [Germ free environment]
- IgM (few IgD) → No class switching

Di George Syndrome

Fish Mouth
Deformed ears
Wide set eyes
Cyanosis ← cong. Heart Disease. [Fallot's M/c]
Seizure due to hypocalcaemia [no parathyroid]
No thymus

Defect - Chr 22 q 11 defect
- failure of development of 3rd, 4th pharyngeal pouch

No class switching → only IgM Ab formed

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

*Hyper IgM Syndrome

defect in CD40L on T cell

↓

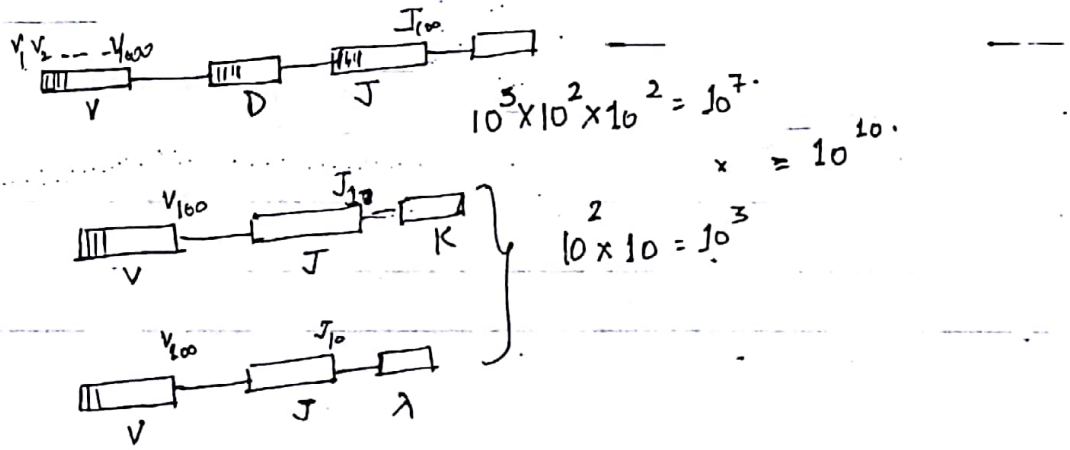
Selective B cell Deficiency

Classified on the basis of clinical outcome

- No class switching
- ↑↑ Ig^M → 10 µg/mL [N 1.5 µg/mL]

Ab DIVERSITY

Mechanism of idiotype formation



$10^5 \times 10^2 \times 10^2 = 10^7$

$x = 10^{10}$

$10 \times 10 = 10^3$

M/c. Helminthic infec" in HIV = Strongyloides.

- Recombination of multiple genes encoding for variable domain of both H & L chains

↓

Recombination of every H chain c all different L chains

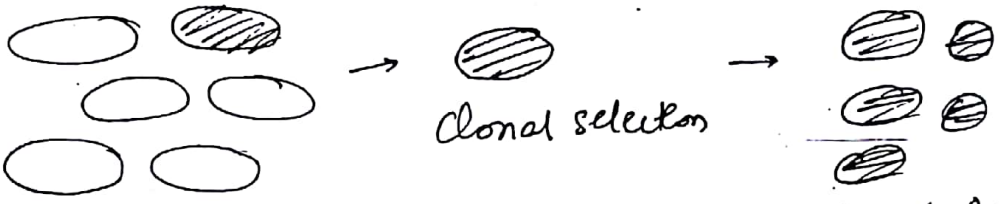
Nucleotides are getting added continuously, hence genes never get exhausted

Mutation also leads to addition of genes

1> Terminal nucleotide addition by tdt enzyme

2> Removal of nucleotide by exonuclease

AFFINITY MATURATION (Somatic Hypermutation)



[1V, 1D, 1J]

Mutation in the gene in such a way that Ag binds ~~c~~ greater affinity in Domain.

By mutation in the variable gene,

↓

↑ affinity

↓

Clonal selection of that cell

rest cell die.

↓

The cell undergoes clonal Proliferation

Through affinity ~~maturation~~ we can know about ~~patient~~ recurrent infection

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

past infn → high affinity
present " → less affinity

C Ab has ↑ affinity ?

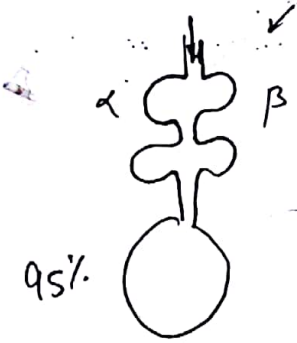
IgG → since time taken is more

IgM → ↓ affinity → but Highest ability (valency) (10)

↳

Valency of B cell Receptor = 2

T cell Receptor = 1.



18/2/18

M/c Mechanism responsible for idiotypes or Ab diversity = Recombination at the variable regions.

Affinity Maturation is due to mutation at the variable region genes.

C ~~Isto~~ Isotype has highest affinity IgG

C " " lowes " IgM.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

- A pt. suffering from CGD not susceptible to c shigella species → Shigella dysenteriae.
- The B cell stage predominant in Bruton hypogammaglobinemia → Pre B cell
- The cytokine responsible for pathogenesis of salmonella gastroenteritis → IL8
- Negative selective helps in prevention of c type of disorders - Autoimmune

ALLOTYPES

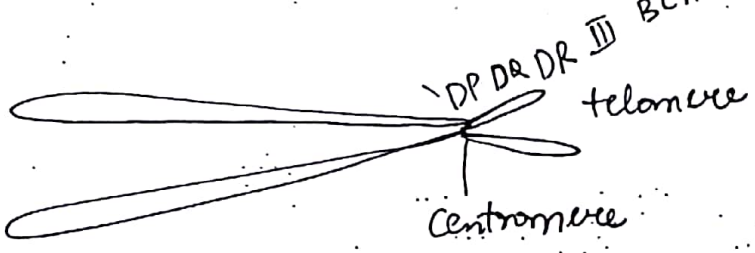
Subtle amino acid difference in the constant region of H chain & L chain.

⇓

Allelic Exclusion

MHC [MAJOR HISTOCOMPATIBILITY COMPLEX]

It is a cluster of genes located on short arm of Chr. 6



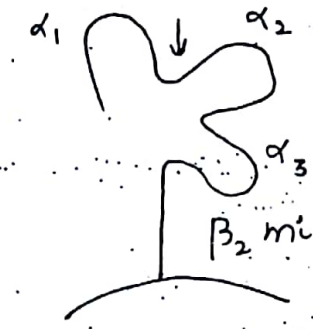
— Telomere end

CD Player
centromere

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

DP DQ DR | B C A
II III distal I

MHC-I



- Site of binding of Ag in MHC-1 ⇒ Distal α_1 & α_2.
- Peptide of length 8-10 AA can bind to this site
- Deficiency of β_2 microglobulin leads to
  - Hereditary Haemochromatosis.
  - Due to mut^n in 283 positon of Hfe gene

↓

Due to this mutation
Cysteine is replaced by Tyrosine

↓

[β_2 microglobulin regulates absorp^n of Fe]

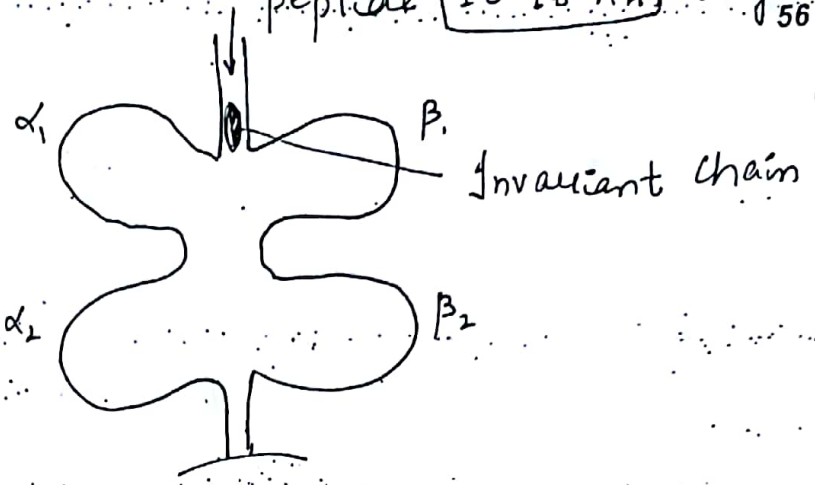
↓

So Iron overload may occur

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

MHC-II

peptide 13-18 AA length



- Invariant chain ~~prevents~~ blocks binding of normal peptide

↓

Hence MHC-II prevents autoimmunity

- Defect in Invariant chain lead to autoimmunity

[It is due to defect in DQ, DR region]

MHC-III

It codes for complement protein C_4, C_2

Heat shock proteins

TNF α, β

21 Hydroxylase.

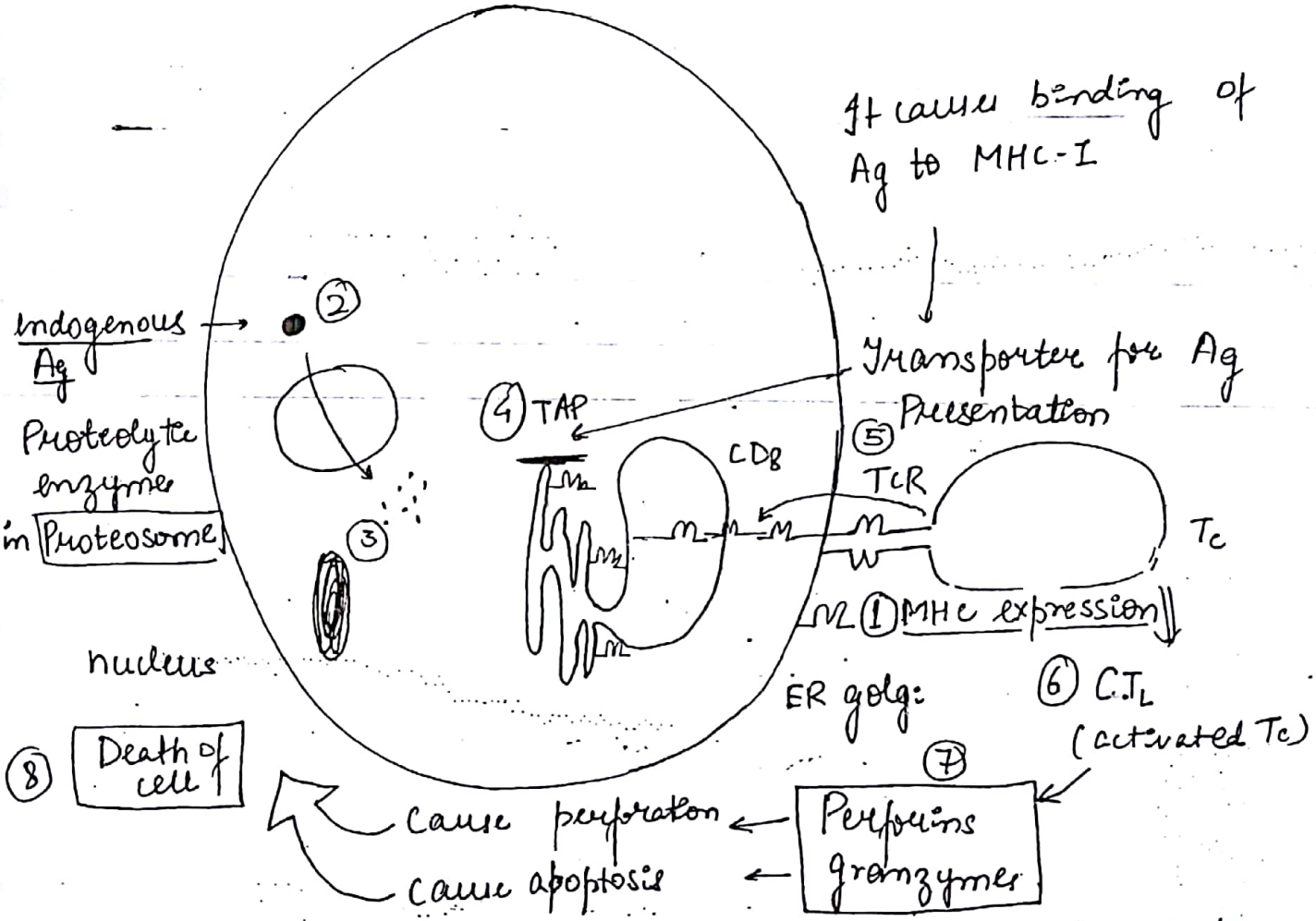
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

ANTIGEN PROCESSING (Td)

Td Antigens

- Endogenous Ag
  - Tumour cells
  - Virus infected cells
- Exogenous Ag

(I) Endogenous Ag Processing



Proteolytic enzymes break endogenous Ag into smaller proteins

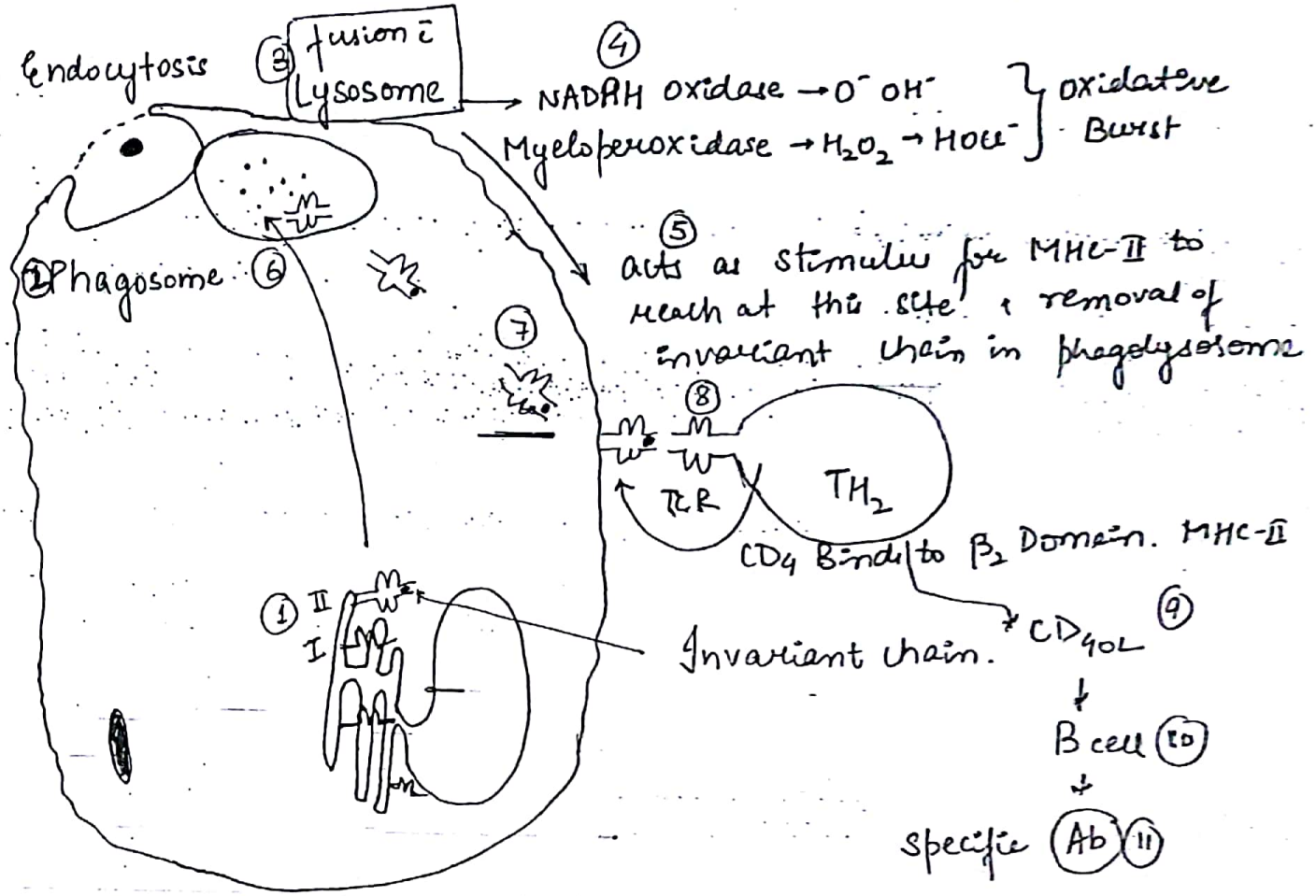
Tc ♀ (CD8) bind to α_3 domain of MHC I [Tc]

CD4 binds to β chain *

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

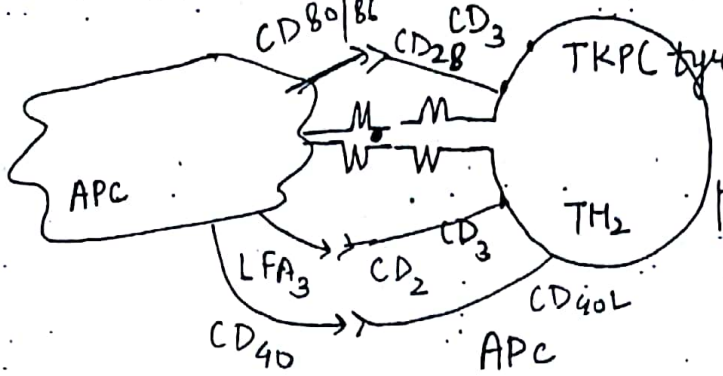
* Exogenous Ag. Processing

B cell → pinocytosis



SIGNAL TRANSDUCTION OF TCELL

SIGNAL TRANSDUCTION



1st Signal — Ag restricted ⟷ TCR
MHC II

2nd Signal (costimulatory Signal)

B_7 (CD80/86) ⟷ CD28

LFA 3 ⟷ CD_2

CD40 ⟷ CD_{40L}

3rd Signal ⟶ **CD_3 activated**

↓

TKP activated

↓

Proliferation
cytokines ↑↑

Signal Transduction

TH_0 [Naive TH cells]

IFNγ → TH_1

Produce
IL2
IL12
TNFβ
IFNγ → form IgG

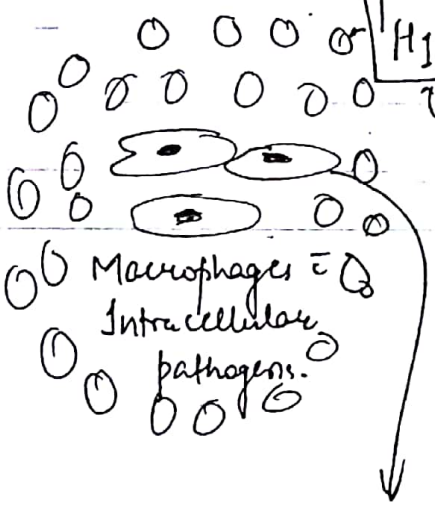
activate macrophages & intracellular pathogens

IFNγ ↑↑↑

Necrosis

TH_1 Lymphocyte

∵ TH_2 is not able to act & produce Ab through B lymphocyte.



epithelioid cells.

Granuloma

↓

Cell mediated Immune Response

IL4 → TH_2

Class Switch B cells → IgE

TH_2
IL13
TGFβ
IL4
IL5
IL6

IgA

IL6 → Proliferation of many cells.

TH_1 → IFN-γ → IgG (B cell)

TH_2 ↑

For formation of IgG TH_1 & TH_2 both has to play the role as IFN-γ is released by TH_1

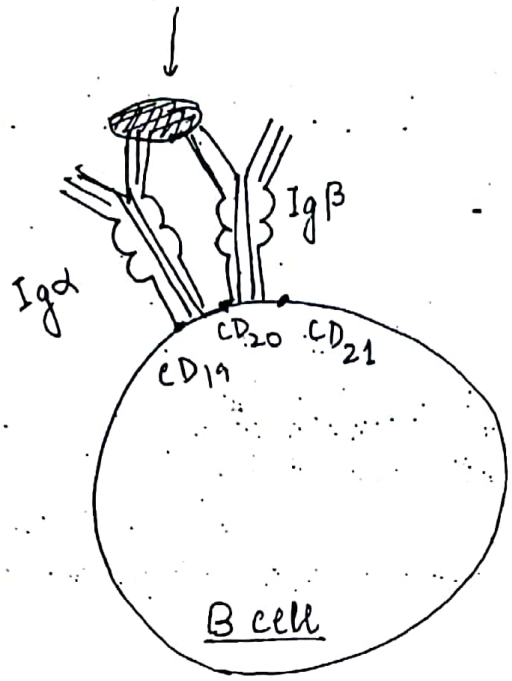
↓

Plasma cells

↓

Humeral Immune Response.

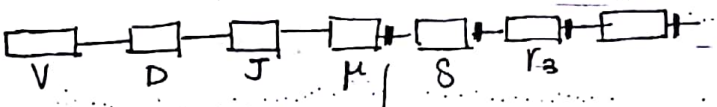
T i Ag



Ig Superfamily

Igα + Igβ

H & L chain



This gene encodes for Igα & Igβ chains → Differential RNA splicing (Plasma → Memory)

Signal Transduction by T i Ag

- Igα
- Igβ
- (MZ) CD19
- CD20
- CD21

} Signal Transduction molecule

↓

Rest is same [TKP activation & following]

↓

IgM → Complement System

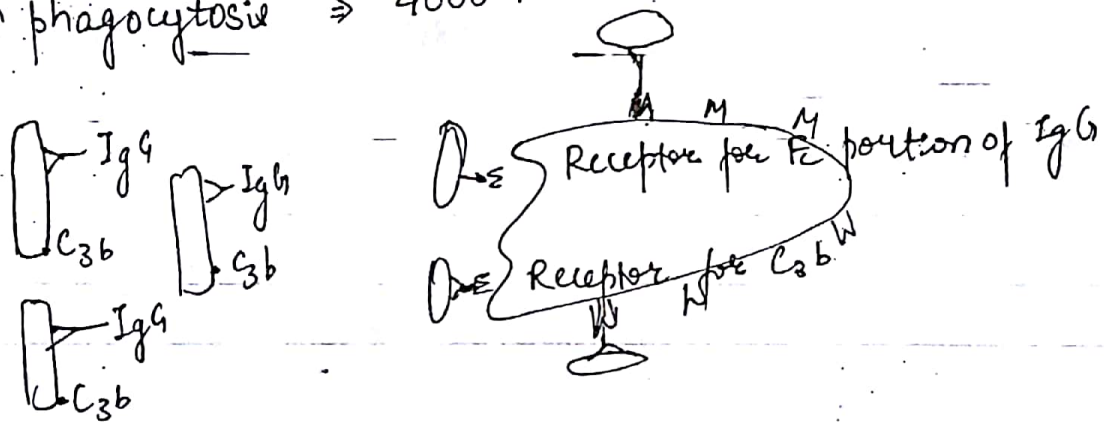
COMPLEMENT SYSTEM

Functions:-

1) Opsonisation (C_{3b})
2) MAC mediated lysis of bacteria (C_{5b-9})
3) Immune complex clearance (C_{3b})
4) Chemotaxis by smaller fragments (C_{5a})
5) Ag - Ab complex activation
6) Memory

OPSONISATION

↑ phagocytosis ⇒ 4000 x



Opsonins

Innate response

- Collectins SP A.
- SP-D.
- MBL
- L-ficolin
- C1q
- * (C3b)
- C4b.
- C3b

C3b

cleavage products (iC3b, C3c, C3dg)

Adaptive response

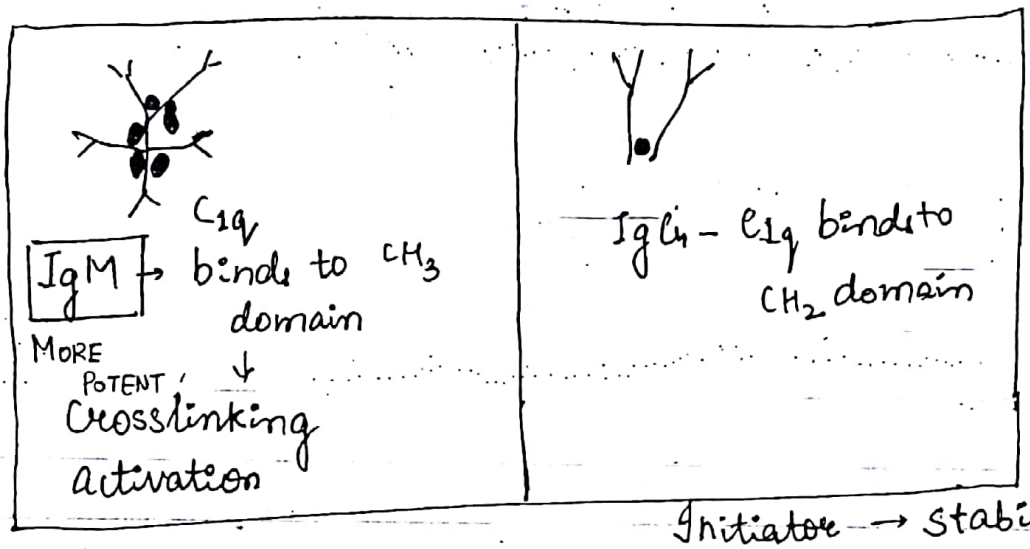
- IgA
- (IgG)*
- CRP

Max. complement Protein ⇒ Bound C_3.

C_3 converter → bound C_3 < C_{3a} / C_{3b}.

(I) Classical — IgM / IgG

(II) Alternate — Free C_3 in blood < C_{3a} / C_{3b} → degrade



IgM / IgG binds to Ag + C_{1q} → C_4 – C_{4a} / C_{4b}

C_{1s} → C_2 < C_{2a} / C_{2b}

C_{4b2a} = C_3 convertase → bound C_3 < C_{3a} / C_{3b}

Initiator → stabilize C_{3b}

factor D or Properdin

Factor B: Ba / Bb

C_{3bBb} = C_3 convertase

C_5 convertase → C_{5b-9}

C_{3bBb3b} = C_5 convertase

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Neisseria Inf^{n} ← Lysis ← MAC

It doesn't allow opsonization.

So,

C_{4b2a} + C_3 → $C_{4b2a}C_3$ → C_{5b-9}

C_{4b2a} = C_3 convertase

$C_{4b2a}C_3$ = C_5 convertase

Initiators of Alternate

1) Endotoxin
2) Snake venom
3) Trypanosoma protein
4) Zymosann on yeast
5) Nephritic factor
6) Dextra sulphate
7) Inulin
8) IgG, IgA, IgD.

C_{4b} binds to C_2, expose it to the action of C_{1s} ↓ C_{1s} cleave C_2 into C_{2a}, C_{2b}

Yes Snake, In ✱ End Trey, Ne → GLAD

IgE, IgG$_4$ doesn't activate complement

(iii) LECTIN PATHWAY

MBL (mannose binding lectin)

↓

It activates C1q directly

↓

rest similar to classical pathway.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Regulation Of Complement

Protein	Function
1) C1 Inhibitor	→ Dissociation & inhibition of $C_{1r_2s_2}$ from C_{1q}
2) Decay accelerating factor (CD55)	→ Dissociation of C_3 convertase
3) ~~CR1~~, C4BP, Factor H	→ Dissociation of C_3 convertase. Cofactor for factor I
4) Factor I	→ Cleaves C_{4b} & C_{3b}
5) Membrane cofactor of proteolysis, MCP	→ Cofactor for factor I
6) S protein or vitronectin	→ Binds soluble C_{5b67} & prevents insertion into host
7) Protectin (CD59)	→ Blocks binding of C_9 & formation of MAC
Carboxypeptidase N, B & R	→ Inactivates the anaphylaxis C_{3a} & C_{5a}

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Deficiency of C_3 (bound) ⇒ No Opsonisation
↓
Pyrogenic Infect°.
GN

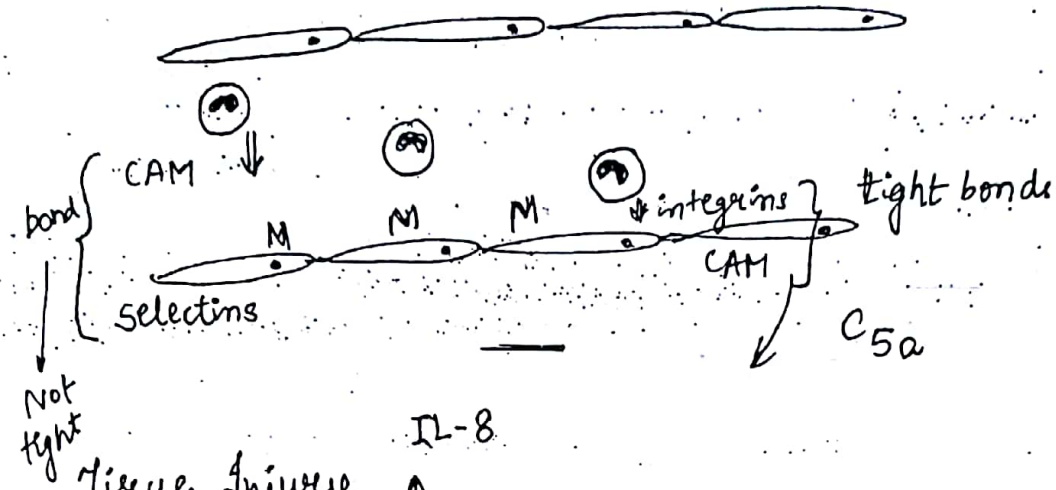
Deficiency of Late complement Proteins ⇒ Recurrent Neisserial Infection.
[MAC mediated Lysis ⊖]

Deficiency of Delay accelerating factor (CD_{55}) ⇒ PNH.

Deficiency of C_1 inhibitor = Hereditary Angioneurotic edema
↓
Swollen lips
Painful abdominal edema
Laryngeal oedema
Δ - Best marker
↓
↓ C_4 Level

PHAGOCYTOSIS

Extravasation of Neutrophils



IL-8

Tissue Injury

tissue macrophages

Margination ⇒ Due to selectins → **Rolling** → **Adhesion**

Rolling → fucosyl transferase enzymes

Adhesion → β_2 integrins

↓

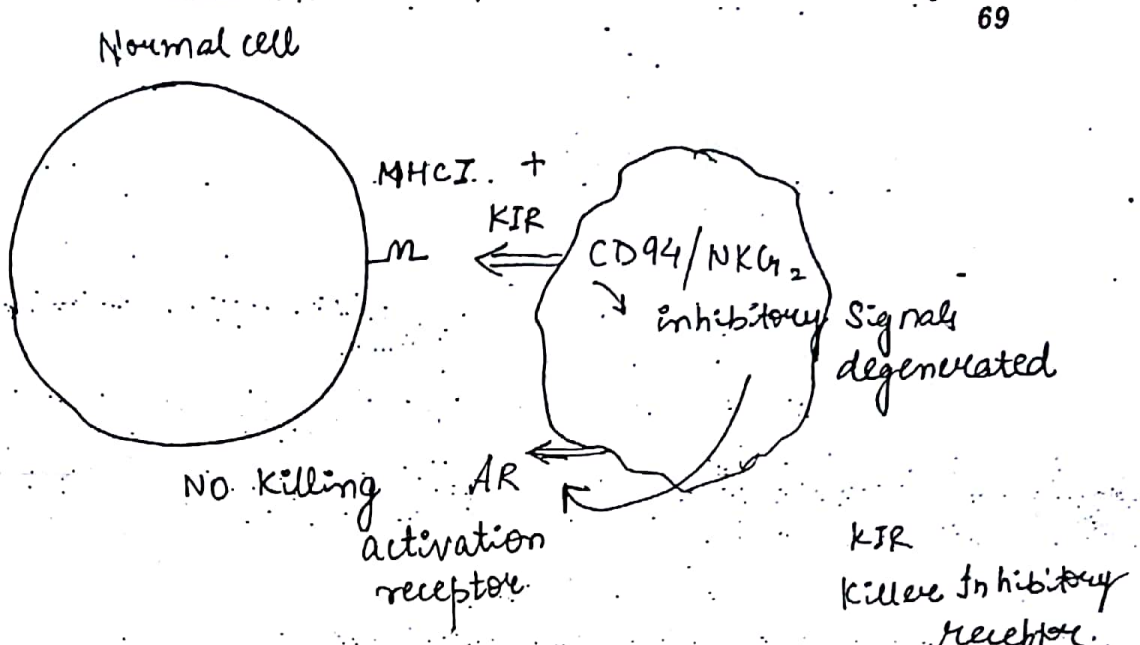
Diapedesis

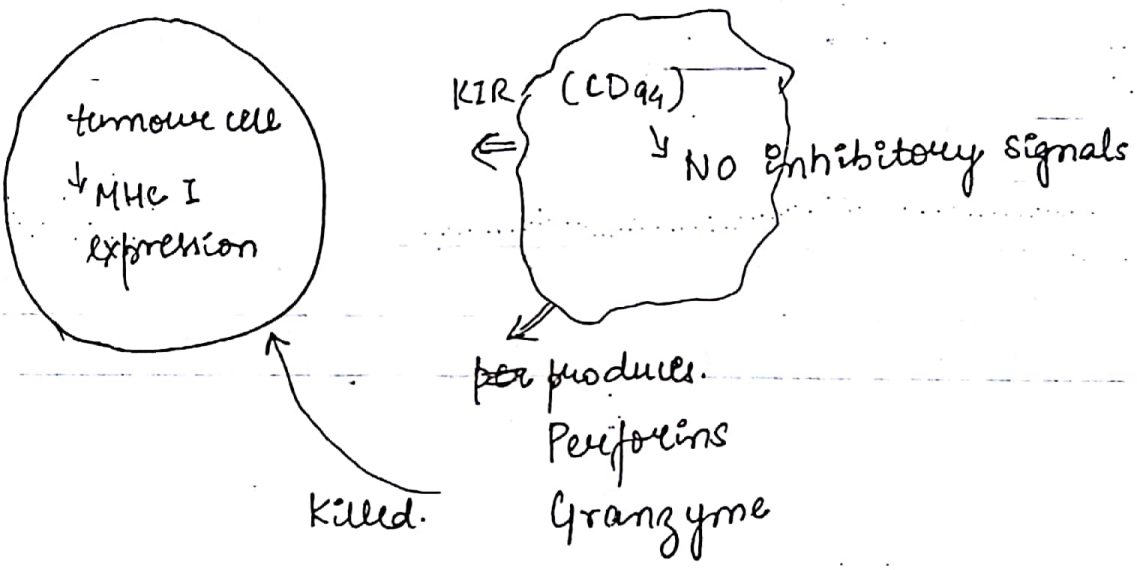
due to contraction of vascular endothelial cells.

Diapedesis → **Chemotaxis**

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

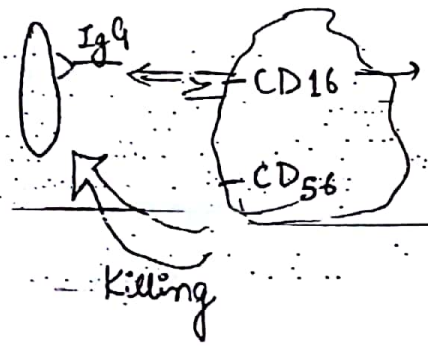
NK cell





Ab independent killing by NK cells.

NK cells → ADCC (Ab dependent cell mediated cytotoxicity)



binds to Fc portion of IgG

[NK cell ↓ Ca cells are killed by independent pathway]

DEFICIENCY OF PHAGOCYTOSIS

(I) Leucocyte Adhesion Deficiency (LAD)

Recurrent infections

No pus ⟶ as neutrophils can't come out

Omphalitis

Extreme neutrophilia (>30,000/μL)

LAD I →

mutation in **β_2 integrin** (CD18), gene (adhesion)

AR

LAD II →

Deficiency of **fucosyl transferase** [selectin]

↓

rolling ⊖

LAD III →

~~Deficiency~~ Defect in **regulatory protein kindlin** (fermt3) & activates ligand for β_2 integrin.

LAD > LAD III > LAD II

(II) G6PD Deficiency

Deficiency of enzymes in **HMP shunt**

Same as CGD (chr Gr. Ds) & associated

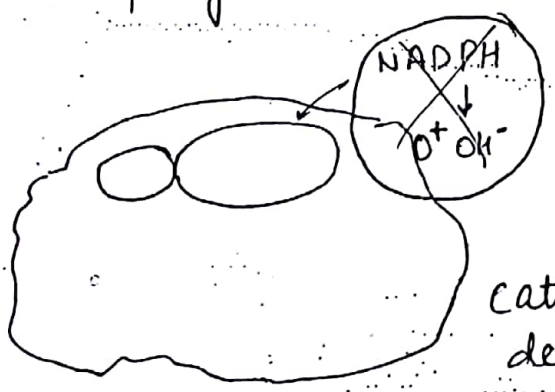
Anaemia

(III) MPO Deficiency
Granule enzyme Deficiency

(IV) Chediak Higashi Syndrome
AR
Defective Intracellular transport Protein (LYST).
Recurrent infn, chemotactic factor, degranulation defect.
~~Ab~~sent NK cells
Partial albinism.

Δ - Giant Lysosome

(V) Chr. Gr. Ds
- XL or AR
- Deficiency of NADPH
- Recurrent Infection of ⊖ Catalase +ve Bacteria
  * Fungi



Myeloperoxidase
$H_2O_2 \rightarrow HOCl^- \Rightarrow$ Catalase ⊖ org. are killed

Catalase ⊕ org. degrades H_2O_2

Candida Aspergillus	Staph. aureus Haemophilus Inf. Mtb Enterobacteriaceae

(Δ) NBT (Nitroblue Tetrazolium) (-)

2) Neutrophil Oxidative Index

If · agammaglobinemia
· recurrent catalase +ve infec" ⇒ Bruton's
NBT (+)

B cell Deficiency

1) Bruton agammaglobinemia
Deficiency of tyrosine kenase B cell maturation
XL
No Ig.
Pre B cells in bone marrow
narrow CMI

2) X Linked hyper IgM syndrome
- Deficiency of CD40L on activated Tcell
- Recurrent Resp. + GI infec" [IgA is absent].
↳ mucosal immunity

3) Selective IgA deficiency
IgA - M/c deficiency
Repeated sinopulmonary + GI infec".
No role of passive immunisation
↳

Passive Immunisation
Delivers ⇒ IgG

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

4) Common Variable Hypo γ globinemia

Onset - Late teens

B cell ↑↑ in blood

↓ Ig over time

↑ autoimmunity

5) Transient γ hypogammaglobinemia of infancy

Delayed onset of normal IgG synthesis

Detect in 5th – 6th ~~month~~.

Resolve by 2½ years

6) Job Syndrome [Hyper IgE syndrome]

Due to deficiency of T helper 17 [T_H17] cell.

Retained 1° tooth

Cold abscess

Coarse Facies

Eczema

[T_H17 cell] → encoded by Chromosome 17.

Differentiated from T_H0 cell by IL-6, TGF β, IL 23

T_H2 produces → IL-17, IL-22

IL17A IL17F

⇓

Stimulate B cell to produce

↑↑ Ab except IgE

↓

① Prevent pyogenic fungal Inf

② Inflammation

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

③ autoimmunity
④ transplant rejection (ADCC)

p40 knock out Mice → Deficient T_{H17}
⇓
↑↑ IgE

T cell Deficiency

1> Di George Syndrome

2> Bare Lymphocytie Syndrome (BLS) [Image]
Granulomatous necrotising Lesion in midface
Type I → TAP Deficiency → MHC I ↓
Type II → MHC II ↓

Combined partial T + B cell Deficiency

Wiskott Aldrich Syndrome
XL
Defect in cytoskeletal glycoprotein (WASP)

Ataxia Telangiectasia
Defect in kinase involved in cell cycle
Ataxia
Telangeetasie
~~Def~~ of IgA + IgE.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Complete Functional B & T cell Deficiency

SCID

- IL-2Rγ or JAK3 deficiency [cytokine Receptor deficiency]
  Defective signal from IL4, 7, 9, 15, 21
  XL, AR

- Adenosine Deamine (ADA) or PNP (Purine nucleoside phosphorylase deficiency toxic metabolite in T & B cell.
  AR

- Zeta chain associated protein (ZAP) deficiency
  defective signal from TCR

- Rag 1 or Rag 2 nonsense mutation, AR
  No TCR or Ig gene rearrangement
  Total absence of B & T cell

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

HYPERSENSITIVITY

	Immune mediator	Immune Response	Response Time
Type I	IgE	Humoral	2-30 min
Type II	IgG & IgM	"	5-8 hr.
Type III	Immune complexes (IgG)	"	2-8 hr
Type IV	T cells	Cell Mediated	24-72 hrs.

TYPE-I

→ 1° response to allergen
↓
Sensitisation of mast cell
@ IgE

→ 2° response to same allergen
↓
cross-linking
↓
degranulation

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Mediators of Type I HSN

1°	2°
Histamine, Heparin	PAF
Seriotonin	Leukotriene (SRS-A)
Eosinophil chemotactic factor	PG
	Bradykinin
Neutrol chemotactic factor	
Proteases (tryptase chymase)	Cytokines IL 1, 3, 4, 5, 6, 10, 13
	TNFα
	TGFβ
	GM-CSF

Egs.

1) Anaphylaxis
2) Atopy
3) Allergic rhinitis (Hay Fever)
4) Asthma
5) Food allergy
6) Allergic eczema
7) ABPA (Type I > Type III > Type IV)
   [allergic bronchopulmonary aspergillosis.]

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Type - II

Autoimmune

- Cytotoxic
- Non-cytotoxic

- ADCC
- Complement mediated autolysis

Non-cytotoxic:

cellular func^{n} altered by autoantibody.

eg. Grave's Ds

Eg.

1) Autoimmune haemolytic anaemia
2) Agranulocytosis, thrombocytopenia
3) ARF
4) Goodpasture Syndrome
5) Transfusion Reac^{n} (ABo incompatibility)
6) Erythroblastosis fetalis (Rh incompatibility)
7) Drug induced haemolytic anaemia
   [black water fever
   penicillin therapy]
8) ~~Myocarditis in chagas D^{s}~~ (American Trypanosomiasis)
9) Hyperacute Graft Rejection

1) Myasthenia Gravis
2) Grave's Ds
3) Type II non-insulin dependent DM
4) Pernicious Anaemia Q

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Type - III Non-specific

Immune complexes

↓

causes tissue damage

↓

extravasation of neutrophil

↓

Site of injury

↓

focal area of granuloma

Mech

Eg's

1) SLE
2) Rheumatoid Arthritis [III > IV]
3) Polyarteritis Nodosa
4) Multiple Sclerosis
5) Serum Sickness
6) Arthus Reac"
7) PSGN
8) Lepra Reac" Type II
9) Meningitis
10) SABE
11) Hepatitis B & C (arthritis)
12) Mononucleosis
13) Dengue (arthritis)
14) 5th disease (~~Slap check~~)
15) Nephrotic syndrome in P. malariae.
16) Katayama fever in schistosomiasis
17) African trypanosomiasis
18) Penicillin + Sulphonide allergic

Website: http://mbbshelp.com — WhatsApp: http://mbbshelp.com/whatsapp

Type IV

Intracellular Pathogens

1) M. Lepraе, M.Tb
2) Listeria monocytogenes
3) Brucella abortus
4) Pneumocystis jiroveci
5) Candida albicans
6) Histoplasma capsulatum
7) Cryptococcus neoformans
8) Herpes simplex virus
9) Variola
10) Measles

Skin Test

Tuberculin, Lepromin
Montenegro, Frei Test
Contact Dermatitis
Picryl chloride
Hair Dye
Nickel Salts
Poison
Ivy
Poison Oak
Hashimoto's thyroiditis
Type I Insulin Dependent DM
Guillain Barre
Celiac disease
Graft Rejection [IV > II]
Lepra Reac^{n} Type I.
Hypersensitivity pneumonia [IV > III]

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

BACTERIOLOGY

Drug Resistance

Chromosomal

Mech

→ Mutation in the chromosome
eg. Mtb

→ Transduction
eg MRSA

Con

Combination = useful
Rx

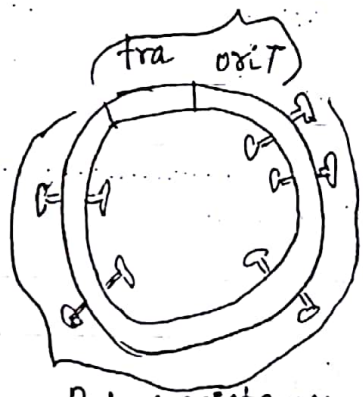
Metabolic Defects
⇓
eg. INH Ⓡ Mtb →
catalase ⊖
peroxidase ⊖

Plasmid

Mech

→ Insertion of Transposons carrying blood resistance genes in plasmid
⇓
Antibiotic Selection Pressure

RTF = resistance transfer factor



Rd - resistance determinant

R plasmid = Rd + RTF

Not useful
> 8 drug Ⓡ seen.

not seen.
(Plasmid doesn't code for metabolic)

Anti-microbial Susceptibility Testing

M/c Muller Hinton Agar
Middle Brook - M.tb.
Blood Agar - Haemophilus

Method

1) **Dilution Method**
   - Broth dilution
   - Agar dilution

2) **Diffusion Method**
   More common
   a) STOKES meth [european]
   b) Kirby bauer (Disk Diffusion) [Imge] as per CLSI (Clinical Laboratory Std. Inst.) USA
   c) E-test

* Broth Dilution method for MIC testing

Serial dilution of Ab
↑
Std. inoculum

Bacteria 0.5 Mc Farland (M/C)
Fungi 2 Mc Farland
⇓
Density best measured by Spectrophotometer

Min. Bactericidal Conc" (MBC) ⇒ estimated by Subculture

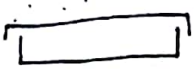
MBC ≥ MIC

MEC - Min. effective conc"
Done for Anti-fungal Susceptibility
Min. conc" at which distortion of Hyphae is seen morphological

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Disc Diffusion Test

- CLSI
- 9cm diameter Petri Plate
- 6 disc used each 6mm diameter.



Incubate

↓

Hazines → resistance

clear zone → inhibition.

MIC can't be assessed.

- E test (epsilator test) [Image]

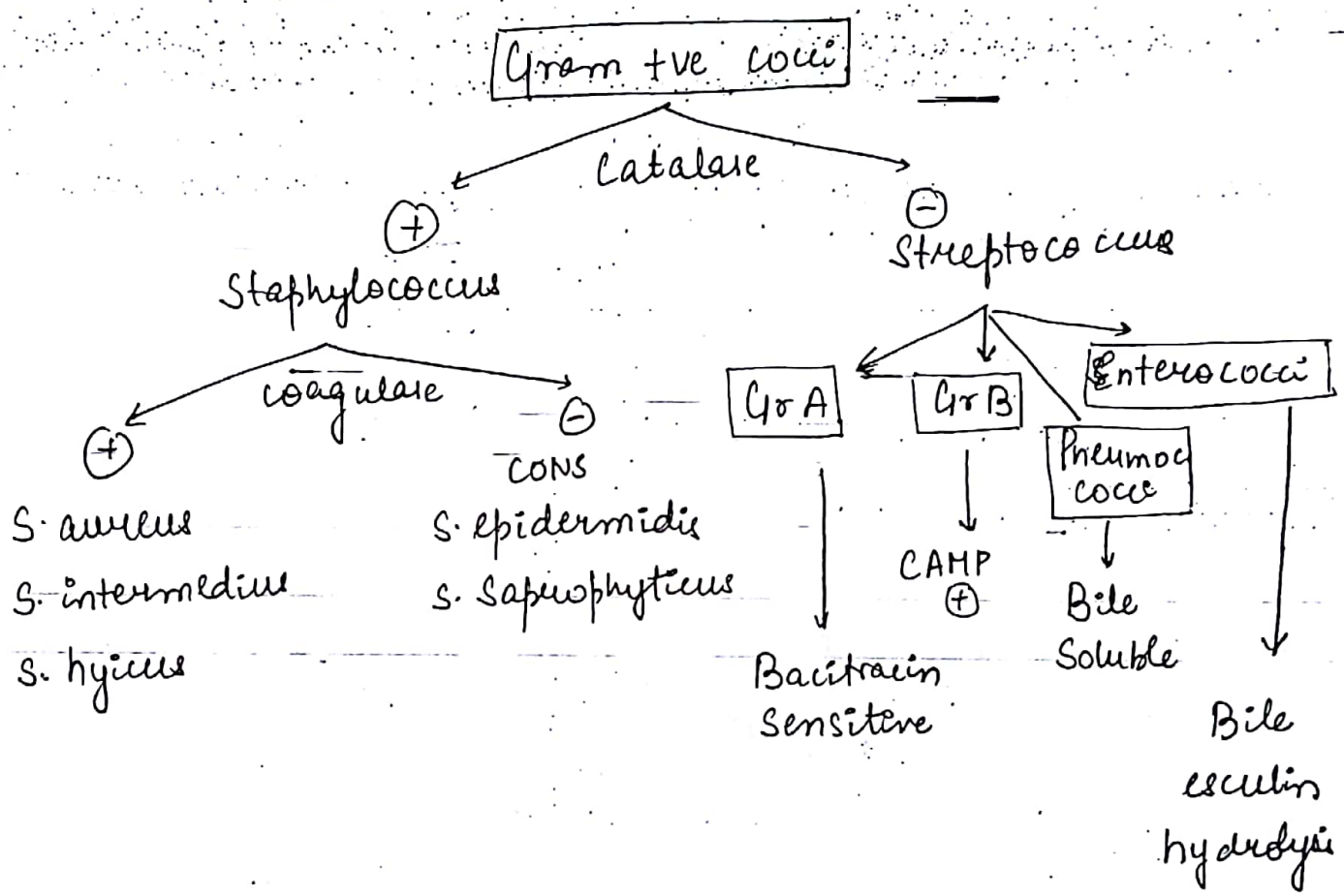
Diffusing Ab Gradient on a strip

Diffusion technique in ∴ MIC can be tested.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

GRAM +ve Cocci

- Staph
  - Catalase ⊕
  - Grape like clusters
- Strepto
  - ⊖
  - chains
  - S. salivarius - longest

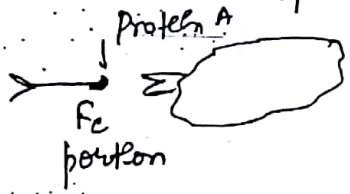


STAPH AUREUS

(I) Virulence Factors

↓ susceptibility to opsonisation

1) Protein A
   - opsonin / Ab depletion by protein A
   - binds to Fc portion of IgG. thus preventing binding of Ab to macrophages



   - 90% of staph have protein A [COWAN I Strain]

2) SCIN (Staphylococcal complement Inhibitor Protein)
   binds & inactivates the C_3 convertase of alternate pathway

3) Protease
   Degradation of IgG, C_{3b} by Staphylokinase

4) Clumping Factor activated Factor I.

5) Extracellular Fibrinogen Binding Lecton.
   Inactivate C_3 or prevents cleavage of C_3.

6) Capsule
   prevents binding of phagocytes to opsonins

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Others

1) Peptidoglycan

2) Teichoic Acid

3) Toxins — M/cc of β haemolysis, ↑ virulent

a) Hemolysin — (α), β, γ, δ

β hemolysis

β toxin → Sphingomyelinase
↓ secreted
↓ virulent

γ toxin → Panton Valentine leucocidin [PVL gene]
2 component toxin [S*F]
— c̄ binds c̄ γ toxin
Synergohymenotrophic toxin

Q. [Associated c̄ Community Acq MRSA]

b) Epidermolytic Toxin / Exfoliative Toxin -

Destroys mucopolysaccharide of Stratum Granulosum

⇓

BULLAE (Coalese)

⇓

SSSS [Staph scalded skin Syndrome] [Image]

children - Ritter's ds } fatal.
Adult - TEN }

Pemphigus neonatorum } mildly form
~~Bullous~~ Impetigo }

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Δ = toxin detection.

c> Enterotoxin =

SuperAg M/c
Cause TSS 1 → by B, C + F.
8 types. ← Phage typing → Gr I
A B C 1 to 3 H I F.
↓
Tampoons.

Δ - Nicolsky Sign +ve
desquamation on ~~pressure~~

Food Poisoning

__Type A M/c
Due to preformed Toxin
IP < 6 hrs
vomiting (vagal nr stimulation)
'outbreak'.

Δ - culture of vomitus / food.

4> Coagulase Enzyme.

Free.
↓
Enzyme
↓
activate coagulase reacting factor (CRF) in Rabbit/ Human plasma
↓ ← used in Lab
fibrinogen → Fibrin.
Tube Coagulase Test [Image]

Bound.
Clumping factor
Slide test

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Tube coagulase
1:6 dilution plasma
Read at 4hrs.
Released in log phase

5) Hyaluronidase ↑ virulent
It destroys tissues

II

M/c of boils / abscess
" " osteomyelitis except
" " Sickle cell anaemia → salmonella
" " IV drug abuser → Pseudomonas
" " epidural abscess
" " native valve endocarditis
" " Hospital acquired Infection

III Δ

Culture on 5-10% Blood Agar.
Selective media → Ludlam media
Salt milk Agar
Pigment → Nutrient Agar
(Golden Yellow) + glycerol monoacetate

Specific Test for S. Aureus = Mannitol Fermentation Test (+)
Phosphatase (+)
Heat Stable nuclease (+)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

S. intermedius
ZOONOTIC → Dog.

Q In 2 wks, 5 newborns in the NICU developed S aureus bacteremia. PFGE of the isolates were similar. Which of the following should be done next

a) Prophylaxis of all newborns in the NICU c I/V vancomycin

b) Protective isolation of all newborn

c) Ensure strict hand hygiene

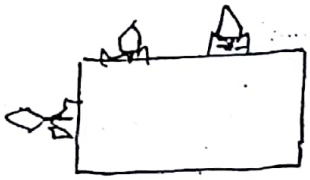
d) Collc" of nasal swab of health care workers.

Best Typing Method → PFGE (pulsed field gel electrophoresis) or sequence based typing.

Phage Typing [Image]
↳ Susceptibility to different phages among S. aureus strains

for virus = agarose gel electrophoresis preferred

Lysis cout ⇒ If 1 bacteria infected c many phages.
(undergoing any replication of phage)



Uses :- 1> S. aureus
M/C phage type in India = Group II
Most useful in epidemiology

2> Shigella

3> Vibrio
M/c = Eltor

4> Salmonella M/c - E_1 Least useful in epidemiologically

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Vi phages used in Salmonella

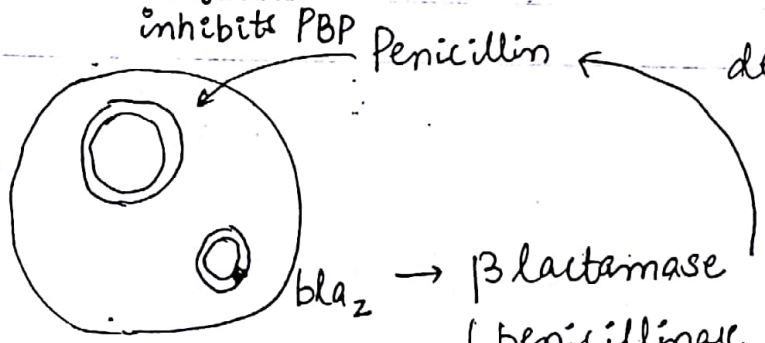
Vi Ag = S. Typhi
S. ~~Parahaemolyticus~~ Typhi
S. Dublin
Citrobacter

Father of Hand Hygiene = Edward Semmelweis
obstetrician
5th of May - Hand Hygiene Day

5 moments

Before & after seeing apt
Before & after a procedure
Contact ⊂ pts. surrounding

(IV) Drug Resistance



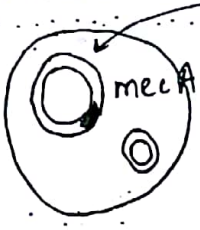
- Plasmid encoded Drug (R) → ~~By Transformation~~
- By Transduction - 90%
  Conjugation - 10%

Penicillinase Resistant Penicillin ⇒ ⊖ PBP → ⊖ degrade Penicillinase

~~Methicillin~~ — Dicloxacillin
Oxacillin — Carbenicillin
Cloxacillin — Nafcillin.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Transduction



S. Scuiri (non pathogen) → grow at <35°C.

mecA → new PBP 2a
(altered binding site)
⇓
MRSA

MRSA

Hospital Acquired Infec"

Chromosomal

DOC → for t/ting MRSA → Vancomycin.

Screening → Nasal swab (50% colonisation
Hand 40% colonisation)

↓

Mannitol Salt ~~Agar~~ ī Cefoxitin

↓

yellow colonies
30°c → incubation [mecA gene expression best at 30°c]

TCBC media for Vibrio.
Green coloured due to citrate

Q. 25 yr old Girl present to OPD ī carbuncle at the back of neck. Pus aspirated reveal MRSA. ⊆ i true about the strain

- community acquired MRSA

a) ↑ Resistance
b) ↓ virulence
c) Associated ī SCC mec I II III [staphylococcal cassette chromosome → pathogenicity island]
d) " " ~~pvl~~ pvl

Criteria of HAI :-

- After 48 hrs of admission
  or
- in 2 weeks of Discharge from hospital
  or
- in 12 ~~weeks~~ month of Discharge in case of prosthetic implant

HA-MRSA	CA-MRSA (new strain)
↓ virulent	↑ virulent
SCC_{HEC} I II III	SCC_{mec} (IV) V VI
	pvl associated
↑ Resistance	↓ Resistance
↓	↓
Clindamycin (R)	Clindamycin susceptible
D test (+)	(−)

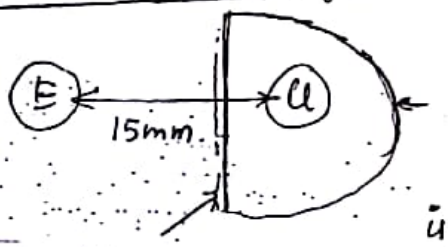
Q. D Test

To detect ~~a~~ Inducible Clindamycin Resistant Strains expressing Erm gene

↓

Erythromycin - induces Clindamycin (R)

This can't be done by Diffusion Test



susceptible strain grows away as resistant is not developed this side

Resistant strain due to erythromycin grows towards clindamycin

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

VRSA ..... Plasmid encoded

VanAgene derived from **enterococci**

≥ 16 µg/mL

↓ common.

VISA (Vancomycin Intermediate ® staph. aureus)

↑ cell wall synthesis

4- 8 µg/mL

VSSA (Vanco susceptible S.A.)

≤ 2 µg/mL

MIC → Done for VRSA
Neisseria

Done by Broth Dilution

Q. Accessory Gene Regulator (agr)

MSCRAMM (Microbial surface component recognising Q **adhesion** matrix molecules)

⇓

Protein A, Clumping Factor, Lectin.

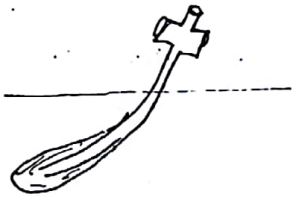
Modified Hodge Test for Carbapenemase ®

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

CONS

(I) S. Epidermidis
75% infec.
Skin commensal → Lysostaphin
↓
⊖ S. aureus

R/F - IVC (central line)
Intercellular adhesin → adher to cellular tip.
↓
thin polysaccharide
BIOFILM (300 nm)
↳ antiphagocytosis
Antibiotic ®



C/F

Δ M/c cause of prosthetic valve endocarditis
(early onset) - ⊞ < 12 mnths HAI

Late onset - Strept. Viridians

M/cc of CR BSI (catheter related Blood Stream Infection)

Δ of CRBSI → culture of catheter tip (5cm)
Congo Red stain → biofilm.
Confocal microscope
↓
multiple focal point image
superimposed

In situ Δ of CRBSI ⇒ BACTEC blood culture of 2 samples
- catheter
- peripheral vein

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

If >2hr difference in positivity → CRBSI

Differential to time test positivity

↓

Bet" the +ve of 2 samples

Catheter — Peripheral vein.

(II) S. Saprophyticus

UTI

Novobiocin (R)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

STREPTOCOCCUS

α hemolytic
Pneumococci
S. viridians Gr
↓
S. mutants
(dental caries)

β hemolytic
Lancefield or
C-Carbohydrate
A to V except I & J
⇓
Gr A - Pathogen
↓
Griffith serotyping
based on M protein

γ hemolytic

Gr. D ~~(H/c - γ hemolysis)~~
Intestine
Entero cocci
- S. faecalis H/c
- S. faecium Host (R)

→ They Don't Grow in 6.5% NaCl, PYR (+)

S. Bovis (S. Gallolyticus) → Grow in 6.5% ~~Bile~~ NaCl
↳ a/c Ca Colon. PYR (−)

GRP-A STREPTO

Virulence Factors

1) Pyrogenic Exotoxin (erythrogenic)
⇓
Scarlet Fever → Rash (pastia's line)
Sandpaper appearance
Strawberry tongue
M_{28} - H/c serotype

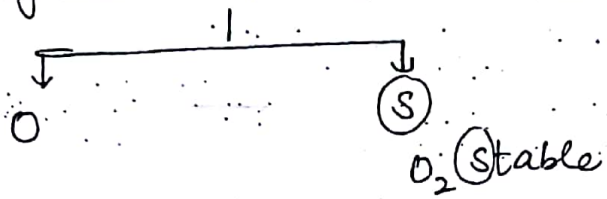
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

2> **M Protein**

antiphagocytosis
Serotyping

T & R protein ⇒ No virulence.

3> **Hemolysin** (Streptolysin)



O_2 labile
active in reduced or anaerobic state

ASO titre

ARF > 200 IU
low in PSGN & Pyoderma
Tonsillitis strains $M_{1,5,12,24}$.
Molecular mimicry → Ab against cell wall protein of Gr A strept. cross reacts ē myocardium.

4> **Streptodornase**

destroys DNA
Anti streptodornase B ⇒ Marker for PSGN & Pyoderma ↓ skin pathogens

$M_{2,5,43,53-55,59-61}$

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

5) **Streptokinase**
dissolve clot
used as thrombolyte agent → source is Gr C or *S. equisimilis*

6) Hyaluronic acid in capsule

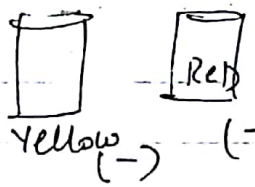
7) **Hyaluronidase** → destroys tissue
Flesh eating bacteria
Gr A strepto M 1 to 3
⇓
Necrotising Fascitis

Diagnosis

PYR ⊕

Bacitracin sensitive.

PYR Test



Aminopeptidase enzyme
Releases free β naphthylamide ← PYR
pyrrolidonyl β naphthylamide

⊕ Grp A Strept., Enterococcus

⊖ Gr B Strept, bovis

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

GR. B STREPTO [S. GALACTRIAE]

↳ Bovine mastitis

20-40% female → genital tract

↓

→ Neonatal Meningitis (direct spread)

H/c

Δ - Hippurate hydrolysis ⊕

CAMP ⊕ IOC

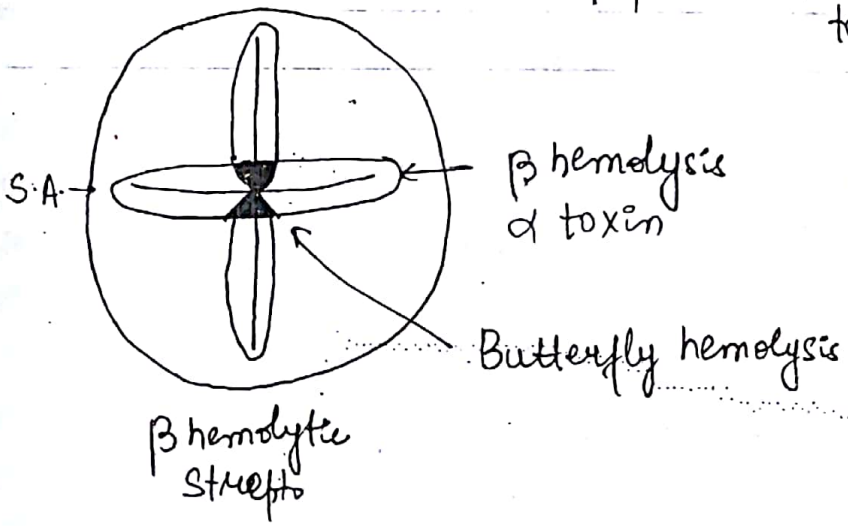
Hippurate Hydrolysis Test [Image].

Glycine + ninhydrine purple colour.

Hippurase enzyme act on Hippurate

CAMP

Grp B strepto → stimulate Steph to release β toxin



β hemolytic Strepto

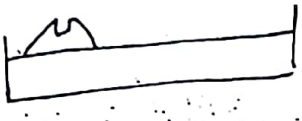
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

PNEUMOCOCCUS

Lanceolate shaped diplococci ± capsule

(DD)

Draughtsman colony (carrom coin)



Virulence Factor

1) capsule
2) Ig A_1 protease
3) Pneumolysin } Not secreted
4) α toxin

Autolysin → destroys bacteria to release

C/F

M/cc of pyogenic meningitis
" " community acquired pneumonia
" " Hosp. acq. pneumonia (VAP)
except
after 5-6 days. } Pseudomonas.
MDR strain
" Otitis media in <5yr

Δ-

① Inulin Fermentation ⊕

② ~~optochin~~ (S) → Screening test
③ Bile Solubility → Confirmatory

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Rx Meningitis → start ī Ceftriaxone + vanco

↓

Penicillin

other infec" → start ī Penicillin

↓

Ceftriaxone + vanco

Vaccine

Adult → PPSV (polyvalent polysaccharide vaccine — 23 serotprevalent strain

↓

High Risk

- splenectomy
- cochlear Implant
- >65yr
- Chr. lung, kidney, Livere, heart Ds
- immunocompromised.
- Diabetics
- Hospitalised pts ī H/o smoking alcohol.

Child - PCV13 [Pneumo conjugate Vaccine]

2 - 24 months

OSLER TRIAD's / AUSTRIAN SYNDROME :-

Pneumococcal endocarditis (Aortic valve) + Meningitis + Pneumonia

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

ENTEROCOCCUS

↑ Resistant → UTI, HAI

↳ Ⓡ to penicillin - hyperprod^{n} of PBP 5

6.5% NaCl
9.6 pH
46°C
40% Bile

Δ → PYR ⊕
Bile esculin hydrolysis ⊕

~~S. Bovis~~ → PYR ⊖
[Gallolyticus] = ~~Bile esculin~~ Hydrolysis ⊕

~~DOC~~ VRE

plasmid

VAN A (MC) → Ⓡ to both vancomycin + Teicoplanin

Van B, C, E → Ⓡ to vanco only

Substitution of terminal [D alanine ~ D serine/ Lactate]

↓

Elimination of Target

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

HLAR → high level aminoglycoside (R)

SUPER ANTIGEN

MHC unrestricted

Bind to Vβ region of TCR

↓

polyclonal activation

↓

20% of Total cells. [(N) → 0.1% of total cell in monoclonal activation]

↓

↑↑ Cytokines.

Pathogen showing superantigen

1) Staph aureus
2) GpA Strepto
3) M. tb. including BCG
4) Rabies
5) HIV
6) EBV

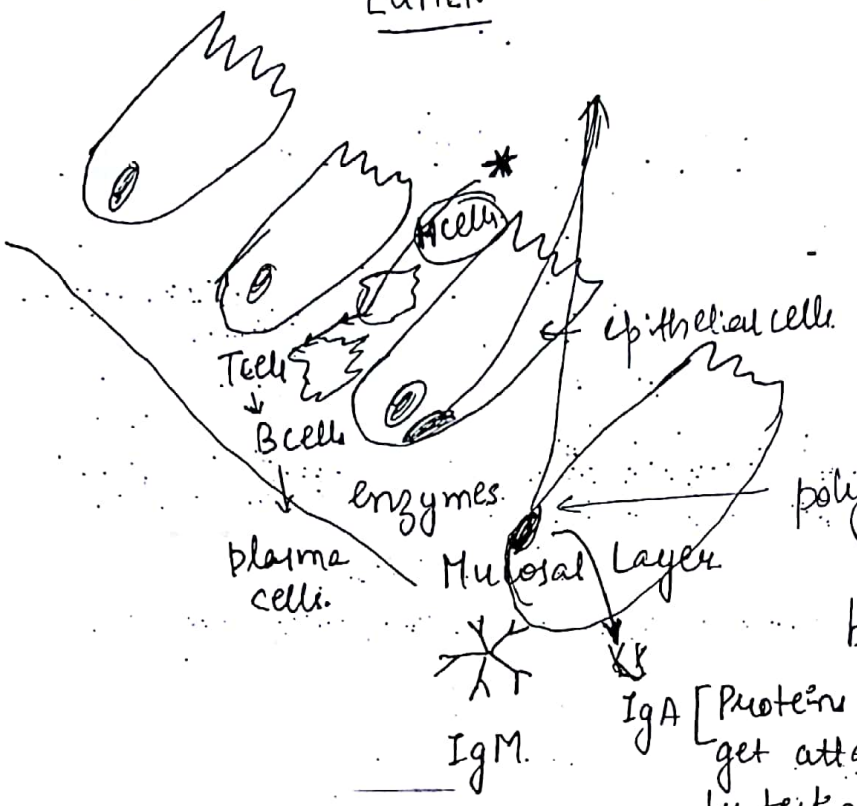
IgA → Mucosal Affinity

⊆ Ig doesn't cross placenta

a) $Ig G_1$
b) $Ig G_2$ → placenta doesn't have receptor for F_c portion of $Ig G_2$
c) $Ig G_3$
d) $Ig G_4$

[Receptor mediated Trans cytosis of Ab]

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp



Enzymatic Degradation of Ab

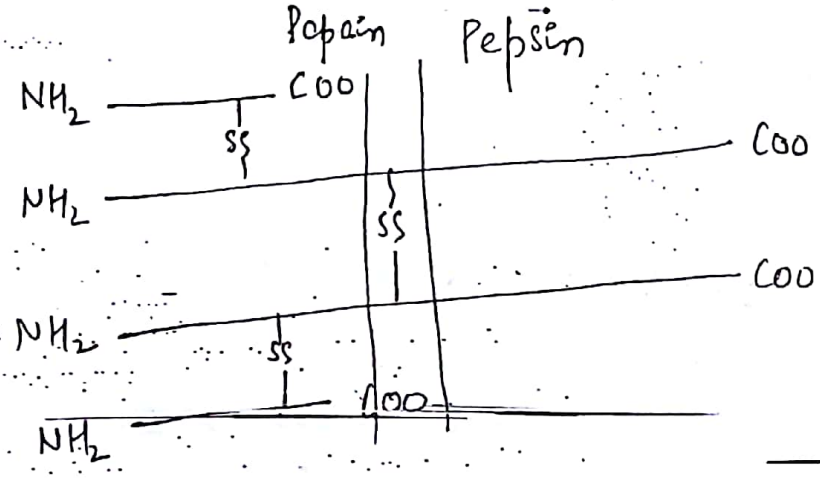
Pepsin → cleaves below di-sulphide Bond.

\\// → \\// 1 $F(ab)'_2$ No Fc

Papain → cleaves above disulphide Bond

\\ // 2 Fab + 1 Fc

||



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

H chain is cleaved → Isotype func" is lost

L chain is intact → Idiotype intact
Ag Binding occurs.

Valency (monomer)
Pepsin → unchanged.
Papain → 2 → 1.

2ME - 2 Mercaptoethanol → cleaves disulphide bond
2H + 2L chains
Idiotype, Isotype all lost

DIFFERENTIATE S. AUREUS FROM MICROCOCCUS

	Micrococcus
	Obligate aerobe
	Non-pathogen
	Tetrads
	Skin commensal
Hugh & Leitsons	Fermentation Test
Oxidation	Fermentation
Micrococcus	S. aureus

Disk in Blood Agar
- Group A strepto → Bacitracin (S)
- Pneumococci → Optochin (S)

24/2/18

* Non-Streptococcal Catalase -ve Gram +ve Cocci

→ Pediococcus * Leuconostoc → Vancomycin Resistant

→ Abiotrophia + Granulicatella spices

nutritionally variant Streptococci → require (Vit B_6) ♀

DOC → Gentamicin + Penicillin (to avoid resistance)

* S. Angiosus Gr

Agglutinate A, C, G (F) antisera

VP test (+)

Butterscotch, or caramel odour.

GRAM +ve BACILLI

(I) LISTERIA MONOCYTOGENES

1> Only Gram +ve Bacillus ∴ has **Endotoxin.**

2> Intracellular pathogen.

Int. A + B toxin — helps in internalisation.

3> (LLO) Listeriolysin O secreted by Listeria destroys phagosome + thus escapes phagocytosis.

Listeriolysin + **cytotoxin** ⇒ helps in escaping phagocytosis

↳ Haemolysin

shows ~~Phemolysis~~

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

3) **Actin Filaments**

helps in intracellular & Intercellular motility

⇓

BLEB Formation [Image]

4) Cold growth. (2-8°c)

5) C/F → Neonatal Meningitis

- Early Onset
  - **Granulomatosis infantiseptica**
  - Intracellular Transmission.
  - **Mother is symptomatic**
  - Disseminated cond"
- Late Onset
  - 10-30 days after birth
  - **Neonatal Meningitis**
  - **Mother is asymptomatic**
  - Spread through faecal contamination by health care workers.

Adult ⇒ Food Poisoning

By consump" of Refrigerated food.

6) A → ① Blood Agar → β hemolysis

② CAMP test → +

③ Anton test → +

④ Tumbling Motility at 21°c.

⑤ Ab detection

⑥ PCR (↑ sensitivity) – Good method nowadays.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

(II) CORYNEBACTERIUM DIPHTHERIAE

1> Gram +ve Bacilli

2> Metachromatic Granules are not seen in Gram +ve

3> For Pathogenesis, toxin is important

↓

It depend on Iron Conc^{n}.

[0-1 mg/c]

4> Toxin $\xrightarrow{\ominus}$ Elongation Factor - 2

⇓

↓ protein synthesis

⇓

Cytolysis

Necrosis

(Pseudomembrane leathery appearance)

5> △

a> Culture → Loeffler's Serum Slope (in 4-6 hrs)

↳ patient.

→ Tellurite [carrier → selective media]

preferred for carrier state

If not specified patient or carrier → go for LSS

→ Hoyle, Tinsdale

Hiss Serum Water

b> Specimen → Throat Swab.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

GRAVIS | INTERMEDIUS | ~~POACHED Egg Colony~~ MITIS

Daisy Head Colony | Frog Egg Colony | Poached Egg Colony

More Virulent

c) Microscopic Exam of Throat Swab
↳ for toxigenicity.

i) Albert Stain
ii) Neisser Stain
iii) Ponder
} Metachromatic or Volutin or Babes Ernest granules.
↓
Pathogenic.

d) Toxigenicity

In vivo → Guinea Pig (250-350gm)

Rabbit - 500gm
Guinea Pig - 250gm
Mice - 20gm

Subcutaneous → S/c inj" of test strain → death in 96 hrs

Use control → S/c injec" of test ~~train~~ strain + 500 IU (Protective Dose) of diphtheria antitoxin intraperitoneally

4 Guinea Pig ⇒ 3 for test + 1 control used

Intracutaneous → I/c inj" of test strain → after 4 hrs → 50 IU of diphtheria antitoxin intraperitoneally → Cutaneous lesions in 48-72 hrs.

Advantage - 10 test performed on 1 guinea pig

1 IU of Antitoxin = Min. amount Required to neutralise 100 Pg of toxin.

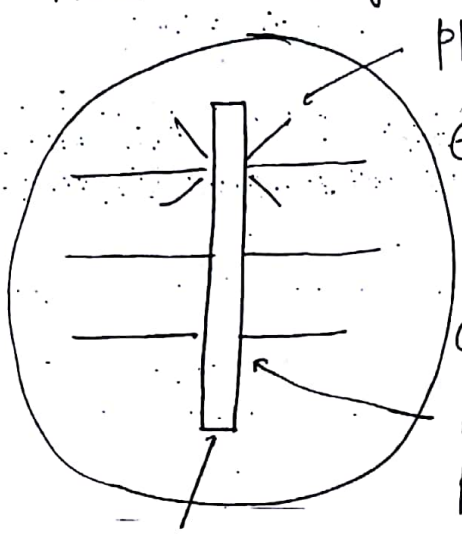
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

In Vitro — Elek's Gel precipitation

↓

Double Diffusion in 2 directions

[Ouchterlony Procedure]



If line ⊕ ⇒ Toxin produced

If line ⊖ ⇒ Toxin not produced

- Corynebacterium Jeikeinum ⇒ MDR
- " Urealyticum ⇒ Urease +ve (UTI)
- Arcanobacterium haemolyticum ⇒ Reverse CAMP test ⊕

SCHICK TEST (Neutralization Test)

for susceptibility

	Toxin (one arm)	Heat inactivated toxin (other arm)
Positive (susceptible) ⊕	⊕	⊖
Negative (Immune) ⊖	⊖	⊖
Pseudoreaⁿ [immune but Hypersensitive] ⊖	⊕	⊕

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

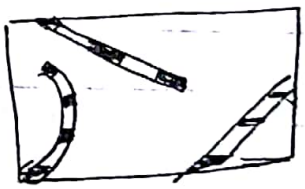
Toxoid is safe than heat inactivated Toxin.
So, no fear of anaphylaxis

DIPHTHERIA TOXOID
5-25 Lf units/dose [0.1mL] [Lf = Limes flocculation]

TT → 10 Lf

dT → low dose → ~~50~~ 1-2 Lf
↓
used in adult.

BACILLUS ANTHRACIS



Zoonotic Disease
Non-Motile.
Seasonal outbreak- summer season.

Dry Grass ← feeding Cattle
↓
gets injured
↓
(Spores +nt in soil) Spores enter
↓
Haemorrhage
↓
Death.

	INCIDENCE	MORTALITY
Cutaneous Anthrax	95%	20%
Hide porter Disease		
↓		
Malignant pustule		
↓		
Black Eschar		
Pulmonary Anthrax	5%	95%
Wool sorter		
Intestinal Anthrax	Rare	95%

Virulence Factor

1) Capsule } Plasmid
2) Toxin }

→ Oedema factor (↑ cAMP)
→ Protective factor } cytolysis
→ Lethal factor }

Diagnosis

Transportation of sample ⇒ Triple Layer packaging
(used in infectious sample)

Culture on PLET Media
[Polymyxin, Lysozyme, EDTA, Thallus acetate]
⇓
Medussa Head Colony →
String of Pearl → ooooo

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Bamboo stick or Box Car Appearance

↙ ↓

B. anthracis (obligate aerobe) — also seen in Clostridium Perfringes. (obligate anaerobe)

Inverted Fir Tree → on Gelatin stab culture

Mc Fadyen Reac" → for capsule

Confirmation

1) γ phase lysis

or

2) MLST (multilocus sequence typing)

— by PCR

[to distinguish other spore bearing, aerobe organism]

Bioterrorism → Category 'A' agent

- B. anthracis — Most potent
- Yersinia Pestis
- Cl. Botulinum
- Francisella tularaepsis
- Small Pox
- Agents of Viral Haemorrhagic fever

→ epidemiologically important.

B. CEREUS

Motile

- causes food poisoning — By RICE

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

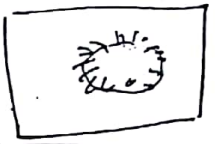
Food poisoning

Emetic
- vomiting
- preformed toxin
- < 6 hrs IP
- ↑↑ bacilli in stool

Enteric
- diarrhoea
- > 12 hrs IP.
- ↓↓ bacilli in stool

Δ - Culture - MYPA media
(mannitol Yolk Phenol Red novobiocin agar)

ACTINOMYCES



Gram +ve Bacilli [Image]
Filamentous

Obligate Anaerobes
- A → Actinomyces
- B → Bacteroides [Gram-ve]
- C → Clostridium

No Superoxide Dismutase
& No Permease

Gram +ve Branching filamentous rods
- actinomyces.
- Nocardia.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Actinomyces

Anaerobe
Non Acid Fast
Endogenous Infec"
↳ Oral cavity
Lumpy Jaw - M/c
GIT
Genitourinary Tract
Thoracic Actinomyces
↳ aspiration of oral secretions

Nocardia

Aerobe
Acid Fast ($1\%-H_2SO_4$)
Exogenous Infec"

Nocardia	Mycobacteria
entangled red bacilli	Long, slender Beaded

Δ of Actinomyces → Actinomyces involvement of pelvis occurs most commonly in association c an IUCD.

1) Sulphur Granules → filamentous bacteria c peripheral clubs.
Ag-Ab complexes.
↓
Sunray appearance.

MYCETOMA → Swelling
→ Sinus
→ granules

Actinomycetoma → actinomyces, Nocardia + streptococcus
Eumycetoma → Fungi pigmented
Botryomycosis → S. aureus - (M/c)

Actinomycetoma

acute inflammatory cond"
Purulent D/c
white or yellow sulphur granules
except actinomadura pelletieri
↳ Red granules.

Eumycetoma

Chronic
~~Purulent D/c~~
Serous D/c

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Brown & Brein stain.
Gram stain.

2) CULTURE → Molar Tooth Colony
Spidery colonies

Δ of NOCARDIA

1° infection in Lungs → Brain & Kidney Abscess.

subcutaneous Infec" → Mycetoma

- Gram stain
- Acid Fastness
- Culture using Paraffin Bait Technique

BACTEROIDES FRAGILIS [Gram-ve Anaerobe]

1) Virulence Factors-

Capsular polysaccharide
Protease & neuraminidase
Cytolysin
Enterotoxin

LPS - 1000 times less Biologically potent

Drug resistance to β lactamase

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

2> LEMIERRE's SYNDROME

Jugular thrombophlebitis

Fusobacterium necrophorum → Bacteroid species

Lung embole, sepsis

3> Δ → culture Media

a) Trypticase Soy Agar
b) Schaedler's blood agar
c) BHI (Brain Heart Infusion)
→ ī Kanamycin.

CLOSTRIDIUM

Obligate anaerobe

No O_2 / ↓ Eh (Redox Potential)

Cl. TETANI

Drumstick appearance

Virulence Factor -

Tetanolysin
No virulence

Tetanospasmin

- plays role in virulence
- ⊖ GABA + glycine
  ↓
  ⊖ of presynaptic receptors
  ↓
  ~~Spasmodic~~ Spastic paralysis

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Δ - Robertson Cooked Meat Broth

Thioglycollate Broth

⇓

Blood Agar

↓

Macintosh Field. → [Image].

(Molybdenum catalyst)

Candle Jar ↓ for capnophiles.

BI for checking O_2 free environment in Macintosh Field ⇒ 'Pseudomonas'

↓

It does not grow if completely O_2 free

GAS PAK JAR → Better, safe

Prevention :- Active Immunisation + Passive immunisation.

PEP for tetanus

Immunity Category	Simple wound	Contaminated wound
Cat A	Nothing Reqd	Nothing Reqd
Cat B	Toxoid 1 dose	Toxoid 1 dose
Cat C	Toxoid 1 dose	Toxoid 1 dose + HTIG
Cat D	Toxoid complete dose	Toxoid complete dose + HTIG.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

A - taken complete course of TT/Booster in past 5 yrs.

B - " " " " " in past 5 - 10 yrs

C - " " " " " in past >10 yrs

D - Not taken complete course of TT/booster in past 5 yrs.

Simple wound - <6 hrs, clean, non-penetrating, negligible tissue damage.

Booster recommended every 10 years.

1° Immunization - 1st 3 dose on 6, 10, 14 weeks.

Safe vaccine.

Pertusis vaccine - causes fever as cellular component is used.

Cl. PERFRINGES / WELCHI

12 toxins

α toxin → Most virulent

↓

Lecithinase c/ phospholipase

C/F

① Gas Gangrene → Cl. perfringes 60%
Cl. novyi / septicum 40%

② food poisoning

Type A

Worldwide

Necrotising enterocolitis

α toxin → ileum → Necrosis + Gas

Type C

Drambrand.

Germany

Pigbel

Papua New Guinea

Enteritis Necroticans

endemic

β toxin → jejunum → Necrosis + Gas

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Necrotizing enterocolitis

↓

Fire In the Belly.

Δ - ① Target Sign.

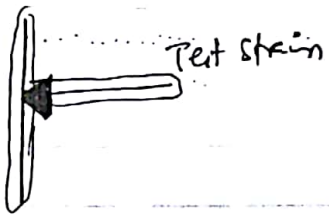
around clostridium ⇒ zone of β hemolysis due to θ toxin.

zone of α hemolysis due to α toxin

② Reverse CAMP Test (+ve)

- Group B streptococcus used
  + Test strain is inoculated..

Arrow type hemolysis.



Bow Type hemolysis

Toxin of clostridium goes to Strepto + causes more hemolysis.

Group B Streptococcus

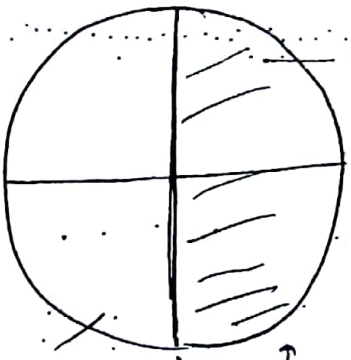
Toxin of strept. goes towards clostridium. ↑ causes more hemolysis.

③ Stormy fermentation on litmus milk

④ Nagler Test

Yolk containing media..

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp



α toxin ← tet strain →

↓

Opalescence

α antitoxin of cl. perfringes

← yolk containing media

Cl. BOTULINUM

* Virulence Factor

Toxins → all are neurotoxins. except C_2 (enterotoxin)

Botox Injec^n → anti-aging

Bioterrorism

* Pathogenicity -

1) ⊖ Ach → Flaccid Paralysis.

2) food poisoning

preformed toxin. in home made canned food.

IP - 8 to 36 hrs Q.

3) Floppy child syndrome

↓

Spores (HONEY)

Infant gut microbiota starts developing in 4 hrs.

~~4) Wound Botulism~~

due to spores.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Δ – Toxin Detection

Cl. DIFFICILE

Cause pseudomembranous Colitis due to Clindamycin, cephalosporin [2nd < 3rd generation] (HC)

* Virulence factor

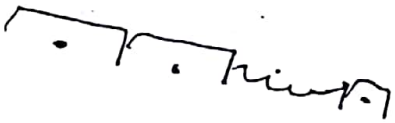
Toxin – A – enterotoxin } Both toxin glycosylate GTP binding proteins of Rho subfamily
Toxin – B – cytotoxin } ↓ protein synthesis

* Pathogenicity –

Sammit Lesions

Pseudomembrane

Necrosis.



No Gross Blood in stool..

* Δ

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Test	Sensitivity	Specificity
Stool culture Best test for confirmation. (Gold Std)	++++	+++
Cell culture cytotoxin test on stool	+++	++++
ELISA for toxin A + B in Stool	++	+++
ELISA for c difficile common Ag in stool.	++++	+++
Best Test NAAT for toxin A+B gene in stool	++++	++++
Colonoscopy or Sigmoidoscopy	+	++++

123

℞ (1) DOC - Metronidazole

or

Vancomycin. → ↑ effective → used in severe cases.

To prevent incidence of VRE.

(2) Fecal Transplantation

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

GRAM -Ve COCCI

NEISSERIA

Intracellular, diplococci

Oxidase (+)

Medea req. for growth = chocolate agar
Thayer Martin
New York City
Martin Lewis

Candle Jar useful → as they are capnophilic

Oxidase Test

Kovac Reagent [P-phenylenediamine dihydrochloride]

↓ cytochrome oxidase

Blue (indophenol)

(+) → Pseudomonas
Aeromonas
Neisseria
Campylobacter
Hemophilus

(−) → Enterobacteriaceae

N. MENINGITIDIS

Virulence factor

1) Capsule
2) Endotoxin
3) ~~Rep~~ Pili

C/F ⇒ Pyogenic Meningitis ± Rash
lead to outbreak.

Waterhouse Friedrichsen Syndrome [due to endotoxin]

Serotypes A, B, C ⇒ outbreak

Y, W_{135} → Sporadic cases

X, Y, Z9E → in HIV pts.

others — carriers

↓

Nasopharyngeal 5-10%.

↓

during outbreak 80-90%.

Chemoprophylaxis – Inj^{n} ceftriaxone > Cipro > Rifampicin.

Affects European countries. In India – Meghalaya

↓

were cipro.

Vaccine – polyvalent polysaccharide vaccine

↓

A, C, Y, W_{135}

(Ur B) → Inj^{n} ± out deficiency of Late complement proteins properdin.

→ M/C Inj^{n} in infants

→ capsule is non-immunogenic

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Group B vaccine:- based on **subcapsular antigens.**

tut in cell wall.
- outer membrane vesicle.
- neisserial adhesion factor A.
- Factor H binding protein.
- neisserial heparin binding antigen

*Rapid Carbohydrate Utilisation Test :-

ONPG test [O-Nitrophenyl β-D-galactopyranoside].

↓ β-galactosidase

galactose + O-Nitrophenyl.
[[yellow].

N. lactamica → ferments lactose unlike other N'species

N. Meningitis ⇒ Maltose fermentation.
N. Flavescence ⇒ F/Sucrose "
N. Gonorrhoea ⇒ glucose "

MORAXELLA CATARRHALIS

Causes - Otitis Media
sinusitis.
COPD :- AE

Δ - - Hockey Puck Sign
colonies can be slid across the agar surface.
without disruption

- Lack carbohydrate Fermentation ~~test~~ to differentiate from saprophytic
- Produce DNAase **Butyrate Esterase.** Neisseria

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Drug Resistance to β lactamase.

N. GONORRHOEA

Virulence Factors

1> Pili Adhesion.

2> Opa (Protein II) - adhesion
- transient ↓ in CDG

3> Porin (~~protein~~ I)
- endocytosis, invasion
- ⊖ complements

4> Rmp (protein III) - Blocks Ab block effect of bactericidal
— Ab to porin + LOS leading to reinfection
(↓ Lipooligosaccharide)

5> IgA1 protease
Fbp (ferric Binding protein.
Lip (HB)

6> LOS - endotoxicity → Chronic Infection.

Rep Pili, Opa, LOS express Phenotypic variation
Por of different strains express different Ag typing

Porins inside human body doesn't change → they remain same.
↳ It shows variation in different strains.

Resistance

PPNG - β lactamase producing ~~strain of N. Gonorrhoe~~ (plasmid encoded)
(M/C)
Common

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

CMRNG - chromosomal encoded high level resistance to penicillin.

Rare

TRNG- High Level Tetracycline resistance (MIC ≥ 16 mg/L)
- tet M gene on conjugative plasmid.

Ceftriaxone resistant - chromosomally encoded pen A gene expressing PBP 2a.

Gonococcus doesn't affect Vagina.

I.P. - 3-4 days [chlamydia - 7 days]

M/C

Chlamydia diagnosed by NAAT

GRAM -ve BACILLI

ENTEROBACTERIACAE

① Ferment Glucose

② Motile / Non-Motile
↓
peritrichous flagella

③ Catalase ⊕ except S. dysentriae Type I

④ Oxidase ⊖

⑤ Reduce nitrate to Nitrite

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Enterobacteriaceae

MacConkey

Lac ⊕

Lactose
Phenol Red
↓ pH ↓
Pink.

induces
Lac operon gene

→ β galactosidase → lactose → glu ^ galac → fermentation of glucose
→ permease
↓
transportation of substrate

Lac ⊖

E. Coli – [except Enteroinvasive E. coli]
Klebsella
Enterobacter
Serratia
Edwardsiella
Citrobacter
Arizona
Providencia
Erwinia
Shigella sonnei

Salmonella
Shigella
Proteus
Yersinia
Enteroinvasive E. Coli.

Triple Sugar Iron Agar Media (TSI)

[glucose : lactose : sucrose]
disaccharide
1 : 10 : 10

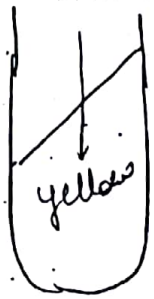
aerobic
↑
Slant
butt
↓
anaerobic

Slant → oxidative deamination.
↓
peptides (AA) ~~broken down to~~ ~~NH_3~~
↓
↑ pH. [Red]

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Butt → fermentation → ↓ pH [yellow].

Lactose ⊕



Initially glucose fermentation occurs
↓
yellow colour.
↓
Later glucose is finished.
↓
Then Lac ⊕ organism carries Lactose metabolism
↓
So pH ↓
↓
Again Yellow

Lac A = Acid / Acid

Lac ⊖

Initially glucose fermentation occur
↓
yellow colour
↓
Later glucose finished
↓
Then Lac ⊖ can't metabolise Lactose
↓
No new acid production
So, oxidative deamination continues. ∴ out any neutralisation.
↓
↑ pH
↓
Red colour

Lac ⊖ = Alkaline / Acid ≈ K / A

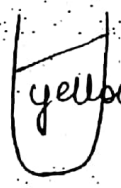
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Non Fermenter

Non-fermenter = Alkaline / Alkaline

Oxidative Deamination occurs.

Vibrio → Lac⁻ glucose / sucrose } fermentation ⊕



for Vibrio – TSI + Mc Conkey Req

as in TSI Resemble Lac⁻ Organisms

H_2S producing Enterobacteriaceae

TSI media since contain Fe

$Fe + H_2S \Rightarrow$ Black Colour. ⇒ BLACK COLONY

Salmonella
Proteus
Citrobacter
Edwardsella

Media used

1) Bismuth sulfite citrate sulfide
2) Deoxycholate citrate agar (DCA)
3) Xylose Lysine ~~deoxy~~ deoxycholate (XLD)
4) Salmonella shigella Agar (SS)
5) Hekton enteric agar (

tube

6) Lysine Fe agar
7) TSI, Kligler Fe Iron (KIA)
8) SIM (Sulfide Indole motility medium
9) Lead Acetate Agar

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

KIA contains – glucose : Lactose
1 : 10

It is used in vibrio non-endemic area as it doesn't contain sucrose as sucrose is for vibrio

E. COLI

UTI – ~~fib~~ fimbriae P, Fe, S, Type 1.

Lower serotypes O_1 O_2 O_4 O_6 O_7.

→ Screening –

M/E

Griess Nitrate Test

Conf^n → culture of urine.

Significant ~~bacteriuria urea~~ bacteriuria **$> 10^5$ cfu/mL.**

Midstream urine

Suprapubic aspiration.

→ KASS CONCEPT

except → Gram +ve org. } 10^2 to 10^5
- Catheterised patient }

Urine culture

Miles & Mishra → **Quantitative**

1 mL of urine in media

Coulter counter

Colony counter

Std. loop technique → **Semi-Quatitative**

4 mm internal diameter

0.001 mL approx.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Media -

1) Mc Conkey + Blood Agar

└ used so that Steph aureus if present

2) CLED (cysteine Lactose electrolyte Deficient media)

- differential media
- prevents swarming of proteus
- ~~pro~~ promotes growth of Steph. + candida

Q[enriched media not required]

Diarrhoea

	Serotype	Virulence Factor
1)	STEC / EHEC	Lambda like Stx1 or Stx2 encoding bacteriophage
2)	ETEC	CFA, LT + ST (plasmid)
3)	EPEC	EPEC adherence factor (plasmid) Locus for enterocyte effacement (LEE) - chromosomal pathogenecity island
4)	EIEC	Invasion, Intracellular spread. cell to cell transmission (plasmid)
5)	EAEC	Adherence + toxin genes (chromosomal plasmid)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

EPEC - Paediatrics
H/C infant children.

Non-Inflammatory Diarrhoea
& Adhesion on HELA/HEP cell lines
↓
Enteroadhesive E.Coli

Δ - Serotyping

~~ETI~~

ETEC - T- Traveller's Diarrhoea H/C

CFA

Toxins:

LT (Labile) ⇓ ↑cAMP

ST (Stable) ⇓ ↑cGMP

Δ - Rabbit ileal loop ligation test

Infant or mice ileal loop ligation

Ballooning

BIKEN test (ppt)

- Ag detect by ELISA using mouse Ig

* Serotyping for ETEC.

ETEC causes non-inflammatory diarrhoea

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

EIEC → atypical E.coli
Non-motile / Lac⁻

Inflammatory Diarrhoea

Δ- Sereny Test [conjunctivitis in Rabbit Eye]

Serotyping

EHEC → Inflammatory Diarrhoea ± Blood.
due to stx (shiga like toxin) or verocytotoxin
↓
haemorrhagic colitis
↓
HUS → EHEC (H/C)
90% anociation.
$Stx_2 > Stx_1$.

M/c cause of outbreak.

Δ- For Screening ⇒ Sorbitol MacConkey media.
↓
EHEC doesn't ferment sorbitol

Serotyping

EAEC → BRICK STACK PATTERN
Non-inflammatory Persistent Diarrhoea

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

KLEBSIELLA

Necrotising Pneumonia ~~c~~ Empyema

Lower Lobes → Lobar pneumonia

HAI. (hosp. acquired)

Hypervirulent Klebsiella pneumoniae (hvKP)

1) Hypermucoviscous phenotype

2) ↑ dissemination

3) String Test (>5mm long) → also seen in Vibrio

4) Klebsiella - lysine decarboxylase

	E.Coli	Klebseilla
Motility	⊕	⊖
Urease	⊖	⊕
Mucoid colony	⊖	⊕
IMVic	++--	--++

Indole

Indole Test

~~Indole~~ Tryptophan

↓ Tryptophase

Indole + Pyruvic acid - NH_3

↓

red complex aldehyde Group.

in KOVAc or ~~Ehrlich reagent~~

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

⊕ → E.Coli

⊖ → Klebsilla
Enterobacter.
Hafnia
Serratia.

Methyl Red

pH indicator - Red at 4.4.

⊕ for E.Coli

Voges Proskauer

Acetoin detected.

⊕ for Klebsella
Enterobacter
Hafnia
Serratia.

Citrate

utelisation of citrate

when citrate utilised, Green → Blue colour change

SALMONELLA

Salmonella enterica subspecies enterica

Serotypes

Typhoidal — faecoral route — Non Typhoidal (NTS)

S. Typhi M/c

S. Paratyphi A

S. Paratyphi B

Enteric fever, Neutropenia

S. Typhimurium M/c

Gastroenteritis.
Neutrophilia.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Serotype - motile except S. Gallinarum + S. Pullorum.

NTS

Salmonella → Toxin → causes ~~Endothelial~~ intestinal epithelial damage
↓
IL 8
↓
Neutrophilia
— No blood or mucus
Pus (+) in stool.

R_x - not required
no antibiotics.
since antibiotics will lead to ↑ fecal shedding
↓
'outbreak'.

ENTERIC FEVER

Salmonella multiplies in peyer's patches [MALT]
↓
Spleen, Lymph node,
Bone marrow.
↳ it gets blocked leading to neutropenia

Neutropenia
- Hepatosplenomegaly
Lymphadenopathy
↓
Other ~~features~~ ~~Complications~~
Rose spots
Bradycardia
Step ladder fever.
Pea soup stool [constipation/diarrhoea]

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

For **confirmation**

Blood culture - 1st + 2nd week 1:10 dilution.

Widal test - 3rd wk onwards.

WIDAL TEST

Tube agglutination.

To detect O + H Ab in pt serum using Widal Ag.

T_O - 'O' Ag of S. Typhi

T_H - 'H' Ag of S. Typhi

A_H - 'H' Ag of S. paratyphi A

B_H - 'H' Ag of S. paratyphi B.

'O' Ab appears early : 'H' Ab persists longer.

'O' agglutinin is granular → round bottle **FELIX TUBE**

'H' " fluffy → conical **DREYER TUBE**

Mirror is used for looking at the agglutination. at the bottom.

16 tubes are used. (4×4)

Widal Ag extraction - (O-901 strain of salmonella used)

'O' Ag → Heat stable

Smooth strain (LPS = O Ag)

grow in phenol Agar. H-O variation. [loss of flagella]

↓

Not total loss

ethanol / chloroform

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

'H' Ag → Heat labile

Rough strain (No LPS - No Ag)

S → R variation (Loss of virulence)

"old culture"

autoagglutinable.

grow in Craigie Tube.

'H' antigen and migrate.

salmonella

→ formalin is used for killing

semisolid agar media

Factors affecting Widal

1) Endemicity (single serum sample)

cut off titre

'O' Ab ≥ 1:320

'H' Ab ≥ 1:640

(or)

4 fold rise in titre

2) Anamnestic Reac^n

Transient Rise in widal Titre due to some other Infection in ~~apparently~~ a previously salmonella infected pt.

IgG is responsible for it

3) False +ve Reac^n

due to some other infec^n.

4) Rx

5) Vaccination. — TAB (killed), Ty 21a (Live)] polyvalent

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Vi- polysaccharide - mono valent
↓ └ Doesnot affect widal titres.
from 2yrs to any age group.

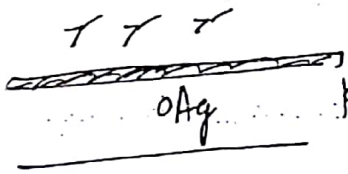
℞ Ciprofloxacin. - DOC
2nd line- ceftriaxone

CARRIER

By Bile culture
Stool culture
Vi Ab detection using viAg (source is citrobacter)

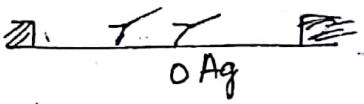
Serotyping in salmonella
Kauffman White Scheme.

Folic negativity while
Serotyping is removed by
V → W variation achied
by heating

(a) 

V forms fresh isolate.
↓
Non-O agglutinable

Best Specimen - Bone Marrow. culture
(painful but ↑ sensitivity)

(b) 

W forms
O agglutination.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

SHIGELLA

- Non. Motile
- ~~Produces Gas (due to pyruvic formic acid)~~
- No Gas :- can't cleave formic acid (anaerogenic)
- Infective Dose - 10-100 bacilli
- Cause outbreak

S. DYSENTERIAE

Chromosomally encoded toxins
- ↓ verocytotoxin (vtx)
- enterotoxin
- neurotoxin (acts on blood vessels)
- 12 serotypes

S.

S. FLEXNERI

6 serotypes — X & Y Variant
More common in India

S. BOYDI

18 serotypes

S. SONNEI

no serotypes → O antigenically homogenous.
Most common worldwide
✓ Colicin Typing (Bacteriocin Typing)

Website: https://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Invasion → By Virulence marker Ag (plasmid)

Δ - Stool Culture. (Salmonella + shigella)

* Enrichment media [liquid ± inhibitor].
  ↳ Tetra thionate Broth
  Selenite F Broth.
  SS Broth

* Selective media → media for H_2S detection

PROTEUS

Swarming
Pleomorphic
produce Urease → cause UTI ± calculi (Struvite)

Δ- PPA test (Confirmation for Proteus, Providencia + Morganella)

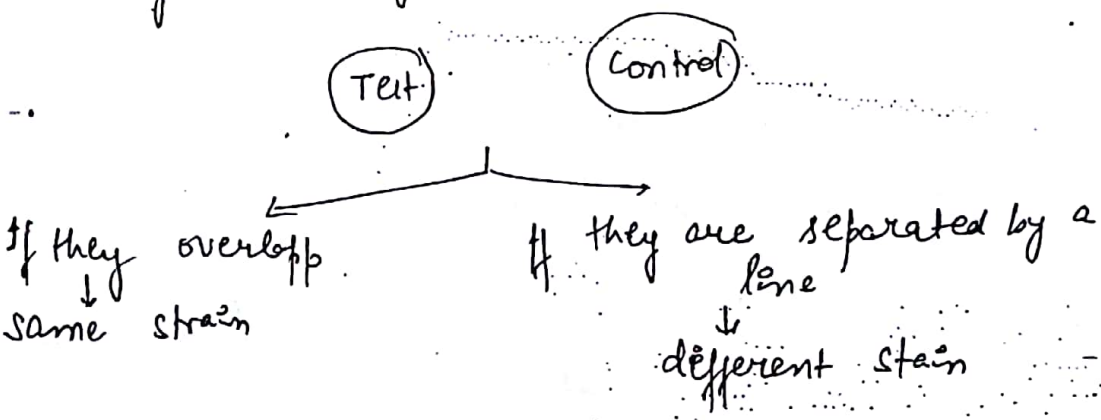
↓

Phenyl pyruvic acid

Diene phenomenon for typing

↓

using swarming



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

YERSINIA PESTIS

Toxin → No virulence ✗

VF:-
- VW antigen
- F_1 protein (plasmid)
- Coagulase
- Phospholipase

} Virulence +. helps bacilli to survive at 27°c in flea midgut

Plague (Black Death)

↓

- Bubo
- pneumonic bubo → if enters lung
- Septicaemic
- outbreak

Endemic Area

① Beed - Latur
② Kohlar
③ Rohtak (shimla)
④ Uttarakhand.

△ - Wayson Stain

Safety pin Bacilli

due to bipolar staining

Ghee Broth - Stallactite growth.

at 27°c

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

YERSINOSIS

Gastroenteritis ± mesentery involvement

Y. enterocolitica M/c

Y. pseudotuberculosis M/c mimics appendicitis.

M/c Bacteria ± mimics appendicitis ⇒ Pasteurella multicida.

Δ of yersinosis -

Stool culture on buffer saline. Q.
'cold enrichment'

Selective Media → CIN (Cefsulodin Irgasan Novobiocin media)

CALYMMATOBACTER (KLEBSIELLA) GRANULOMATOSIS

Intracellular

- Donovanosis / Pseudo bubo / Pseudoelephantiasis.
  [no lymphadenopathy]
- Safety pin appearing Bacilli in mononuclear cell (PUND cells) → Diagnostic

H. DUCREYI

↓
Pain.

Chancroid – Painful

Requires only Factor X for growth.

A ~~Sh~~ School of fish or Tramtrack or Rail Road.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Extracellular
Gram -ve Coccobacilli

BURKHOLDARIA PSEUDO MALLEI

shows safety Pin Appearance
Gram -ve.

Safety Pin Appearance

Vibrio parahaemolyticus
Pasteurella
Burkholderia Pseudomallei
Calymmatobacter
Yersinia

FERMENTORS

VIBRIO

VIBRIO CHOLERAE

Comma shaped & single Polar Flagella.

Virulence

→ Endotoxin - no virulence

→ Exotoxin

- CT (cholera toxin) Most Imp
- ACE (Accessory Cholera exotoxin)
- ZOT (Zona occludens toxin)
- TCP (Toxin coregulated pilus)

] found in O_1, O_{139}

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Cholera Toxin

fragment A → A_1 — A_2 (transports A_1) → Intestinal cells → ↓ adenylate cyclase stimulated → ↑ CAMP → LUMEN ⇒ ↓ Na absorption into villus cells
↑ Cl secretion from crypt cells
= NaCl
H_2O
⇓
Low osmotic tension in lumen
↓
intracellular K^+, Cl^-, HCO_3^- come into lumen
⇓
Loss of H_2O + electrolytes
Zona occludens layer disrupted
⇓
Rice watery stool ⇒ dehydration
acidosis
Hypokalemia

fragment B → Binding

Diagnosis

① Stool Culture

② Enrichment Media → Alkaline Peptone Water
Monsur Taurocholate broth

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

① Transport Media – Carray Blair
VR media
autoclaved sea water

② Selective Media – Bile Salt Agar
GTTA (Gelatine Taurocholate Tellurite)
TCBS (Thiosulphate Citrate Bile Salt Sucrose)
↓
V. cholera → yellow colonies
Halogenic vibrio → Green colonies ~~Halophilic~~.
↓
1) V. parahaemolyticus → causes necrotizing enterocolitis
Kanagawa phenomenon ← [β hemolysis on High salt ~~Agar~~ containing Blood Agar Media
[Wagat Suma Media]

2) V. vulnificans.

Darting Motility.

other test –
- String Test
- oxidase ⊕
- Cholera Red Reac" ⊕
  ↳ Nitrosso indole formed.

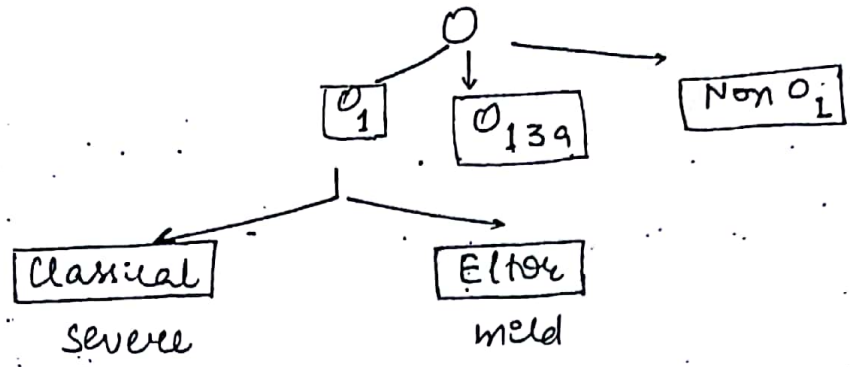
★ Epidemic Period → Source : Human

★ Interepidemic Period → Source : Crustaceans in sea water

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Typing of Vibrio

Serogroups



1st 6 pandemic — originated from Bengal

7th pandemic — from Indonesia

Best for typing

Biotyping

(VP Test)	⊖	⊕
Agglutination of RBC	⊖	⊕
Hemolysis of RBC	⊖	⊕
Polymyxin B	S	R
Phage susceptibility	IV	V

'Mukharjee'

~~Biovars~~ Biovars - classical, Eltor

- Classical
  - Ogawa — AB
  - Inaba — AC
  - Hikojima — ABC
- Eltor
  - O
  - I
  - H.

O_{139} - Capsulated.

↳ capsule contains O_{139} Ag

↓

1st isolated in Chennai.

- Bengal Strain → 1992-94 outbreak in Bengal

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

It caused outbreak.
So, Non-pandemic Strain.

O_{139} is antigenically, epidemiologically distinct from O_1

Clinically similar
No cross immunity seen.

Vaccine
Killed vaccine oral vaccine ~ classical, Eltor ~
Ogawa, Inaba
↓
↑ Mucosal Immunity
'Copro Ab' Q.
in stool.

NON-FERMENTORS

PSEUDOMONAS [Obligate Aerobe]
→ Environment

Colonies have shiny "Gun Metal" appearance.
fruity odour / Grape odour

NLF, Oxidase +ve
Grows at 42°C

Pigments :-
Pyocyanin - blue.
Pyoverdin - green
Pyorubin - red
Pyomelanin - black

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Virulence Factors

① Pili - Adhesion to cell

② Flagella - Adhesion, motility, inflammation

③ Capsule - Biofilm

④ LPS - Bind to CFTR for internalisation
Antiphagocytosis
Inflammation

⑤ Type III Secretion System - Exo S
Exo U
Exo T
Exo Y
Antiphagocytosis

⑥ Type II secretion system - **Exo A** - inhibition of EF2
Cytotoxicity of phagocyte

⑦ Phospholipase - Cytotoxicity of Phagocyte

⑧ Proteases - Proteolytic activity

Complement System Evasion by Pseudomonas

Elastase & alkaline phosphatase

↓

degrade C1q, C3b/iC3b

Δ - **Cetrimide Agar** - Selective Media

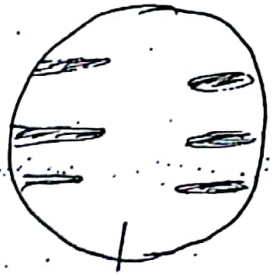
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Typing - Bacteriocin Typing [Image]

↓

Difference antimicrobial Agents secreted by different strains

Shigella Sonnei - colicin
Klebsella - Klebocin



Grow strain in between

↓ remove it next day

↓

Chloroform application.

↓

Now put again standard strain.

↓

Growth differ due to antimicrobial substance released.

Rx

1) Neutropenic host or HDR

↓

Cefipime

② Non-neutropenic host

↓

Monotherapy → Ceftazidime

Combination → Pip/taz or Carbepenem ± Amikacin

BURKHOLDARIA PSEUDOMALLAI

① Capsulated

② Most virulent amongst Non-fermenters.
It has all ~~seuo~~ screton system + capsule.

③ ~~Mod~~ Melioidosis → Pulmonary Infection
Abscess
pneumonia
necrotizing lung Disease
Skin ulceration
Lymphadenopathy

④ Bioterrorism - Cat II agent

⑤ Long Latent Period ⇒ 'Vietnam Time Bomb Disease'

⑥ Δ → Gram -ve
Safety Pin
Culture - Ashdown media -
cornflower head wrinkled
Purple colonies

DOC - Meropenam / TMP-SMX.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

STRENOTROPHOMAS MALTOPHILIA (Non-Fermenter)

Gram-ve,
Motile (polar)
Environmental
HAI

Δ - culture → Lavender Green
→ Gray colour colonies on blood agar
oxidase ⊖
Oxidation of glucose, maltose

DOC- TMP-SMX + Ticarcillin - clavulanic acid

ACINETOBACTER

Environmental, HAI
Non-motile
oxidase ⊖

Rx - same as pseudomonas.

Non-Fermenter (ZOONOTIC)

BURKHOLDARIA MALLEI

Equinus (Horses) → Glanders.

BURKHOLDARIA CEPACIA

causes Cepacia Syndrome
↓
associated with sepsis

Δ - Colistin containing ~~med~~ agar.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Pneumonia in Cystic fibrosis → mucoid colonies
↳ B. cepacia

BACTERIAL VAGINOSIS

caused by: Gardenerella
Bacteroides
Mobiluncus sp.
↓
↓ Lactobacillus

Nugent score > 7 ⇒ Diagnostic
Based on less no. of Lactobacilli & more pathogens.

Clue cell - Epithelial cells studded with Gram -ve bacteria

Whiff test - Amines (fishy odour)
pH > 4.4.

CHROMOBACTERIUM VIOLECIUM

Purple coloured.
Lead to lung & wound infection
Gram -ve

SERRATIA Marcescans

Pseudohaemoptysis.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

CAPNOCYTOPHAGA

Slow growing
Capnophilic
Gram-ve
- Fusiform filamentous

Gliding Motility

Modify Chemotactic ~~factor~~ activity of neutrophils
Fulminant sepsis in asplenia or alcoholism.

fusiform
Gram-ve

HACEK

Haemophilus parainfluenzae (MC) s/o isolated from.
- HACEK endocarditis

A. actinomycetemcomitans - Prosthetic valve endocarditis.

Cardiobacterium Hominis → aortic valve

Eikenella corrodens → Least common cause of HACEK endocarditis.
Human Bite → clenched Fist injuries Q.

Kingella kingae - septic arthritis in children. (M/C)
Purpuric rash similar to meningococcus

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

LEGIONELLA PNEUMOPHILIA

BCYE

* Charcoal in the ~~BYEE~~ media used to isolate Legionella pneumonille
  ↳ (Buffered charcoal Yeast Extract)
  ↓
  detoxifying agent
  [Black colour]

* Contaminated water (amoeba/ algae)
  ↳ aerosol through A/c aspiration.

→ No person to person transmission

→

Legioneres Disease
Pneumonia

Pontaic Fever
No pneumonia

Δ - ① Neutropenia

② Culture on BYCE media [charcoal for detoxification]
↓
Monoxenic media.
(requires 1 biological agent in media)
Ⓝ used in practice Cultures

③ Immunoflourescence - sensitive method

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

H. ~~INFLEN~~ INFLUENZAE

Pfeiffer's Bacillus

aerobe
oxidase ⊕
pleomorphic
Resp. sample - coccobacilli
CSF - filamentous.

1st organism - entire genome sequenced
2 months to 3 years - No Ab to PRP

Biotype 1 is M/c cause of meningitis

Virulence
capsule → 6 serotypes (a to f)

Type b → capsule has PRP
[95% infection] (polyribosyl ribitol PO_4)
↓
causes invasion.

5% of infection - Non-capsulated or Non-Typable Strains

Vaccine - Hib
(monovalent polysaccharide conjugate vaccine)

Δ — Require X & V factor for Growth.

① Culture

a) chocolate agar - factor V released

b) Blood agar ± S. aureus

c) Nutrient agar ± disc of X & V factor

d) Levinthal agar (capsulated strain produce iridescence)

e) Fildes Agar - peptic digest of blood on nutrient agar. (Best)

— Satellitism in — H. influenzae is due to factor V.

~~Colon~~i Bigger colony around S. Aureus.

↓

It stimulate produc^{n} of V factor

H. AEGYPTICUS

Koch's weeks Bacilli or Brazilian purpuric fever Egyptian conjunctivitis Red eyes.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

BORDETELLA PERTUSIS (Gram-ve coccobacilli)

160

Whooping cough → inspiratory stridor

100 day fever

No animal reservoir unlike B. Bronchoseptica

Virulence -

① capsule → No Role in Virulence

② Pertusis Toxin (Type I, IV) - ~~combine~~ secretory system

activate adenylate cyclase → ↑ cAMP

③ Tracheal cytotoxin

④ Adenylate cyclase Toxin

⑤ Dermonecrotic toxin

⑥ Endotoxin

⑦ Adhesin (Type V) → FHA, pertactin, fimbriae

secretory system

BrkA protein

⇓

↑ Histamine

↑ insulin.

Lymphocytosis - huge

△ - ① Thumb Print appearance

② Regan Lowe → mercury Drops or Bisected Pearls

(Charcoal + 10% horse blood + cephalexin) Regan Lowe ⇒ Transport media

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

③ Bordet Gengou → Potato Blood Agar

④ Ab detec' by ELISA

⑤ PCR 154bl - PT promoter region gene

Vaccine

whole celled

acellular

contains ↓ more safe

PT - pertussis

FHA1 - fimbrae

FHA2 } filamentous
FHA3 } haemagglutinin Ag

Pertactin.

Thiomersal - preservative

✓FRANSICELLA TULARENSIS

- Zoonotic
- Transmission - ticks / deer fly or direct contact c/ rabbits / muskrats
  penetration of skin M/c
  inhalation, ingestion
- culture media
  - ✓cholate agar
  - ✓MTM (mod. Thayer Martin)
  - ✓BCYE

Gram -ve coccobacilli

Δ - Serology (M/c)

Rx - resistance to β lactams
streptomycin / gentamicin.
tetracycline
chloramphenicol
FQs

CAT A agent of Bioterrorism.

(BSL III req for culture).

M.TB

① Obligate aerobe
② Micro-aerophilic → M. Bovis.

③ Virulence factor
- CORD factor.

Δ-1> M/E → ↓ sensitivity
10^4 bacilli/ mL of sputum is req

a> **Zn stain** - slender, long, curved.
[for confirmation] beaded

b> **Auramine Rhodamine** - Direct flourescence assay
↓ Binds to mycolic acid
Highly sensitive → used for screening

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

2) Culture

LJ media

↓

Egg containing media ± asparagine

Malachite Green (Selective)

M.Tb → Eugonic growth

M.Bovi → Dysgonic growth. (Sparse)

Petroff's Method → sputum processing.

(15-20min) ↓

4% NaOH

N-Acetyl Cystein (mucolytic agent)

↓

Centrifugation at ↑RPM

⇓

BSL (III) (Biosafety Level)

Best

CBNAAT (Cartridge Based Nucleic Acid Amplification Test)

- PCR
- BSL - (II)

INNOLIPA (Line probe assay)

Reverse Hybridisation technique.

20 DNA probes of different Mycobacterial species are immobilised on nitrocellulose strip. the amplicons (amplified DNA) are hybridised ± the probes

Chromogenic Reagent is used instead of radioactivity

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

GTMD (Genotype Mycobacteria Direct)

NASBA (~~NA~~ · where RNA is amplified & reverse hybridised & RNA probes on strip.

↓

Nucleic acid sequence based anay

Only 5 species detected

IS6110 - Best for Genotyping

Best Culture Technique - BACTEC NAIT.

↓

✓ flourecent.

✓ 2 days - 7 days.

Latent TB

Mantoux Test → 5 TU of PPD-S

or 1 TU of RT_{23} strain ← RNTCP

after 72hrs ↓

in (L) forearm.

>10mm induration along short axis on (L) forearm

⇓

Positive → exposed

Quantiferon Gold Test / IFN-γ Release Assay IGRA

↓ — Lymphocyte → ↑ IFN-γ

whole blood

↓

Stimulate & M.Tb Ag eg. - ESAT 6, CFP 10, MTb 7.7

↓

(+)

exposed

⇒ less falsi tve

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Q No cross R* c/t BCG or atypical Mycobacteria or NTM or MOTT except M. Kansasi.

ATYPICAL MYCOBACTERIUM

* Runyan classification

Photochromogens → Pigments in Light
- M. Kansasi
- M. Marinum [swimming pool / Fish tank granuloma]

Scotochromogens → Pigments in dark [crow gai in dark]
- M. Scrofulaceum
- M. Szulgai

Non-Photochromogens – No pigments.
- M. ulcerans → Buruli Ulcer
- MAC → <50 CD_4 cells in HIV
- M. avium
- M. intercellulare / (Batey Bacilli)

Rapid Growers (<7 days) –
- M. Chelonei
- M. fortuitum

} ⇒ cause post trauma abscess

[loan + fortune = rapid growers]

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

	MTB	Atypical
① Niacin	⊕	⊖
② ~~Aryl~~ Aryl sulphatase	⊖	⊕

M. LEPRAE [acid fast staining ī 5% H_2SO_4]

- SSS (short, stought, straight bacilli) → [Image]
- acid fast B. in palisade

>50 bacilli - globi

c̄ in histiocytes - FOAM cells

Specimen -

SSS - split skin smear (6 specimen → 4 skin, 1 ear lobe, 1 nasal mucosa
+nt in edge of Lesion

Ab to PGL1

Δ - M/E - ↓ sensitivity 10^4 bacilli / gm of tissue.

IOC

culture - Best Armadillo (natural infection)

M/c - Mice (suckling)

↓

Thymectomy

(to induce lepromatous Leprosy)

~~LEPTOSPIRA~~ Leptospira → ?

Dark Ground Microscopy ← Treponema

Light microscopy → Borrelia

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

SPIROCHAETES

Spiral organisms & endoflagella → cork screw motility

T. Pallidum → venereal Syphilis.

1° stage → Hunterian **chancre**
↓
painless, indurated.
self limiting in 4-6 weeks.

2° → Dissemination.
after 2 to 6 months.
⇓
Condyloma

Latent → No sign & symptom

3° → complications.
Aortic aneurysm
Tabes Dorsalis

Δ -

1° stage → ① Dark Ground Microscopy
↓
only reflected light ~~through~~ from object through spiral condensor.
Resolution power not increased.
only optical illumination used.

② EIA (Enzyme Immuno Assay)
IoC

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

2° stage → TPPA (Treponema Pallidum Particle Agglutination)
(Easy) ↓ gelatin
- Most sensitive & specific. Overall
Used for Confirmation.

Screening → VDRL
Slide flocculation Test
⇓
Cardiolipin Ag [Calcutta Ag]
(derived from ox heart)

Reactive → clumps. [Image]
Non-reactive → Scattered
Using microscope → flocule seen.

RPR
Cardiolipen + carbon particles
Passive agglutination based test

Nichol Strain → Pathogenic Treponems

TPI not safe. but ↑ specificity

TPHA - haemagglutination assay
↓ sensitivity

FTA-ABS Reiters Strain → non-pathogenic treponems
(Difficult) + Absorption → Non-specific Ab in serum
then ⇓
Nichol's strain used [Indirect Immunofluorens]

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

LEPTOSPIRA

① Curved at 1 End. ? interrogans.

② M/c Zoonotic disease.

③ 3R → Rats. Rainfall. ricefield

rat urine → penetration of skin.

affect liver & kidneys

↓

Jaundice haemorrhagic fever. & myalgia

WEIL's Ds / Andaman Fever

A - ① Culture on Korthoff, Fletcher, EMJH media

② Ag detect in urine

③ Typing → Serum is used.

(Leptospira difficult to grow)

↓

Reference Lab

Macroscopic agglutination Test (MAC)

↳ Killed Leptospira Ag used to detect Serogroups

⇓

Serotypes having similar Ag

Passive Agglutination

Serogroups detected.

Microscopic agglutination test → Serotypes detected

Live Leptospira

immobilisation test → Dark Ground Microscope used

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

BORRELIA

Thick → can be seen in Light microscope

Causes Relapsing Fever

- Epidemic → Louse – B recurrentis
- Endemic → Tick born

B. Burgdorferi ⇒ LYME's Disease

Erythema chronicum Migrans [Image].

↓

Concentric centrifugal Rash.

Δ –

P66 Ab by Western Blot Assay

(Non-Specific But Best)

25/2/18

RICKETTSIACEAE FAMILY

→ Rickettsia
→ Orientia
→ Coxiella
→ Ehrlich

} Weil ~~Fte~~ Felix Test

↓

Heterophile Agglutination Test

↓

Non-motile Proteins strains

P. vulgaris OX19 , OX2 — P. mirabilis OXK.

Russia in endemic for Typhus Fever

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

TYPHUS FEVER

Epidemic	Endemic	Brill Zinsser (Recrudescent)
Louse	Flea	
causative: R. Prowazeki	causative: R. Typhi	P. Prowazeki

Some of the elderly not suffering from Disease

Spotted Fever (Tick Borne) - 0x2. - ~~Rocky~~ Mountain. - R. Ricketsiae
Fever

— Indian tick typhus, Japanese " ", Siberian " " } R. conorii

mite → Ricketssial pox → R. Akari

Scrub Typhus - Thrombiculid → orientia tsutsugammshi
0xk mite (Larva)

Epidemic Typhus	Endemic Typhus
Neil Moosee or Tunica Vaginalis test	
⊖ in R. Prowazeki	⊕ in R. Typhi

LAT

✓ Q FEVER / ABBATOIR / QUEENSLAND FEVER

⇒ (Tick) act as reservoir → transmit to sheep, goat, cattle but not to humans

→ Transmission to humans by [respiratory route] - aerosol from soil, tissue or during parturition. only rickettsial infec" can be transmitted bout arthropod i.e. man to man → resp. route

→ Acute Infection ⇒ Influenza like

→ Chronic " ⇒ [Infective Endocarditis] M/c

→ Risk Factor - Pre existing valve anomaly
- Immunocompromised

Δ -

→ Culture only in [cell lines] [BSL 3 lab]

Δ
- Δ Immunofluorescence IOC
Giemsa stain.
PCR

✓ Coxiella Survives Holder's Method by pasteurisation.
↓
(63°C) for (30) min.

[Flash method - (72°C) for 13-15sec].

Ehrlichia → [Morula] (vacuoles in phagocytes)

Sp
Sennetsu → raw fish.
Chaffensis } - tick. → affects monocyte
Phagocytophilia → affects granulocytosis.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

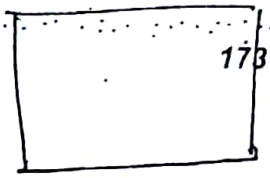
CHLAMYDIA

Gram -ve cell wall But no peptidoglycan. (no neuraminic acid)

Lack ATP synthesis ⇒ Energy Parasites

Infectious form E/n/a Elementary Body (50-330nm)

Δ form ⇒ Reticulate body



① Inclusion Bodie (Reticulate Body)

② MacCoy cell Line

Pathogenicity :-

C. Trachomatis → ~~H.B~~ H.P. Body (Heidstaden Prowazeki)

serotype A-C → Trachoma → Fitz Hugh Curtis → Reitter's Syndrome

D-K → Inclusion conjunctivitis. NGU — C conjun / U urethritis / Poly arthritis

LGV 1 to 3 → Lymphogranuloma Venerium
↳ painless ulcer painful bubo

Δ - TRIC Serovars.

M/E → Giemsa, Giminez, Castaneda: Machiarella. LGV → Miyagawa corpuscle

→ culture on MacCoy cell lines

→ Ab detection by ELISA

→ NAAT by PCR.

LGV Serovars. → Frie Test

Ab detec' by Micro Immunofluorescence Assay

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

C. pneumoniae } → } atypical pneumonia
C. psitaci → LcL Body }
Inclusion Body

Typing :-

1) LPS → Genus Specific Ag (CF Test)
2) Envelope Ag → Species specific Ag
3) Outer Membrane protein → serovar or serotype specific Ag [Micro IF test]

MYCOPLASMA

My fried egg glided in dining while eating

PPLO or Eaton Agent
[pleuro-peritoneal like org]

M/c cause of atypical pneumoniae or walking pneumonia

✓ No cell wall
✓ Sterol tnt in cell membrane
No turbidity in liquid media → also seen in B. anthracis

Δ

① Culture in media ī cholesterol
⇓
✓ Diene stain of isolate [Methylene Blue + Azure]
fried egg colony

② Serology → Heterophile agglutination Test
a) Cold agglutination → O -ve RBC at 4°C.
b) ~~Streptococcal~~ MG Test

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

HELICOBACTOR

1) Deep in mucous layer on epithelial side (pH - 7.4)

2) ~~Proteases~~ Proteases → modifies gastric mucosa - reduce diffusion of acid.

3) Urease activity → Ammonia - buffering of acid

4) Complement system evasion by H. Pylori

Protectin inhibits MAC → C_5-C_8

Δ :-

1) Warthin Starry silver stain ⇒ Sea gull wings.

↓

also used for —

Campylobacter

microerophilic

↓

media :- Skirrow's
for Both. Butzler's
CAMPY Blood agar.

~ - comma shaped
darting motility

↓

Microaerophilic (5% O_2)

→ HLA: B27 - Reactive arthritis.
Trigger guillian Barre syndrome
(serotype 019)
grows at 42°C
gullwing shaped, darting motility

Pathogenicity :-

Helicobacter → peptic ulcer

↓

Adenoma / Maltoma

Campylobacter → Gastroenteritis & blood.

↓

Reservoir (poultry)

Gold std. for Δ of Helicobacter ⇒ Urea Breath Test

Biopsy + Urease ⇒ for dysplasia

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

BARTONELLA BACILLIFORMIS

CARRION's DISEASE

← [Female Lutzomyia (sandfly)]

Oroya Fever - Acute phase
- fever + other constitutional symptoms
- Severe anaemia, jaundice, Hepatomegaly, Lymphadenopathy, myalgia

Verruga Peruana - after resolution of oroya fever
[Image] Non tender,
red to purple
nodular Lesion.

Δ :-
M/E → Wartin Starry or Giemsa stain
∴ Bacillin in RBC

Culture on blood agar at 30°c
Ab detect
PCR.

B. QUINTANA →
Trench fever (5 day fever)
By louse
camp outbreak

B. HENSELAE → Cat Scratch Disease → Cervical LN
Basillary Angiomatosis

Cat Bite → Pasteurella

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

RAT BITE FEVER

Spirillum Minor

3-5 µm

Coiled spiral org.

Rat bite fever (Sodoku)

Local Lesion, regional gland swelling. Skin rashes.

Culture - inoculation in guinea pigs / mice

Flagella at Both ends

Streptobacillus moniliform

Gram (-ve)

Aerobic

Pleomorphic bacteria that forms irregular chains of bacilli interspersed ī fusiform enlargements

L-forms seen.

Rat bite fever - Septic fever

Blotchy

— Petechial rash -

painful Polyarthritis

Ingestion of milk - epidemics of Haverhill fever

Culture - trypticase soy enriched ī 20% blood.

BRUCELLA

Zoonotic (from animal milk)

affects the Reticulo-endothelial system (Intracellular)

↓

- Hepatosplenomegaly
- Lymphadenopathy

Malta or undulating fever (typhoid like illness)

- Neutropenia

Triad

1) Undulating fever fever ī night sweats
2) Arthralgia
3) Hepatosplenomegaly

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

DOC - Doxycycline + streptomycin.

Δ - Castenada Blood culture.
'byphasic media'

Serology
→ coombs test
→ Std. agglutenation test
11 tube dilution.
"PROZONE" Phenomenon.
→ PCR. → Gold std

Silver Impregnation → Levaditi / Fontana
for spirochaetes.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

PARASITOLOGY

- Protozoa (unicellular)
- Helminths (multicellular)
  - Platyhelminth (flat)
    - Cystodes (segmented) → Digestive, excretory, reproductive spores are separate
    - Trematodes (unsegmented) → Incomplete alimentary canal
  - Nemathelminth. Round. → Nematodes → complete alimentary canal

"NO alimentary canal" — NO CYCLOPS

Hermaphrodites except schistosoma

Separate sexes

INTESTINAL PROTOZOA

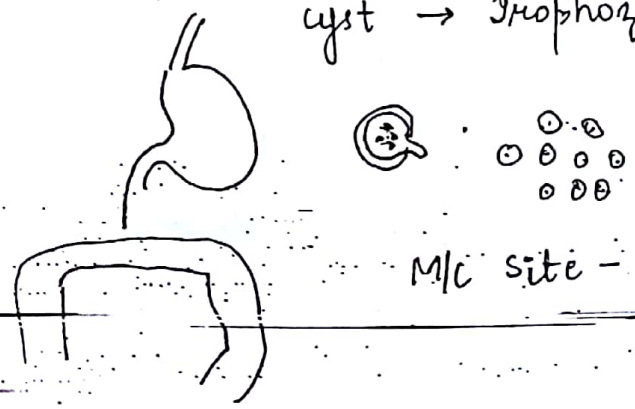
ENTAMOEBA HISTOLYTICA (pathogen)

[Image]

Infective form ⇒ Quadrinucleate Cyst

Excystation occurs in ileum (↑ pH)

cyst → trophozoites.



M/C site – Sigmoid colon

~~Caecum~~ (M/c)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Virulence factors :-

① Galactosamine Lactin → binding

② Protease → degrade collagen

③ Calmodulin, phosphatase A } inhibit phagocytosis

④ Thioredoxin reductase → degrades toxic O-1 N· radicals.

Dy Distal colon → encystation occurs.

Trophozoites → cyst

Diagnosis :-

① M/E of stool. (wet or iodine or trichrome stain)

	Pathogens	Non-Pathogen
Trophozoite	15-20μm	20-30 μm
	active	sluggish
	RBC or cellular debris in trophozoites [Erythrophagic]	Bacteria in trophozoites
Nucleus	central	excentric
	Ectoplasm + Endoplasm [thin] [granular]	Endoplasm
Cyst	6-15μm	15-20 μm
	1-4 nuclei	1-8 nuclei
Glycogen Mass	uninucleate stage	Binucleate stage
Chromatoid Body	No difference	

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Δ - Rectal Biopsy ⇒ Flask shaped ulcer.

Other ways of Δ

① Nested PCR

② zymodene assay → isoenzyme pattern on electrophoresis

③ galactosamine Lectin Ag detection by ELISA] IOC for Gal / Gal NAC ELISA. Invasive amoebiasis

EXTRAINTESTINAL AMOEBIASIS

~~Haem~~ Hematogenous Route

Liver (M/C) Lung Brain

↳ Posterosuperior quadrant of (R) lobe

Cutaneous (directly)

↳ cutaneous amoebiasis.

Δ

① M/E of Liver aspirate ⇒ Anchovy sauce pus
trophozoite ↓

② PCR → most sensitive

③ Radiology

④ Clinical diagnosis

Trophozoite at periphery

FREE LIVING AMOEBA

Found in natural water source

Acanthamoeba → 1° lung infection.
↓ haematogenous

Granulomatous Amoebic encephalitis.

Keratitis (contact lens)

Δ - CSF ⇒ Both cyst + Trophozoites

Naegleria → flagellated amoeba

↓

travels via olfactory n/v

↓

pierces cribriform plate

↓

1° amoebic meningoencephalitis

↓

fatal.

Δ → CSF only trophozoites

- Δ of free living Amoeba
- culture on non nutrient agar ī E.coli → Tracts.
- M/E of CSF
  - H+E stain → cyst + trophozoite → acanthamoeba
    Trophozoite → Naegleria.
  - Immunofluorescence [Image]

GIARDIA INTESTINALIS

Infective form - Quadrinucleate cyst

Excystation take place at the Jejunum. - M/c site

Trophozoites bind ī ventral sucking disc

↓

disrupt brush border enzymes

↓

Malabsorption

Steatorrhoea

foul smelling stool

Anaemia (↓ IF → Megaloblastic - Pernicious

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Diarrhoea

Stool → "Loose Greasy" yellow colour

Δ -

① Stool M/E for trophozoites + cyst (M/c)
wet mount, trichome, Kohn, Giemsa

② Direct Immunofluorescence assay → auramine

③ Ag Detection by ELISA + rapid immunochromatographic assay

④ Other test - Entero-test → string ingestion + then exam.
Duodenal Biopsy
NAAT

Each Trophozoite has 4 pair of flagella [Image]

→ [1 ant
→ 1 middle
→ 2 post.]

BALANTIDIUM COLI

Ciliated.

- LARGEST PROTOZOA

Infects Pig, humans (occasionally)

Asymptomatic (M/c)

Persistant Intermittent Diarrhoea.

DOC - Tetracycline

Δ - stool M/E → trophozoite (cysts rarely seen)

Tissue staining ⇒ H&E after endoscopy

[Differential Interference Contrast → for cilia]

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

COCCIDIAN INTESTINAL PROTOZOA

Diarrhoea in HIV pt. • extreme of age

CRYPTOSPORIDIUM PARVUM (6μm)

Infective form → Thick walled ~~cyst~~ oocyst

oocyst ↑ gametocyte ↑ merozoite

sporozoite ↙ ↘ trophozoite → schizont

oocyst

Thick walled (80%) — Thin walled (20%)

↓

They invade other cell.

• cause infection.

[autoinfection]

⇓

Persistent Diarrhoea

No t/t, only improve immune system

CYCLOSPORA (10μm)

autoflourescence seen.

ISOSPORA

① Kinyoun

Δ :- ~~Kinyoun~~ Stain [Modified ZN stain] ⇒ Acid fast oocyst
cold technique

[Cryptospora – 6μm
cyclospora – 10μm
Isospora – 25-40μm]

Decolourising Agent → 0.5% H_2SO_4.

* ~~Ghost cells~~ → unstained cells

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

② Immunofluorescence Assay by auramine.

MICROSPORIDIUM

↳ earlier considered Coccidian

- Fungi
- causes diarrhoea + ocular Infec"
- spores seen.

Δ :- "Weber Stain"

PLASMODIUM

Pigments - ?

Peripheral Blood Smear - Gold Std

Δ :-

RBC	P. Vivax	P. Falciparum
	Enlarged + Pale	Normal
	Schuffner's - yellow	Maurer's dot - Black
	Single infection	Multiple infec"
	~~1 RBC~~ 1 RBC = one parasite	1 RBC - multiple parasite
	All Stages	Early + Late stages

Early + Late stages
↓
SEQUESTRATION
↓
vascular endothelial cells

Mech: of
a) Cytoadherence.
- adhesion molecule

b) Rossette formation
- 2-3 parasite stick together

⇒ ~~Agglutination~~ - ~~surface~~ adhesion of RBc

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

P. vivax

Ring form

Romanowskii stain

[Early Trophozoite]

Amoeboid form

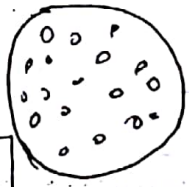
[Late Trophozoite]

Schizont

completely fill the RBC

Merozoites

>12 in no.



Gametocyte

P. Falciparum

Causes Renal failure

Accole forms

'signet Ring'

Divided Nuclei is also seen here

Crescent or Sausage

Gametocyte

P. MALARIAE → causes Nephrotic Syndrome

Zeimann's Dots (light Brown)

RBC - normal

Band forms

Basket forms

Merozoites

≤8 No.

P. OVALE

Similar to vivax

James Dot's
Dark Brown

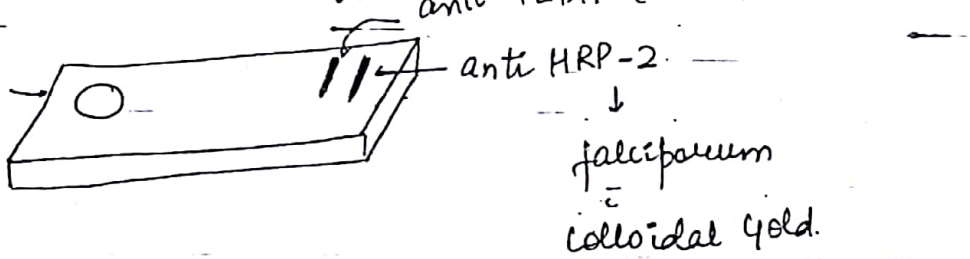
Quotidian → Shinton + Mulligan

Thick Smear → Screening

Thin Smear → Species identification

Other tests for Diagnosis

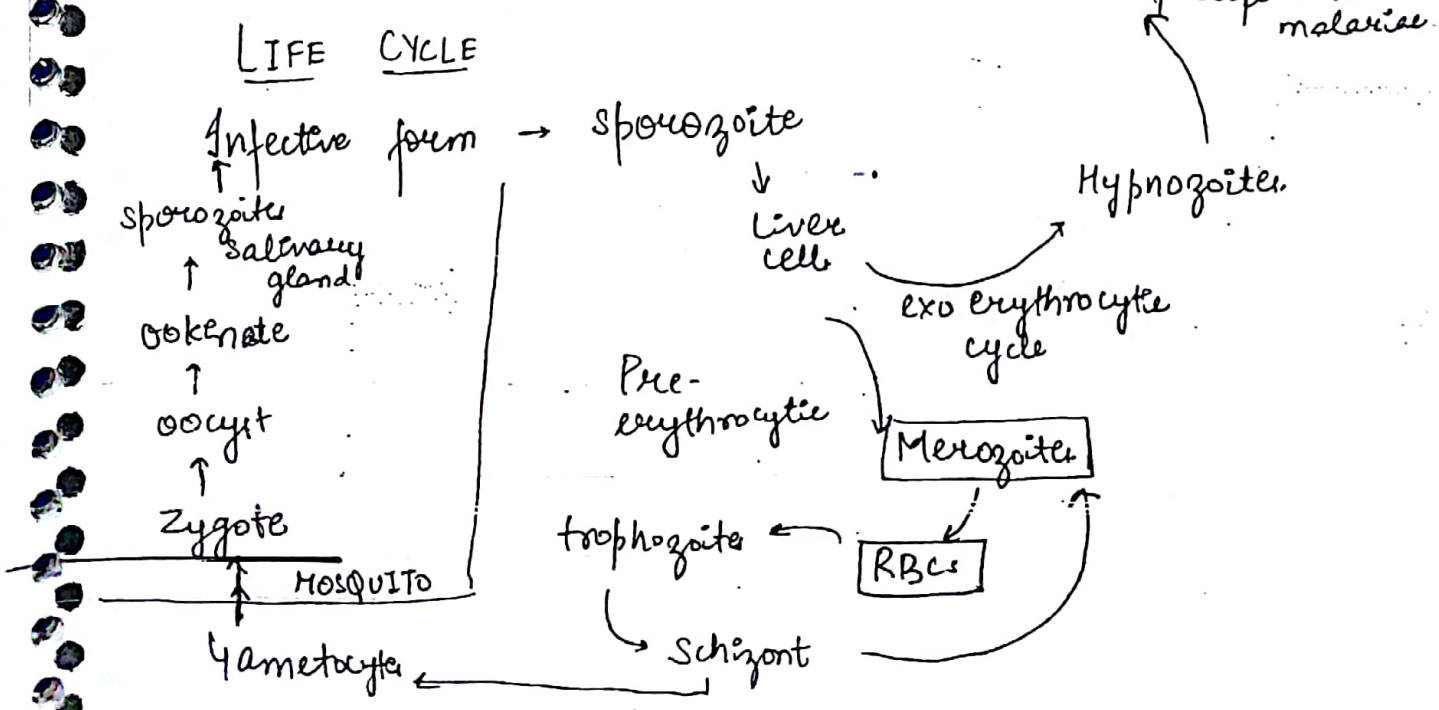
1) Rapid Immunochromatographic assay



2) Quantitative Buffy Coat Technique

Acridine Orange for flourescent

LIFE CYCLE

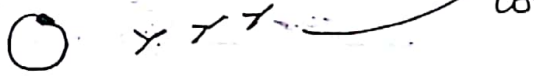


Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

* Transfusion Malaria / Mother to child
  - Short I.P.
  - H/c Trophozoites
    - Schizonts
    - Merozoite
  - ∴ No pre-erythrocytic cycle

* Screening of blood
  - Serology → Rapid Immunochromatographic Assay
    - Advantage of Rapid
      - No expertise required.

Falciparum
- quinine therapy → Black water Fever
  - acts as hapten
  - quinonised RBC
  - autoimmune HSN II
  - hemolysis of RBC.
  - complement mediated



quinine → causes hypoglycemia
- hence should be accompanied ē 25% D.

BABESIA MICROTI - Protozoa invading RBC

- Tick Borne
- R/F → Splenectomy
- Maltese cross tetrads → seen in RBC.
- Δ form

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

HAEMOFLAGELLATES

- Leishmania
- Trypanosoma

LEISHMANIA

L. Donovani
L. infantum
L. Chagasi — new world.
→ Visceral Leishmaniasis.

Infective form → Promastigote (flagellated form.)

↓

deposited on the skin by

Sand fly
- Phlebotomus - old world
- Lutzomia - new world

↓

Penetrate the skin through tracts

↓

AMASTIGOTE

Spleen	BM	LN
95%	65-80%	50%

↑↑ IL-10

↓

inhibits TH_1.

↑↑ TH_2 response

↓

IL-6 released

Proliferation

↓

Massive splenomegaly

Kalazar.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Δ ① M/E of Bone Marrow.

Best Test → Macrophage → LD Body

↓ kinetoplast on amastigotes

↓

'Dot & Dash' [Image]

② Napier Aldehyde / antimony test.

Serology

③ Montenegro Test

Negative except in Sudan

④ Culture on NNN medium

↓

Rosette formation of promastigotes.

Cutaneous LEISHMANIASIS

L. Tropica M/c

Delhi Boil or Oriental Sore

Mucocutaneous - L. Braziliensis M/c

L. Mexicana complex

PKDL - Nodular Lesion on face after Visceral Leishmaniasis

↓

East Africa [Sudan] - after 2-6 months

Indian Subcontinent - (Bangladesh) > 3 years.

India - W.B., Bihar, Assam

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

TRYPANOSOMA

- T. CRUZI
- T. BRUZI

T. CRUZI

Causes Chagas Disease

↓

Chagoma

Infective form → Trypanomastigote

↓

deposited by

Triatome/ **Reduvid** Kissing or Assassin.

⇓

Chagoma - skin lesion.

cardiomyopathy

megacolon

Romona Sign ⇒ U/L Periorbital oedema

Δ - Amastigote in (heart) tenue.

C-shaped Trypomastigote in blood

T. BRUZI

causes Sleeping Sickness

Infective form → Trypomastigote

↓

vector - **Tsetse Fly**

↓

inhibition of Insomnia Receptors.

Winter Bottom Sign ⇒ cervical L.N. enlarged

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Δ - NO amastigotes.
ELONGATED PROMASTIGOTES

glycoprotein switching
↓
Immune evasion.

TRICHOMONAS VAGINALIS

[Image]

- 1 morphological form ⇒
- 4-5 ant. flagelle + 1 along - Undulating body

- Greenish frothy D/c
- Whiff Test +ve

LMP TOXOPLASMA

A ♀ ; H/o recurrent abortions present to ANC in her 1st Trimester

TORCH screen

	↳ IgM.	IgG.
Toxo	+	+
Rubella	-	-
CMV	-	+
HSV	-	+

Next Management ?
a) Start Spiramycin
b) advice MTP
c) IgG avidity test
d) IgA deficiency.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Toxoplasma Gondii

Transmission through cats, canines.

Infective Form ⇒ oocyst in cat faeces

↓

ingested

↓

Bradyzoites

↓

Tachyzoites (motile)

↓

tissue cyst (dormant)
(Bradyzoites)

Sign, symptoms develop in Immunocompromised, ♀.

HIV pt.

Reactivation. $CD_4 < 50$

↓

Fetal encephalitis

Δ - ① No IgM, low IgG titre

② MRI - Crescent shaped multiple Ring enhancing lesion.

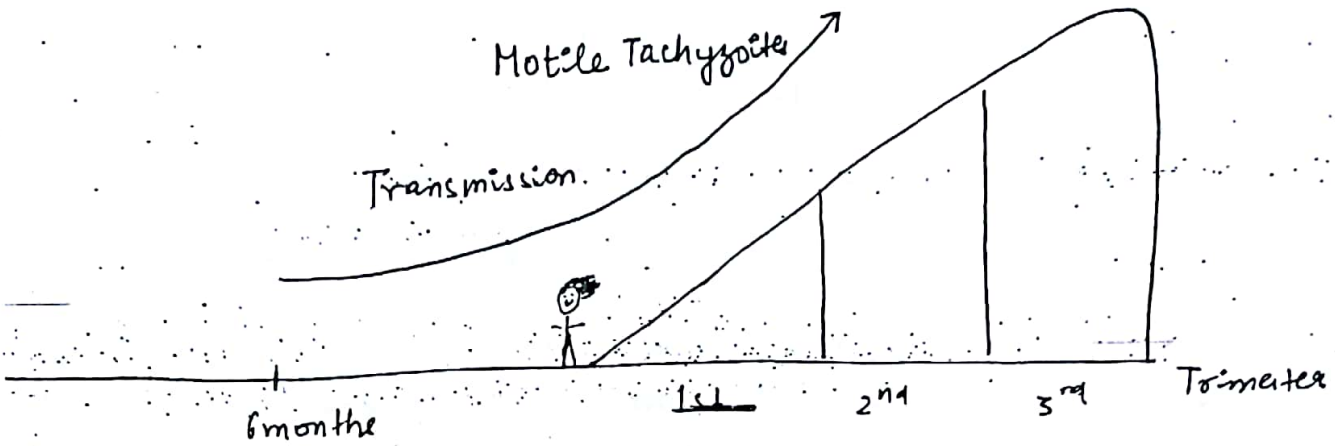
Eccentric target sign

③ PCR of CSF.

↓ spiramycin - DOC

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

In ♀



Beyond 6-months
no tachyzoites
↓
no transmission

Foetal affection more in earlier part

In ♀F

Asymptomatic or Severe Symptoms (anencephaly)

Late sequelae of Chorioretenitis
↓
Lead to Blindness

Risk Assesment In Cong. Toxoplasmosis :-

By Serology

IgG +
IgM -
↓
Past Infec
[Not significant]

IgG +
IgM + (stays for ≥ 1yr)
↓
IgG avidity Test
(measures affinity)
high → Recent infection
Low → Susceptible
↓
Preventive

IgG -
IgM +
↓

IgG -
IgM -
↓

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Ig A detection → Low Ig G avidity

↓

more sensitive test for recent infn

Sabin Feldman dye Test

to detect Ab

↓

Not recent Inf.

CYSTODES

Developmental Stages

Eggs - Coracidium — Procercoid Larva - Plerocercoid Larva

Trematodes Developmental Stage

Eggs - Miracidium – sporocyst — Radiae → cercaria - Metacercaria.

Definitive Host	Intermediate Host
T. Saginata	Echinococcus
Diphyllobothrium	Sparganum
Hymenolepis	Coenurus
Dipylidium.	

Both Definitive & intermediate - T. solium.

Paratenic Host - no development of parasite in this host

1) Prawn → Angiostrongylus cantonesis
2) Big Fish → pleorocercoid larva of D. Latum
3) Fish → Gnathostoma Spinigerum
4) Man → pleorocercoid larva of **Sparganum** Q

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

DIPHYLLOBOTHRIUM LATUM.

Life cycle

Definitive Host → Main, Dog or Cat → adult → eggs (operculated)

Coracidium (ciliated) in water ← eggs (operculated)

↓

1st Intermediate Host → cyclops (procercoid)

↓

2nd " → Fish (pleurocercoid larva or Sparginum)

infective form

Pathogenicity:-

Asymptomatic Infn - (M/C)

Abdominal Pain

Pernicious Anaemia (absorption of B_{12}).

LARGEST CYSTODE

Δ- Eggs 45-700 (upto 100 μm)

Brown :- Operculum at one end.

Knob at another

Eggs of Diphyllobothrium, Fasciola, Fasciolopsis

>100 μm, operculated, indistinguishable.

SPARGANUM

Definitive host - Dog, Cat

↓ adults

↓

eggs

↓

Coracidium in water

↓

1st intermediate host - cyclops (procercoid Larva)
→ infective form ← (M/C)

2nd intermediate host → fish, reptile, amphibians [plerocercoid larva]
infective form

Man - plerocercoid Larva (paratenic form).

TAENIA

INTESTINAL TAENIASIS

Infective form - cysticerci (single scolex)

T. Solium	T. Saginata
(Pork)	(Beef)
2.5 m	10 m.
Asymptomatic Malabsorption	

Δ- scolex → hooks [13 No. in rostellum] ⇒ T. Solium

Proglottids
Eggs
Bile stained
Striations

NEUROCYSTICERCOSIS

Infective form - Eggs (contaminated vegetables) of T. Solium
↓
Onchosphere — m/s - (M/C)
↓
Cysticercosis — Brain - epilepsy.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Δ. of NCC

Absolute Criteria

↓

Cysticerci in tissue.

" by fundoscopy

" by Radiology (MC)

If cysticerci not seen, then **other criteria** :-

a> other radiological signs

b> Ab detection by ELISA

c> Clinical evidence

d> Epidemiological Indicators

COENURUS (T. multiceps or T. serialis)

- Multiple scolices
- Coenuri of T. multiceps → found in eye & Brain
- " " T. serialis → " " subcutaneous tissue.

ECHINOCOCCUS (HYDATID CYST)

Ectocyst (Outer cuticular Layer)

acellular

Laminated hyaline membrane

appears as white of hard boiled egg

Endocyst (Inner germinal Layer)

cellular

Vital layer of cyst

~~Gives rise~~ to brood capsule & scolices.

Secretes the specific hydatid fluid - forms outer layer

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

E. GRANULOSUS → Hydatid cyst

E. MULTILOCULARIS - Alveolar cyst
(cyst Metastasis)

E. VOGELI - Polycystic Ds

Dog Tapeworm [Definitive Host]

Δ - 1) Casoni Test (anaphylaxis)
2) Ab detection by ELISA
3) CT scan IOC

Screening for Echinococcus
for E. multilocularis

DIPYLIDIUM

Infective form :- fleas harboring cysticercoids [Dog, Cat, Man]
↓
Solid cyst ± scolex

M/c in children
Asymptomatic M/c

HYMENOLEPIS

Infective form - Egg → cysticercoid → Adults.

One HOST (No intermediate Host) Q

Δ - Eggs - 30-40μm
Non-Bile Stained
6 spicules ± Knobs = HEXACANTH } similar to egg of Taenia

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

TREMATODS

Q. The infective stage of trematode causing swimmer itch is
Cercaria

Eggs as infective Form 200
Hymenolepis
Echinococcus
T. multiceps
serialis
T. solium (NCC

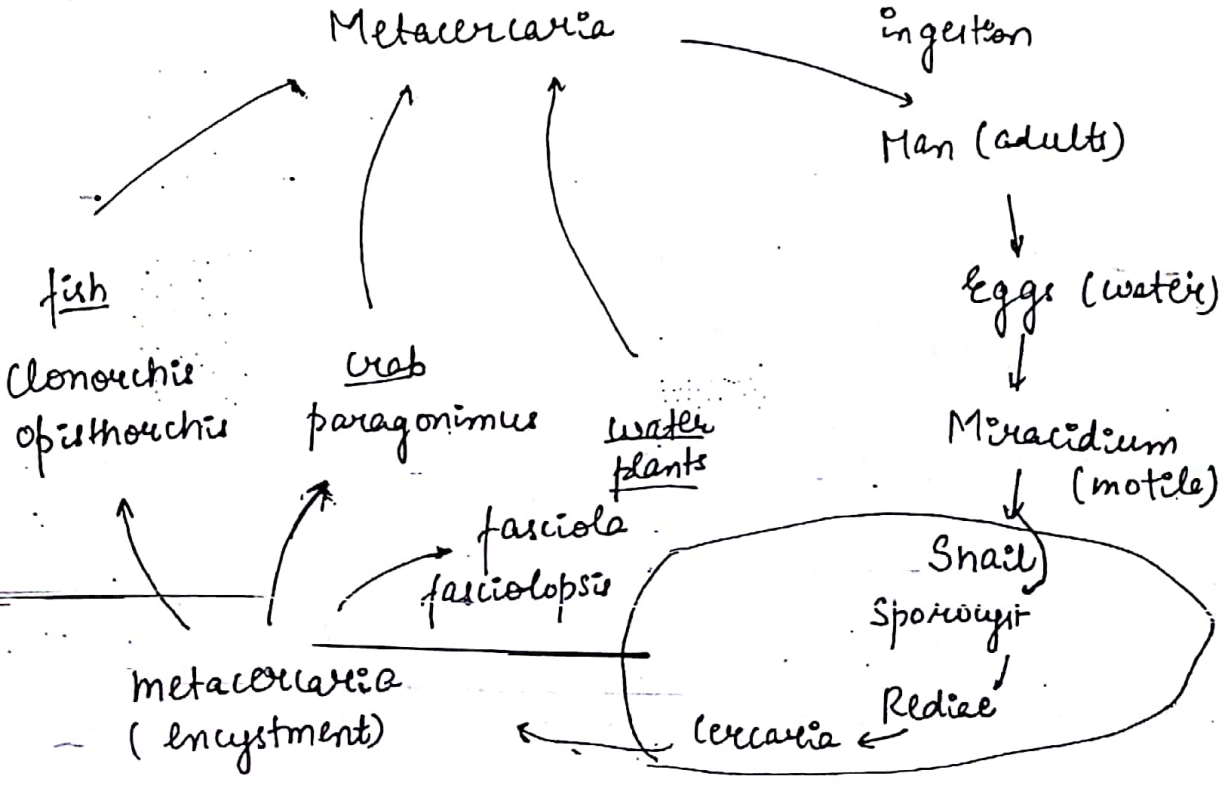
SCHISTOSOMA

Separate Sexes
Male - gynaecophoric canal
~~Oper~~ Non-operculated
No Rediae
Inf. form → Cercaria
↓
penetrates skin

OTHERS

Hermaphrodite
Operculated
Rediae
Metacercaria
↓
ingestion

Life cycle



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

All Trematode are oviparous

Hepatomegaly → egg granuloma

Katayama syndrome → oviposition, a serum sickness like illness.

Fibrosis (Symmer's)
due to Th1 response

Swimmer's itch [cercarial dermatitis]
in S. mansoni, S. Japonicum.

S. Haematobium

Egg - 100-150 μm, non-operculated

S. Haematobium - terminal spine

Ca Bladder.

S. Mansoni - Lateral spine

S. Japonium - spine inconspicuous

CLONORCHIS OPISTHORCIS

Only egg of Trematode operculated & shoulders.

<100μm = 15-30μm

Cholangiocarcinoma

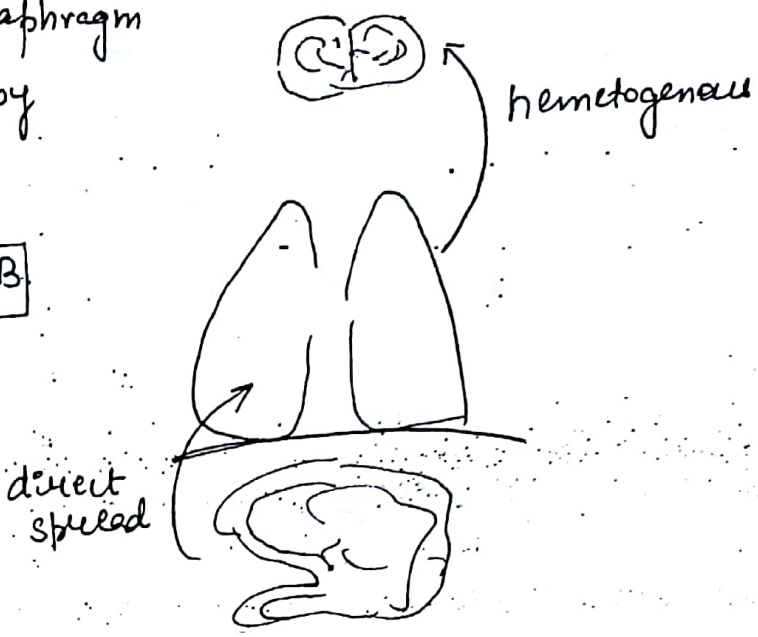
PARAGONIMUS

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

PARAGONIMUS

It directly pierces Diaphragm
But spread to brain by
haematogenous spread

Paragonimus Mimics P.TB



Δ- Golden Brown eggs in the sputum.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

NEMATODES

INTESTINALIS

- Oviparous
  - Enterobius, Trichuris — No pulmonary cycle — Caecum appendix
  - Ascaris, Ancylostoma, Strongyloides — Pulmonary cycle — Small intestine
- Strongyloides → ovoviviparous [egg → Larvae]

Larvae In Stool ⇒ Strongyloides

ENTEROBIUS — (Pin worm)

Inf. form Egg → ingested → Man (adult) → egg

Adults – Pointed / sharp ends → **Pruritus.** M/c symptom

Δ scotch tape (NIH swab) → Perianal region.

Egg :- 70 µm
Non Bile stained
Plano-convex

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

TRICHURIS (Whip Worm)

Asymptomatic Infec^n
Anaemia
Rectal Prolapse.

Δ - Eggs in stool
70-80 μm
Bile stained
Barrel shaped
Bipolar plugs.

ASCARIS

Infective Form - Egg ± Rhabditiform larvae
↓
Larvae
(penetrate into circulation)
↓
Heart
↓
Lungs
↙
Epiglottis
(swallowed)
↖
Small Intestine
(adults)

Adults - Fecundity ↑ (No. of eggs laid/worm/day)
(2.4 lakhs)

Cause intestinal Obstruction.
Larvae → Loeffler's syndrome

Δ - adults (male are shorter & have curved end)
Egg — 50-60 μm
Bile stained
Rugosity

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Non-Human Ascaris worms

Toxocara canis M/C

" Catis

⇓

Visceral Larva migrans

ANKYLOSTOMA

Infective form - Filariform Larvae

↓

penetration of skin

Adults - 0.2mL of blood/worm/day

Anaemia

Larva - Loeffler's syndrome

Δ Eggs - 50-60μm

Non Bile stained

4 blastomeres

Non-Human Ankylostoma

A. Braziliensi → Cut. Larva Migrans

M/C "creeping eruptions"

STRONGYLOIDES

Inf. form - filariform Larvae

↓

penetration of skin

Parthenogenic female - lay eggs ↓ out males fertilised

~~Indirect development~~ in soil → ♂ : ♀

Dermatitis LARVA CURRENS - Larva migrate @ 10cm/hour.

Δ ① Bermann Funnel technique

② culture by Harada-Mori Filter paper technique / agar plates.

Filariform Larvae → sharp (B) side

Rhabditeform Larvae - Blunt 1 end

TISSUE NEMATODES

Filarial worms — Trichinella spiralis

FILARIAL WORMS

Inf. form → 3rd stage Larva
↓ mosquito
Tissue

Signs + symptoms → due to adult except ONCHOCERCA.

Δ - Microfilariae in blood.
except onchocerca

BRUGIA MALAYI

Fragmented Nuclei in tail end of microfilariae

Nuclei - Blue
Cytoplasm - Pink

W. BANCROFTI

Nuclear material do not extend to the tip

LOA - LOA

Nuclear material extends upto loa loa

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

MANZONELLA

Unsheathed.
Nuclear material upto tip

ONCHOCERCA

Similium (deer fly)
↓
Inf. form Larva
↓
adults in tissue nodules Q
over bony prominences.

also called → RIVER BLINDNESS

Δ. adults in tissue
culture of larva from skin snips

ANGIOSTRONGYLUS CANTONENSIS (rat lungworm)
Eosinophilic meningitis
Infective form - Ingestion of 3rd stage in molluscs.
Visceral larva migrans in Brain - M/c cause is this

Angiostrongylus Costaricensis
Abdominal angiostrongyliasis M/c.
symptoms mimics appendicitis.

ANISAKIASIS

Anisaki simplex & Pseudoterranova decipiens
3rd stage Larva in fish.

Surgical Resection.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Gnathostoma spinigerum

3rd stage Larva in fish or poultry

Eosinophilic meningoencephalitis

Migratory cutaneous swellings of the eye, visceral organs.

Surgical Resection.

TRICHOSTRONGYLUS

Infection - Ingestion of Larva (vegetable)

Ingest far less blood than hookworms

Asymptomatic. (M/C)

Heavy infections — anaemia + eosinophilia.

Stool Exam

Eggs resemble hookworm eggs but are larger. (85 by 115 μm)

TRICHENELLA SPIRALIS

Infected form - Encysted Larva in pork or polar bear

↓

adults in intestinal mucosa

↓

migration + encysted larvae cause signs + symptoms

Δ - Eosinophilia

↑ CPK

Ab detection

M/s Biopsy (at the tendon insertion)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Lemon Sign (Nurse cells)

Bachman Intradermal Test

M/s involved → EOM, Bicep, Jaw, Diaphragm.

Larval Load - < 10 larva/gm of tissue → asymptomatic

> 50 " → fatal.

Egg Load → Chandler's Index

7300 → Major Public Health problem seen in Hookworm

AUTOINFECTION

C - Cryptosporidium, Capillaria philippinensis

H - H Nana

E - Enterobius

S - Strongyloide

T - Tenia Solium

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

MYCOLOGY

Cell Wall - Chitin
Mannan
Glucans

Cell Membrane - Ergosterol

β-glucan assay - all fungi except Cryptococcus.

SDA

Isolates → Lactophenol cotton Blue.

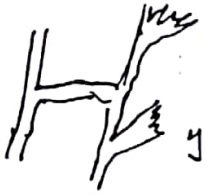
Calcofluor white → flourescent

Classification (Sexual reproduction)

Zygomycete

Ascomycete

Basidiospore



Deuteromycete NO sexual spore

'Fungi Imperfecti'

Morphology

Yeast - Cryptococcus

Yeast like - Candida

Dimorphic - < 37°C Yeast Endemic
25°C Mould

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Pyl ∈ Sporothrix schenckii - Himachal [Rose Gardener's D]

Penicillium marneffi - Manipur.

Histoplasma → Eastern
Blastomycosis
Coccoidiomycosis → Western
} North America

Paracoccidiomycosis → South American

Moulds.

Rest

OPPORTUNISTIC FUNGAL INFECTIONS

M/c - Candida

CANDIDA

Endogeneous —

↓

CMI ↓ → mucocutaneous

Neutrophil ↓ → invasion

↓

True & Pseudohyphae

True Hyphae → apical elongation when candida is grown in serum for 2 hours [Raynaud Braun phenomenon]

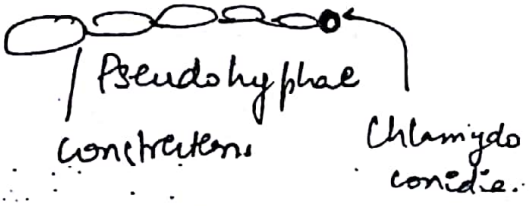
Pseudohyphae → failure of daughter bud to separate

↓

Seen in Corn meal Agar

[Nutritionally Deficient media]

Germ Tube → HYPHAE



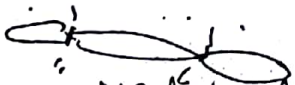
Candida Albicans	Non albicans
Germ Tube +	
~~Chlamydoconidia~~ + Chlamydoconidia	8-%

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

C. Dubliniensis – non-albicans ≅ can produce germ tube + chlamydio conidia

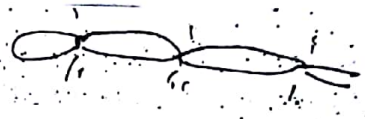
NON-ALBICANS

C. Tropicals



Nodal blastoconidia
spores from bud

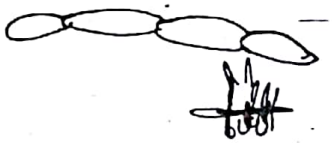
C. parapsilosis



(B) Nodal + internodal

C. Glabrata (mucoid) — No pseudohyphae

C. Krusei



Cross matchstick

CRYPTOCOCCUS

It causes infⁿ in HIV pt.

Virulence factors :-

1. Sialic acid
2. melanin
3. Urease
4. superoxide dismutase
5. Mannitol fermentation
6. capsule
7. Mating Types

1° Infection ⇒ LUNGS ⟶ then Brain.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Δ - culture in Niger Seed Agar → Brown mucoid colonies
India Ink.
Ag Detection by Latex Agglutination.

IgA · IgG₂ ⇒ protective against capsule

ZYGOMYCETES

Obtuse ∠

Nodal - Rhizoide

Mucor - No rhizoide

Angio invasive → Rhinocerebral mucormycosis
↑ mortality R/F - Diabetic ketoacidosis
Desferroxamine Rx

Δ - Profuse Growth → Lid thrower.
ASEPTATE IRREGULAR BROAD, ribbon like hyphae
Branching at OBTUSE ANGLE.

ASPERGILLUS

Fumigatus → Invasive (↓ neutrophil)
Flavus → keratitis
Niger → Otomycosis

ACUTE ANGLE DICHOTOMOUS BRANCHING
'V' forms

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

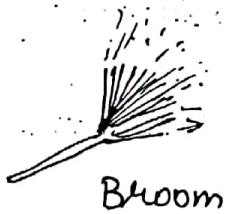
PENICILLIUM MARNEFFI

Umbilicated Lesion. → like molluscum contagiosum

Seen in HIV pt.

4 - Septate yeast → Binary Fission

Red Pigments



Broom stick

PNEUMOCYSTIS JIROVECII

Cause Interstitial Pneumonia (Non productive cough)

AIDS - induced sputum

HIV - BAL

4 - can't be cultured

Gomori methamine silver → cyst wall

Toluidine Blue →

Giemsa → sporozoites (8 in No.)

Best IFA → Best Technique

Fungal Infection In Immunocompetent

Dermatophytes (MIC)

↓

Keratinophilic

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

	Macroconidia	Microconidia
Trichophyton (skin, hair, nail)	pencil shaped few	plenty
Microsporum (skin, hair)	spindle (boat) plenty	few
Epidermophyton (skin, nail)	clavate (club)	No

Mentagrophytes → Hair Perforation ⊕
(Trichophyton) Urease ⊖

T. VERSICOLOR

— Malassezia globosa (M/C), furfur —
↓
Lipophilic

Δ culture - SDA ± olive oil
Spagetti × Meat ball

TPN Rx → Invasive.
(↓ lipids)

SPOROTHRIX SCHENCKII

Thorn prick 'Rose Gardeners Ds'
Lymphatic spread → series of ulcer

Δ - Cigar shaped yeast
Rosette like conidia in SDA
'Splendore Hoeplii phenomenon'

→ Cutaneous (asteroid) zygomycete
→ Blastomyces

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

CHROMOBLASTOMYCOSIS

Coloured fungi (Pigmented)

Δ - **sclerotic Body** → Brown septate Yeast appearing like "copper coin".

'BOOMERANG CONIDIA' CURVULARIA

Dematiceous

1) Curvularia.
2) Alternaria
3) Bepolaris
4) Cladophialophora
5) Exophilia
6) Fonsecala
7) Madurella
8) Scedosporium
9) Scytalidium
10) Wangiella etc.

C/F - Verrucose cauliflower like lesion.

MYCETOMA

C/F
- Swelling
- Sinus
- Granuloma

RHINOSPORIDIUM SEEBERI

- PROTOZOA.
- Polyps R/F → Pond Bathing
- Δ - 10% KOH → **spherules** & **endoscope**

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

SYSTEMIC FUNGI

Injective form ⇒ Arthroconidia → spores in Hyphae 217

↓

Pulmonary Lesions
TB like

Δ - Blastomycosis → Broad Based budding

Paracoccidiodomyces → multiple budding yeast
Mariner/Pilot wheel

Coccoidiodomyces. → Barrel shaped arthroconidia
Valley Fever
Desert Rheumatism
Spherules (tissue)

Histoplasma Capsulatum
found in Bats. → Tubercular projections on 'spores'.

VIROLOGY

DNA

Pox
Papova
Parvo
Herpes
Hepadna (HBV)
Adeno
Bacteriophage

RNA

+ sense
↓
gene encodes in RNA

Requires viral polymerase
↓
- sense genome
↓
mRNA sequence
↓
mRNA (complementary)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Non-Enveloped virus ⟹ released by Lysis

DNA	RNA
Parvo	Astro
Adeno	Picorna
Papova	Reo
	Calci
	HAV
	HEV

SP Cancel. Ho RAE

Enveloped virus released by budding.

Segmented RNA viruses

Genetic re-assortment occurs.
They can show genetic shift

B - Bunya virus (3 segment)
I - Influenza virus (8 segment)
R - Rota virus (11 segment)
A - Arena virus (2 segment)

DNA VIRUSES

PARVO B_{19}

Smallest 20nm
affinity to immature RBC
Immuno competent child.

Ab excess
↓
Immune complex
↓
Vascular Damage
(Slapped cheek) ⟵ Erythema Infectiosum (5th DS)

Immuno competent Adult → Ab excess → polyarthropathy

Sickle cell → Ab response → Aplastic (Transient) crisis

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Immunocompromised - No Ab response → Pure Red cell Aplasia (PRCA)

♀ → fetal liver, spleen, kidney ⇒ Hydrops Fetalis.

Δ - Ab detection
PCR
Quantitative PCR (Real Time PCR) (Best)
↓
Taq man assay.

PAPOVA

POLIOMA = JC virus → Progressive Multifocal leuco-encephalopathy (PML)

BK virus → Kidney Infec"

PAPILLOMA:
↓ warts
Ca Cx → E protein → virulence
↓
Suppress the tumour
Suppressor genes

L protein → serotyping

6, 11 , 16, 18, 31, 45, 47, 52, 58
Low Risk — 50% — 80% infec" — High Risk

VACCINE → Cervarix (16, 18)
Gardasil (6, 11, 16, 18)
Ped Gardasil 9

Δ of Ca Cx = Koilocyte → cells = pyknotic nucleus = perinuclear halo

POX

Molluscum Contagiosum
↓
Pearly white umbilicated nodular Lesions
self limiting
direct contact

1 - Molluscum Body (I.B.)

Bollinger Body → fowl pox } Inclusion Body
Guarnieri Body → vaccinia }

DNA virus ⟶ Intranuclear except Pox
RNA ,, ⟶ Intracytoplasmic except influenza, HIV

HERPES

HHV 1, HHV 2, HHV 3 } α virus. ↓ epithelial cell

HHV 5, HHV 6, HHV 7 } β virus ↓ Glands

HHV 4, HHV 8 } γ virus (oncogenic) ↓ Lymphocytes

HHV1	HHV2
Stomatitis	Genital infx
Keratitis	
Encephalitis	Aseptic meningitis.
[Temporal → frontal]	
Less	More virulent

Ant. HSV → non protective (due to trivial exposure)

1° Infection → Latency ⟶ Reactivation.
↓
EPISOME (integration of viral DNA in host chromosome)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

A- ~~diagnosis~~ ① Tzanck Smear → Giemsa

↓

Multinucleate Giant cell

Eosinophilic IB (~~nuclear~~ intranuclear)

↓

Cowdry A

② Ab detection.

③ PCR. → IOC

HHV 3 – V-Z virus

Chickenpox → Lesions in crops

Lifelong Immunity in case of Chickenpox

Shingles → Reactivation from Dorsal n/v root ganglion.

of Trigeminal & Sacral n/v.

⇓

affect T_3 to L_2 U/L

Trigeminal, Facial

(Ophthalmic Div.)

Ramsay Hunt Syndrome.

Ant 2/3rd of Tongue

middle ear lesions

Bell's.

Congenital V-Z Syndrome

Scarring of lesion (skin)

Hypoplasia of limbs.

Chorioretinitis.

A - Tzanck.

~~Ab detection~~

PCR

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Vaccine = oka strain.

Passive - Vz Ig.

HHV-4 → EBV

Reservoir → memory B cells

① Infectious Mononucleosis → False ⊕ serological Test
(Kissing Disease)

↓

Paul Bunnel Test (Heterophile agglutination test)

↓

Sheep RBC

Differential Ab absorption Test

	Guinea Pig Kidney	OX RBC
Normal Serum Ab	adsorbed	⊖
Forssmann Ab (after serum Rx)	adsorbed	adsorbed
IM	⊖	adsorbed

② Oral Hairy Leukoplakia
white plaque under Tongue (self limiting)
children, HIV pt ↓
bleeds

③ Malignant - Nasopharyngeal Ca
Burkitt's Lymphoma
Hodgkin's
NK/T cell
B cell lymphoma

Lymphoproliferative Ds
Adenoma

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

HHV-5 CMV

enlargement of cell
Ubiquitous
Secreted in all body secretions
↓
Retinitis in HIV ⊕ < 50 CD_4
Inclusion Body Ds - children.
Transplantation

Δ ① Owl Eye I.B.
② Ag Detec"
③ PCR

HHV-6 - 6th Ds - ROSEOLA INFANTUM
or
Exanthum Subitum

HH7 → ↓ CD_4 in HIV
HH8 → Kaposi's Sarcoma

ADENO VIRUS

Apical Fibrils
"space objects"

Serotype
8, 19, 37 → Epidemic Keratoconjunctivitis
11, 21 → Acute haemorrhagic cystitis
40, 41 → Infantile Gastroenteritis
1, 2, 3, 5 → Resp. Infections.

Vaccine : Live Non-attenuated Vaccine
↳ Administered through Oral route

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Δ - ① Ab detection

② Culture in cell lines (human origin)

② HELA / HEP

CaCx — Ca Larynx

Basophilic I.B. [Cowdry B]
(intranuclear)

RNA VIRUSES

Infantile Gastroenteritis.

Rota virus M/c → ds RNA

vomiting followed by diarrhoea

— family - Reo

11 Segments.

Vaccine — VP6 * VP7.

↓

Intussusception.

Δ - VP6 Ag detection by ELISA in stool

CALCI — Noro (Norwalk) → M/c in adults · children
Sapo

ASTRO

Toga

Adeno Type 40, 41 — DNA Virus. (only)

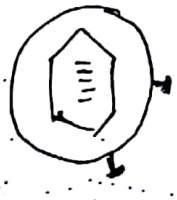
Δ - can't be cultured in
EM.

ORTHOMYXO

Influenza

Type A } 8 segments HUMAN
B }
C → 7 segments

Based on nucleocapsid protein.



H haemaglutenin 18 } Envelope Glycoprotein.
N neuraminidase 9 }

Δ - RT PCR.
Sample - nasopharyngeal swab.

AVIAN INFUENZA

Reservoir. H_5 ~~N_1~~

↑ virulent
IVD person to person Transmission.

Migratory Birds (Reservoir)

H_5N_1

poultry → water

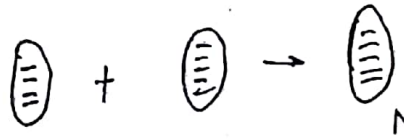
↓ death [Culling]

PIG (swine)

↓ Receptor for all influenza virus

amplifier

Genetic Reassortment



New virus

→ Pandemics

↓ Antigenic shift (change in H.)

Mutation → epidemics → antigenic drift

H_1N_1 → 1918 Spanish flu
H_2N_2 → 1957 Asian
H_3N_2 → ~~1968~~ 1968 Hong Kong

H_1N_1 - 2009 Swine flu

Pig → Reservoir.

Von Magnus phenomenon (haemagglutenin)
↑ titre
↓ infectivity

Δ - RT PCR.

PARAMYXO

RSV → Bronchiolitis

Mumps → Parotitis - aseptic meningitis M/C
orchitis
Vaccine - Jeryl lynn Strain.

Measles → Fever c Rash (IP - 14 days)
↓
Behind ears (1st)
KOPLIK'S SPOT → Opp. 2nd Molar (lower)

M/c complication - otitis media
Mc CNS " - Post measles encephalitis (autoimmune)
c in 1 year.

SSPE - Rare complication
5-25 years.
due to defective virus. (spongiform encephalitis)
Prion proteins

Δ - Ab detection (after 7 days of onset of rash)
PCR (nasopharyngeal swab)
c in 5 days.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Vaccine- Edmonstan Zagreb.

RUBELLA

German Measle

Vaccine → RA 27/3

Adults → Exanthematous Rash / Keratitis.

Congenital rubella syndrome

Cataract
Deafness
heart Defects

Δ - Ab detecⁿ.

♀ 1st Trimester - is exposed to her friend suspected of Rubella - What next?

susceptebility ♂ ♀ → diagnose

If friend have IgM +ve, then check for IgG in ♀
IgG +ve → no worry
IgG -ve → come for next month
IgM +ve → abortion.

a)	IgG	-
b)	IgG, IgM	IgM
c)	IgG	IgM.
d)	-	-

ARBOVIRUS

arthropod virus → mosquito + Ticks.

Flavi Virus

Bunya "

Toga "

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Ticks

- Powassan
- Russian spring Summer
- Kyasanur forest dc
- CCHF (crimen congo HF) haemorrhagic fever

DENGUE

5 serotypes

DF ⟶ DHF/DSS

Ab enhancement
Immune complex

* Factors affecting Haemorrhage :-

1) Repeat infection c different serotype
2) Sequence of infection. Type 1 followed by Type 2
3) Serotype 2
4) white
5) < 12 yrs.
6) Female

⟶ Malnutrition. → protective

Δ - IgM Capture ELISA
NS1 Ag (c in 5 days)

ZIKA

* Microcephaly in newborn.

JE → pig → amplifying host

Δ - Ab detection

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Vaccine - SA-14-14-2 (Live) - 1 dose.
↓
tissue culture

CCHF (Crimean Congo Haemorrhagic Fever)
- Case reported in Gujrat, Rajasthan.

Δ - Ab detection
✓PCR

Rhabdovirus

Bullet shaped
↓
3mm/hr or 230 mm/day [Rate of spread].

dog bite
captured
Y → observe for 10 days → No Hydrophobia → S/S → Y → Start PEP
N → short PEP

S/S → N → No PEP

Start PEP
↓
antemortem (pt) → skin from nape of neck.
↓
Immunofluorescence

Postmortem (behead dog) → Brain.
↓
Sellar stain
↓
Negri Body → + Hippocampus
Cerebellum

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

POLIO

AFP

Δ - stool culture (2 samples)

↓

Sequencing → Type 1 or 3 or VDPP

HEPATITIS

HAV (Picornavirus)

feco-oral route → acute infⁿ

↓

fulminancy in adults.

outbreak

Δ - only hepatitis virus cultured in cell line

IgM Anti-HAV

↓

one serotype & 4 genotype

HEV (Hepe virus)

feco-oral route → acute infⁿ

↓

fulminant in pregnancy

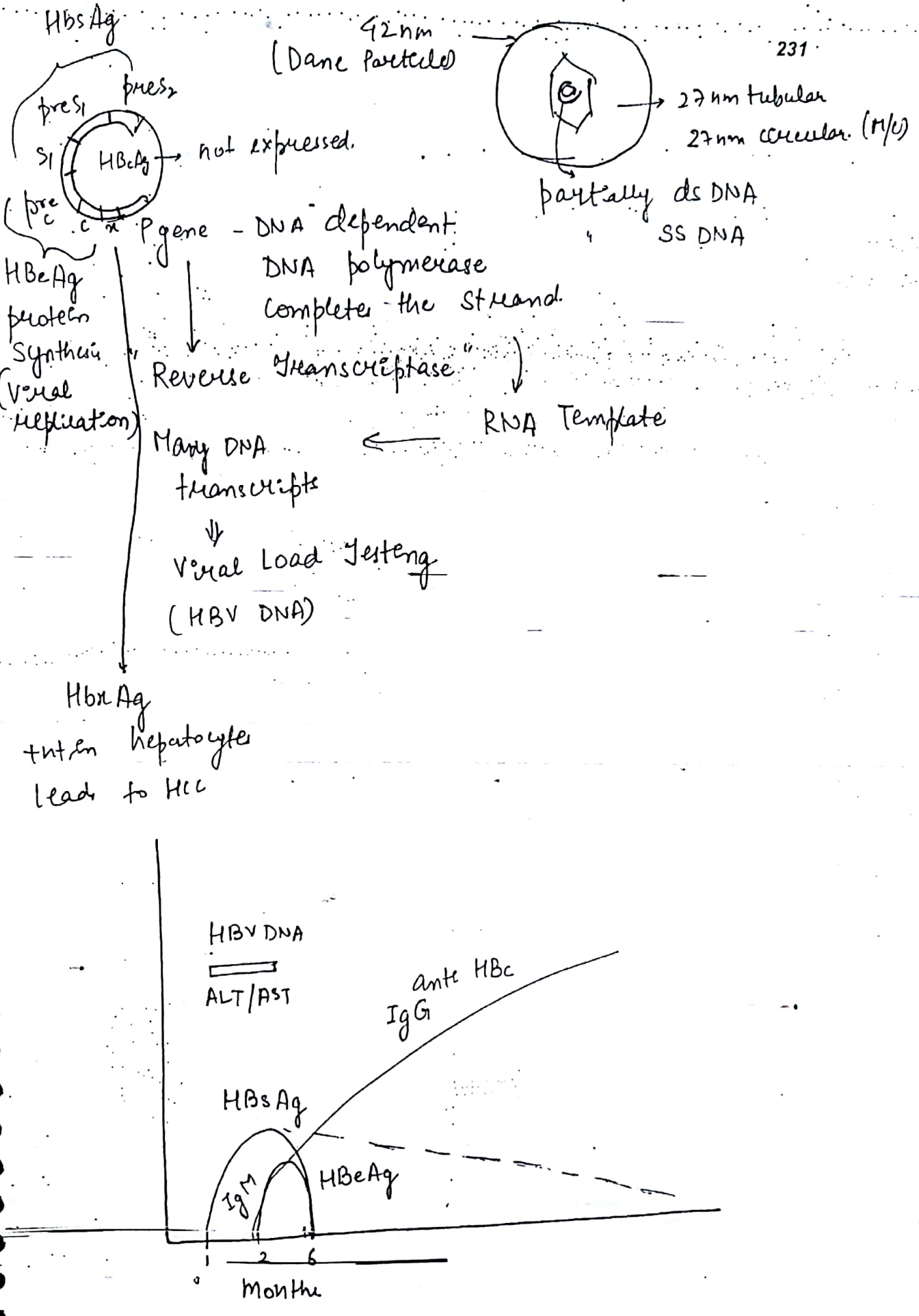
outbreak

Blood Transmission (rarely documented)

Δ - IgM anti HEV

HBV - (Hepadnavirus)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp


HBsAg
pres1
pres2
S1
HBcAg
not expressed.
pre C
C
X
HBeAg protein Synthesis (Viral replication)
42nm (Dane Particle)
27nm tubular
27nm circular. (M/C)
partially ds DNA
SS DNA
P gene - DNA dependent DNA polymerase complete the strand.
Reverse Transcriptase
RNA Template
Many DNA transcripts
Viral Load Testing (HBV DNA)
HBxAg
tutors hepatocyte
lead to HCC
HBV DNA
ALT/AST
anti HBc IgG
HBsAg
IgM
HBeAg
1
2
6
Months

Acute Hep B infec" in adult ⇒ usually resolves

Vertical Transmission → chronicity ↑

(M/c)

Best Marker of Acute Hep B ⇒ IgM Ante HBc

Chronic active → Infections : Require Rx

supercarrier ⇓

IgG ante HBc , HBV DNA

Chr. persistant → IgG ante HBc (+) HBV DNA (−)

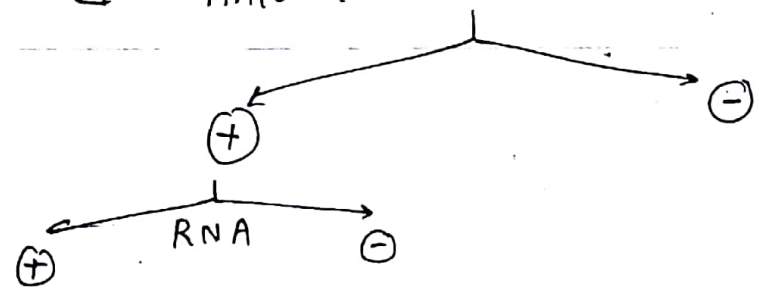
HCV flavivirus.

Chr. Infec ↑↑

acute → No signs/symptoms.

unsafe injec" → (M/c)

Δ – Ante HCV



Rx

Sofosbuvir + daclatasvir

3 months

genotyping not Req

Ribavirin + IFN → genotyping

India Type 3 > 1

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

HDV

Co infec" → IgM Anti HBc

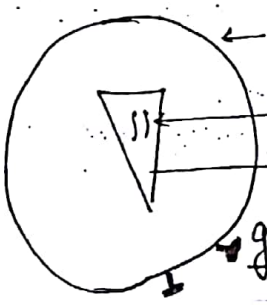
Super infec" → Ig G anti HBc.

fulminant

↑ incidence of fulminancy - 20%

H/c fulminancy → HBV

HIV



→ Receptor

Binds to CD_4.

↓

fusion protein.

Co-receptor on the host cell

(CCR 5)	CXCR 4
(R_5 virus)	(X_4 virus)
↓	↓
M trophic	T Trophic
↓	↓
Monocytes/ macrophages	Lymphocytes
⇓	
Resistance	

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

HIV 1 HIV 2

M N O West Africa

Major Intrinsic (R) to NNRTI

Human

Subtype - C → India

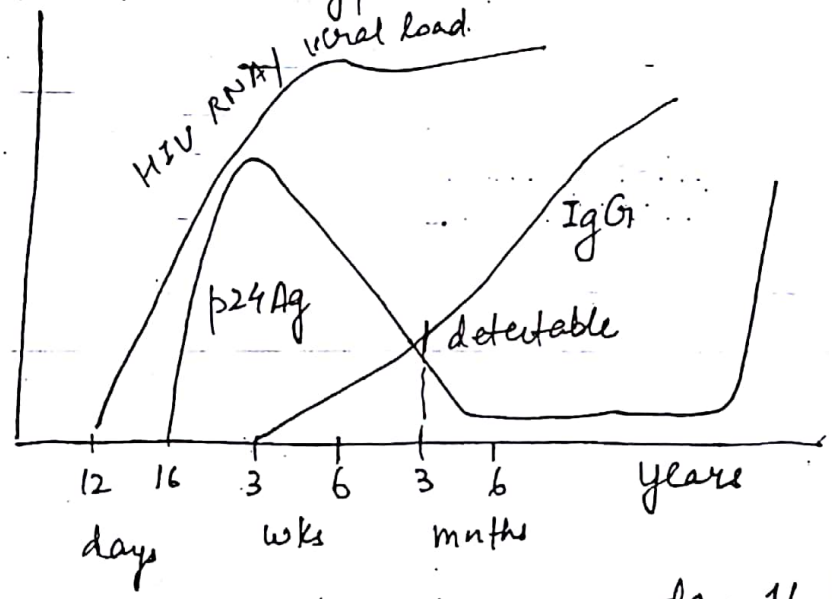
Env gene is concerned between HIV 1 & 2

gag & pol share 90% homology

Env Ag. used for diagnosis

gp 120 & gp 41 - HIV I

gp 36 - HIV 2



Recent H/o exposure p24 Ag → day 16 to 3 months

Δ of HIV → Ab detection

Most sensitive → 4th generation ELISA

detects both p24 Ag & HIV Ab.

↓ 3 tests

Confirmation → Western Blot

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Δ in children - DNA PCR Q.

"dried blood spot"

Disease Monitoring

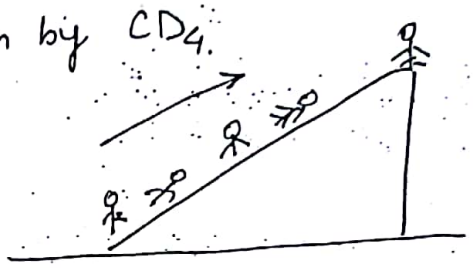
CD_4 → opportunistic Infⁿ, treatment

Viral Load → Prognosis

Present Immune Status given by CD_4

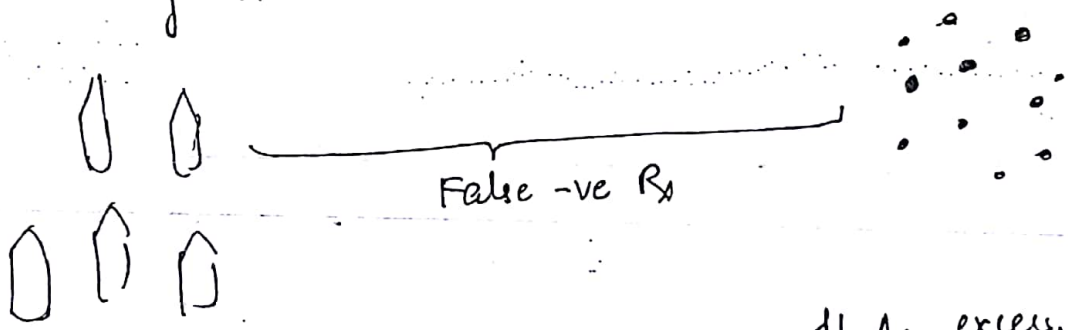
Rapid progressor (5 years)

Slow "



SEROLOGY

Ag - Ab Rxn.



If Ab excess ⇒ PROZONE

If Ag excess. POST ZONE

zone of equivalence

Serological Tests → dilution (2 fold serial) of serums

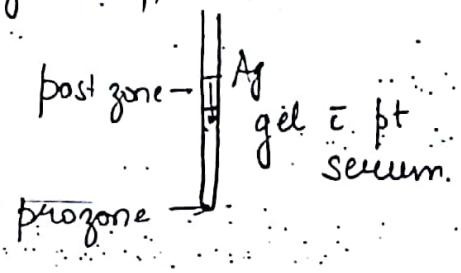
Titre → Highest Dilution at ± Rxn is seen.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

PPt^{n}

Soluble Ag binds to Ab to form soluble ppt

Single diffusion in one dimension Oudin procedure



Double diffusion in one dimension Oakley Fulthrop procedure

Single diffusion in two dimensions Radial Immunodiffusion

Double-diffusion in two dimensions Ouchterlony procedure
eg. Elek gel's electrophoresis

Quantitative → Rocket Electrophoresis

Agglutination

Particulate Ag binds to Ab to form visible clumps

↓

Passive Agglutination → Particles to detect Ab

Reverse " " → particle to detect Ag

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Complement Fixation

Detects Ab.

ELISA is used nowadays → as it detects Ag + Ab

large no. of samples ~~test~~ tested at 1 time

ELISA

Direct ELISA

detects Ag

specific

Indirect ELISA

detects Ab

sensitive

Competitive ELISA

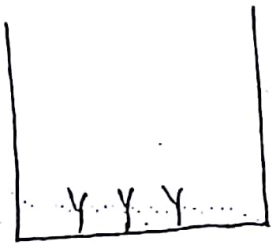
— detects Ab → highly specific

Capture ELISA

detects isotype of Ab →

using monoclonal Ab → isotypes are captured 1st

eg. Dengue IgM.



mAb for IgM.

add Dengue Ag + Ab + antigen

↓ now add substrate + enzyme

Colour change

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Immunofluorescence

FITC dye
fluorescein isothiocyanate.

Chemiluminescence (CLIA)
↳ Light emitting particles.
10 - 100 times more sensitive ELISA.

OBligate Intracellular Parasite

CRV CM PTL

Chlamydia
Rickettsia (Ehrlichia, anaplasma)
Virus
Coxiella Burnetii
Cryptosporidium parvum
Mycobacterium leprae
Plasmodium sp.
Pneumocystis jeroveci
Toxoplasma gondii
Trypanosoma cruzi
Leishmania Donovani

Facultative Intracellular Parasite

MBBS CRY for NHL

Mycobacterium
Bartonella henselae
Brucella
Salmonella Typhi
Cryptococcus neoformans
Rhodococcus equi
Yersinia
Francisella tularensis
Nocardia
N. meningitidis
Histoplasma capsulatum
Listeria monocytogenes
Legionella

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Pharmacology

Handwritten Note

MBBS Help

http://mbbshelp.com

http://www.youtube.com/mbbshelp

http://www.facebook.com/mbbshelp.com

Name: _____

Subject: **Pharmacology**

Blank Page

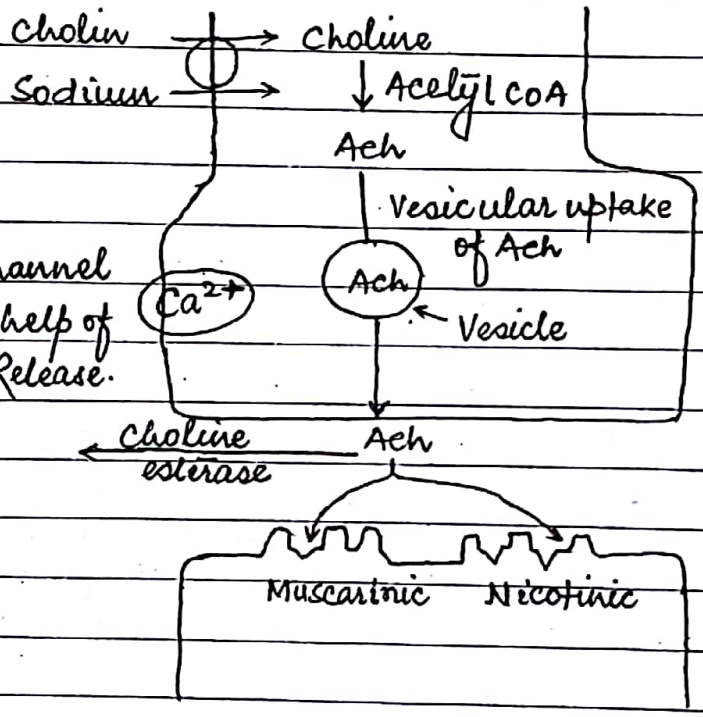
PHARMACOLOGY

- Sympathetic System Neurotransmitter – Nor-Epinephrine
  ↳ Thoraco lumbar outflow (T_1 to L_3)
- Parasympathetic System Neurotransmitter – Acetyl choline
  ↳ Cranio-sacral outflow (III, IV, IX, X, S_2, S_3, S_4)

Cholinergic drug:

Choline uptake – Na^+-choline Symport
↳ 1st step → Rate limiting step in synthesis of Ach.

Source of choline → Serine.



True cholinesterase → +nt at synapse.
Pseudocholinesterase → +nt in plasma.
Cholinergic drug —metabolised by→ Pseudocholinesterase.
Choline uptake inhibited by → Hemicholinium.
Vesicular uptake up of Ach blocked by → Vesamicol.
Release of Ach modulated by < Blocked by – Botulinum toxin
Stimulated by – Spider Venom.
Defect in Ca^{2+} Channel – Lambert Eaton Syndrome.

Lambert Ealon Syndrome:
Defect is Ca^{2+} channel Presynaptically.
For t/t we need Ca^{2+} channel activator → 3,4-diamino pyridine
(Dalf Ampridine)
↓
Also useful for t/t of
- Multiple Sclerosis
to improve walking capacity.
- It is K^+ channel blocker & Ca^{2+} channel activator.

Sites of Release of Ach Neurotransmitter:
at the ① Ganglion
- Preganglionic fibre of sympathetic & parasympathetic Release Ach at ganglion.
② Adrenal Medulla.
③ Neuromuscular junction.
④ Postganglionic Parasympathetic fibre.

Postganglionic sympathetic fibre normally releases
- Nor-epinephrine (NE)

Exception:
a) Sweat gland - Release Ach (Sympathetic cholinergic)
Hyperhydrosis (Excessive Sweating)
↓
t/t < Sympathectomy
Botulinum toxin injection.
b) Renal blood flow :- Release Dopamine by Sympathetic postganglionic fibre.

Extra point:

① Conversion of NA into Adrenaline by Methylation
- Eg. of Phase II reaction.

② Conversion of Histamine into methyl histamine by Methylation.

Mast cell secrete histamine.

- Mastocytosis (Histamine releasing Tumour)

↓

urinary estimation of Methyl histamine - Useful for diagnosis of Mastocytosis.

Urinary estimation of VMA (Vanilyl Mandelic Acid) - Useful for diagnosis of Pheochromocytoma.

Toxins in ANS:

BOTULINIUM TOXIN — A to G Subtype.

Clinical uses of Botulinum A toxin:

① Blepharospasm
② Strabismus
③ Wrinkle (in forhead corrected)
④ Cosmetics.

Clinical uses of Botulinum B toxin:

- Used as Muscle relaxant.
  ↳ Cervical dystonia (Painful muscle spasm)

ONABOTULINUM TOXIN

- Derivative of Botilinum A toxin.

Useful for — ① Prophylaxis of Chronic Migraine.
② Relaxation of Detrussor muscle - Given intra vesically.

↓

Causing Retention of urine
So useful for t/t of overactive bladder.

Page No.
Date : / /

Alpha Bungarolōxin:

- Component of Venom of Banded Krait

Nature of toxin — Antagonistic action at N_M receptor.

Saxitoxin, Tetradoxin — Both released by Dinoflagellates (Algae)

↓

This toxin infect a fish (shell fish)

↓

Ingested by human — cause Na^+ channel blockage, causing Muscle Paralysis.

So, called Paralytic shell fish poisoning.

T/t of α-Bungarolōxin:

Neostigmine & Atropine

↓

↑ Ach in synapse

Action

Muscarinic — Nicotinic

↑⊖

Atropine

- We need only nicotinic action, we don't need muscarinic action.

So, muscarinic blocker given.

Cholinoceptors.

Muscarinic	Nicotinic
- M_1, M_2, M_3, M_4, M_5	N_M, N_N
- All muscarinic are G-coupled protein receptor.	- All nicotinic are ligand gated.
- Acting via	

Adenyl cyclase pathway
- G_s → Stimulatory
- G_i → Inhibitory

Phospholipase pathway
2 imp. 2nd Messenger: IP_3, DAG.

Adenylcyclase Pathway:
2nd Messenger — CAMP.
M1, M3 & M5 follow Gq pathway
M2 & M4 follow Gi pathway.

Muscarinic Receptors:
M1 : Location – Stomach
Action – Releasing HCl
Overstimulation of M1 – Gastritis
Selective M1 agonist – Oxotremorine.
↳ GE – Gastritis
For Gastric ulcer – Block M1.
Selective M1 antagonist < PIRENZEPINE > For t/t of gastric ulcer.
TELENZEPINE

M2 : Located on Myocardium
↳ Maximally in AV node.
Action : Stimulation of M2 causes reduction in conduction velocity.
↓
Causing Bradycardia
as Vagus (X) fibre is Parasympathetic fibre
↳ act on M2 receptor → Causes Bradycardia.
Athletic person → High Vagal tone
Vagomimetic drug → Causing Bradycardia
Use of M2 agonist → SVT (Supraventricular Tachycardia).
Selective M2 agonist – METHACHOLINE < 98-99% – M2 (Action)
1-2% – M1, M3
Selective M2 antagonist – METHOCTRAMINE
TRIPITRAMINE
Methacholine challange test → Δ of Asthma.
↳ Cause bronchoconstriction.

Digoxin = Vagomimetic property
- Anti-arrythmic
  Atrial Fibrillation
  Atrial flutter.
- Inhibit $Na^+ - K^+$ ATPase test.
- Accumulate intracellular Ca^{2+} ($\uparrow Ca^{2+}$)
- ↑ Force of contraction
- Useful for t/t of low output CCF.

Muscarinic Receptors:

M_3 Receptor — Location:
- Smooth muscle — Blood vessel (endothelium)
- Eye
- Endocrine glands.

Smooth muscle

Vascular	Visceral
– Endothelium	– M_3 antagonist – (COPD / BA)
↓	• Ipratropium bromide
Vasodilation	• Thiotropium bromide.
Hypotension	We don't use Atropine bcoz
	– Selectivity.
	• Don't interfere muco ciliary muscle.
	– Intestine & Bladder
	• Pro-kinetic action

M_3 agonist: Uses
- Constipation
- Post op paralytic
- ileus, urinary retention.

Page No.
Date : / /

Selective M_3 agonist acting on Intestine & Bladder
→ BETHANECHOL

Selective M_3 agonist acting on GIT & Bladder
- DARIFENACIN
- SOLIFENACIN
- useful for t/t of diarrhoea & diarrhoeal dominant IBS.
Over acting bladder.

Selective M_3 agonist acting only on Bladder
- Vesico selective M_3 agonist.
  - Oxybutynin
  - Flavoxate
  - Tolterodine
  - Fesoterodine (Prodrug)
  - Trospium chloride.

Active form

Extra information on bladder:
β_3 Action - Relax detrusor - causing urinary Retention
↓
MIRABEGRON (β_3 agonist)
↳ Use - Overactive bladder.

Location of β_3 mostly in adipose tissue
- SIBUTRAMINE (β_3 agonist)
  - Adipolysis (wt. loss)
- It is withdrawn - Bcoz Cardiotoxic.

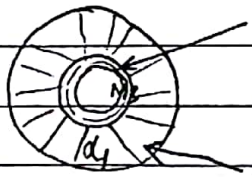
Nocturnal enuresis
- Imipramine (TCA)
  - Anticholinergic

DOC : Desmopressin
V_2 analogue - Vasopressin

Stress incontinance :
t/t → Duloxeline
- ↑ urethral tone
- also useful for t/t
  - Chronic neuropathy pain
  - Fibromyalgia.

- It is SNRI (Anti-depressants)
  ↓
  eg: Duloxeline
  Venlafaxine (S/E - Sustained HTN)
  Milnacipram
  Leva-milnacipram
  Vilazodone
  Vortioxetine] Newer drug.

M_3 on Eye :



Sphincter muscle
Constrictor
Stimulation of M_3
- Constriction of pupil
(Miosis)

Radial muscle
Dilator
Stimulation of d_1 :
- Mydriasis
  ↳ On Radial muscle.

M_3 agonist acting on eyes
- Pilocarpine
- Ecothiophate
  - Organophosphorus Compd
    Irreversible cholinesterase inhibitor

α_1 agonist acting on eyes:
- Phenylephrine
(Adrenergic agonist)

Adrenergic drugs – Only Mydriasis

Anticholinergic drugs – Mydriasis + Cycloplegia
(loss of light reflex)

β-blocker don't alter pupil size
Timolol – Use in t/t of Glaucoma.

Oculomotor Nerve supplies constrictor muscle.
(Circular muscle).

Causes Miosis.
Injury – Mydriasis
Even after CN III nerve injury if we use pilocarpine we will get miosis, as receptors are intact.

M_3 ~~receptor~~ agonist – Useful for glaucoma.
Pilocarpine – Useful for glaucoma by promoting drainage
Ecothiophate – S/E – Cataract.

Mydriatic anticholinergic:
Atropine (longest acting = 1wk)
Homatropine
Cyclopentolate
(M/C) Tropicamide (Fastest but shortest acting = 3-6hr)

↳ C/I – Glaucoma.

Only for fundus exam – Mydriasis enough
↓
Phenylephrine prefferred
(OR)
Tropicamide.

Error of Refraction:
• Mydriasis & Cycloplegia
DOC – Tropicamide

• In child < 5yr
• Atropine Ointment 1%

M_3 on exocrine glands:
M_3 location – Salivary gland
Lacrimal gland
Sweat gland.

M_3 agonist : Pilocarpine
Cevimeline

Sjogren syndrome – Pilocarpine used
Xerostomia

Amifostine – Radioprotective
↓
Antidote for Cisplatin
↳ S/E – Nephrotoxicity.

Radiosensitizer – Gemcitabine, Metronidazole.
Radiation Recall – Dactinomycin, Doxorubicin
Anticancer antibodies

Gemcitabine :

Pyramidine anti-metabolite

DOC - Pancreatic Cancer.

Atropine — C/I in hyperthermia

Nicotinic Receptors :

Nm & Nn

Nm :

N = Nicotinic , m = Skeletal muscle

① Activation of Nm causes opening of Na^+ & Ca^{2+} channel.
Entry of Ca^{2+} causes contraction of muscle.
(Muscle depolarisation)

Ach — ↑ muscle power
So, cholinergic drugs used for t/t for Myasthenia gravis.

Skeletal muscle Relaxation (SMR) :

d - Tubocurarine = Competitive antagonist.
↳ Non depolarising SMR.
For reversal — Neostigmine
c Atropine

Newer drug — Sugammadex
↓
Useful for Reversal of Rocuronium & Vecuronium.
• Similar to Neostigmine

Non-depolarizing SMR

Steroidal — Non-Steroidal (Benzyl isoquinoline)

Pancronium, Rocuronium, Rapacuronium, Vecuronium

Pancronium → Anticholinergic action (or) Anti Vagal.

Glycopyrolate : Anticholinergic agent
Useful for pre anaesthetic medication to control Secretion.
It is quaternary compd — lipid insoluble,
So, NO CNS side effect. So it is useful instead of Atropine.

Rocuronium :
- Fastest acting SMR
- Alternate to Succinyl choline (Sch) for Tracheal intubation
- Least histamine releasing property.
- Severe pain during injection

Rapacuronium :
- Cause Severe Bronchospasm.

Vecuronium :
- Preferred in cardiac pts.

Page No.
Date : / /

Benzyl isoquinoline

Doxacurium
- longest acting (120min)
- Most potent.

Mivacurium
- Shortest acting (15-21 min)
- Useful for day care Sx.

Gantacurium
(5-10 min)
↓
Newer drug.

Atracurium
- Undergoes Hoffman's degradation (Self metabolism)
↓
metabolism out liver & kidney.
They do not need enzyme for degradation
- Safe in Hepatic/ Renal failure
- Produce by product
↓
Laudanosine
(Causes - Seizure)

d-Tubocurarine
- Max^{m} Histamine Releasing
- Adverse effect
  - Bronchospasm
  - Hypotension.

Cis Atracurium — Less laudanosine
Less secreting histamine.

SMR having less histamine releasing property
- Cis. Atracurium
- Rocuronium.

Depolarising SMR:

Succinyl choline (Sch):

Structurally & functionally ~~—~~ similar to Ach.

S/E – Muscle fasciculation
Post op. muscle pain

- Shortest acting (3-5 min)
rapidly undergo metabolism by Pseudocholine esterase.

Some people have Atypical Pseudocholine esterase
↑ action < 5 min
Lead to Sch Apnoea
T/t – Fresh blood transfusion bcoz blood plasma is rich in pseudocholine esterase.

Dubucaine number:

Useful to access whether the pt. have atypical pseudocholinestrase or normal.

Caine – Local anesthetic agent.
80% – hydrolysis – Normal Pseudocholinesterase.
<20% – hydrolyses – Atypical "

Adverse drug effect of Sch:

- Hyperkalemia ((Burns), nerve injury, crush injury
- Malignant hyperthermia
- ↑ Intra ocular/gastric pressure

→ those who are having genetic abnormality in Ryanadine receptor.

Page No.
Date : / /

Primaquine – Causes hemolysis only in G6PD deficiency.

Pharmacogenomic / Idiosyncracy – Ryenodine Receptor
↓
Occurs disease in only genetic abn person.

T/t => Daulrolene
(Directly acting SMR)
↓
DOC for : Malignant hypothermia
Neuroleptic malignant Syndrome.

SMR – causes pain on injection – Rocuronicum.
GA causing pain " – Propofol
Post. op muscle pain – Sch
Analgesic used during Sx causing Post-op truncal rigidity – Fentanyl, Alfentanil
T/t – Wooden chest Syndrome.

Antibiotics causing SMR :
- Aminoglycosides (Max^{m}) – Neomycin
- Macrolides
- Quinolone
- Tetracyclines

Aminoglycosides – Inhibit Release of Ach
Similar to Botulism toxin.
T/t – Neostigmine + Calcium.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Page No.
Date : / /

N_N :

Location: Autonomic ganglia (Most)
Adrenal medulla
CNS

Autonomic ganglia –

Sympathetic:

Preganglionic (< Ach N_N) Post-ganglionic NE

Ganglia

Parasympathetic:

Preganglionic (< Ach N_N) Post-ganglionic Ach.

Ganglionic Blockers (N_N)
- Hexamethonium
- Trimethaphan
- Mecamylamine → (Smoking control)

useful to produce controlled hypotension.

Anti-smoking drugs:

First line drug (therapy)
- Varenicline ($\alpha_4\beta_2$ nicotinic agonist) – Suicidal thoughts
- Nicotine (patch, inhaler, lozenges, chewing gum)
- Bupropion – NDRI (Norepinephrine Dopamine Reuptake Inhibitor)
  Antidepressant
  Weight loss
  ADHD (off label)
  Adverse drug reaction – Seizure.

Second line therapy:
Clonidine (α_2 agonist)
Nortriptyline (TCA)

ADR = Adverse Drug Reaction

Page No.
Date: / /

Miscellaneous:

Rimonabant

Topiramate – Antiepileptic

ADR – Weight loss, Nephrolithiasis.

Mecamylamine

Rimonabant: Inverse agonist/ Antagonist of Cannabinoid 1 receptor.

- Weight loss
- Prevents craving of alcohol.

ADR – Psychiatry problems (withdraw)

ADHD (Attention deficit hyperactivity disorder):

Drug used – Amphetamine

↓

Causes – Cardiotoxic
Addiction
Appetite Suppressant.
(Failure of growth)

First line drugs:

- Methyl phenydate (First choice)
- Atomoxetine

↓

Ritalinic acid (Metabolite).

Other drugs:

~~Pl~~. Pemoline (Hepatotoxic)

Modafinil – Use: Narcolepsy
Shift worker
Obstructive sleep apnea.
ADHD. (FDA – Unapproved)

Newer drug under Narcolepsy:
H_3 inverse agonist
↓
Pitolisant (OR) Tiprolisant
Narcolepsy (Orphan drug status)

Drug useful for t/t of obesity:
- Sibutramine (β_3 agonist) – Cardiotoxic (Withdrawn)
- Orlistat (lipase inhibitor) – Steatorhoea
- Olestra (Sucrose polyester) – cooking medium.
- Rimonabant (Canabinoid 1 antagonist) – Withdrawn
- Leptin (Endogenous slimming peptide)

Combination therapy:
Bupropion + Naltrexone (opoid antagonist)

Bupropion + Zonisamide (Antiepileptic)

Phentaramine + Topiramate (Antiepileptic)
(Sympathetic stimulant
Causing
Apetite suppressant)

Newer drug: 5HT2c agonist – LORCASERIN
S/E – Serotonin Syndrome.

GLP-1 → LIRAGLUTIDE
FDA approved drug for obesity.

Extra point: Antiepileptic causing Wt. loss
- Topiramate
- Zonisamide
- Felbamate

Antiepileptic causing Wt. gain:
- Sodium Valporate
- Gabapentin

Felbamate < Hepatic failure (F/E)
Aplastic Anemia.

Type 2 DM c obesity — 1st line drug — Metformin
Non-diabetic c obesity — No Metformin.

Antidiabetic causing:
Weight gain :— Insulin, Insulin secretagogues.
- Sulfonyl ureas, meglitinides, Thiozolindindiones.

Weight loss — Pramlintide, GLP-1 agonist, SGLT-2 inhibitor

Weight neutral — Metformin, DPP4 inhibitors.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

OPC's = Organophosphorus compd.

Page No.
Date : / /

ANTI CHOLINESTERASE

Reversible

Carbamates
→ Physostigmine
(Natural origin)
Alkaloid (plant)
• Highly lipid soluble
DOC : Atropine poisoning
(Belladona)

→ Neostigmine
Pyridostigmine
Edrophonium
(Water soluble)
No CNS effect.

Neo – direct action on NM receptor
Pyri – long acting
Orally active
Edro – Anionic site binding
• Rapid dissociation
• Used for Δ of myasthenia gravis.
(Tensilon test
or, Ameliorative test)
– Provocative test
(done by injecting d-Tubocurarine)

Acridine
→ Tacrine
↓
Hepatotoxic
So, not used in Alzheimer's

Irreversible

OPC's
→ Dyflos
→ Echothiophate
→ Parathion
→ Malathion
→ Diazinon
(Insecticide)
→ Tabun
→ Sarin
→ Soman
(Nerve gas or, war gas.)

Malathion – Pediculosis (lice) infestations
Echothiophate – Use in Glaucoma
S/E Cataract

Ageing of enzyme
Tabun (Slow)
Sarin (3-5 hrs)
Soman (2min) – Fastest acting

t/t – Atropine + Pralidoxime
In convulsion – Diazepam

Carbamate
→ Carbaryl
→ Propoxur
(Baygon)

Rivastigmine, Donepezil, Galantamine } useful for t/t of Alzheimer's ds
↓
deficiency of Ach.

OPC's poisoning:

Parathion, Malathion, Diazinon
Cholinesterase inhibitors
(Irreversible)

1st line DOC : Atropine (Muscaranic Blocker)
↓
Dose is depends upon Sign & Symptoms of Atropinisation:
- HR > 100/min
- Pupil Size
- Pulmonary Secretion
- Secretion

Max^m upto — 200 mg.

Oximes:
- Cholin Esterase ~~inhi~~ reactivation.
- Only used for t/t OPC's poisoning
not carbamate poisoning.

eg: • Pralidoxime (1-2g, slow i.v., 15-30 min)
• Obidoxime (more potent)
• Diacetyl mono oxime (Highly lipid Soluble)
↳ More CNS action

S/E — HTN
↳ T/t — Phentolamine (Non-selective α Blocker)

Myasthenia Gravis (MG):

Ameliorative test
Provocative test

Definitive test → Anti Ach Receptor Radioimmuno Assay.

Confirmatory → Single fibre Electro Myography. (SF-EMG)

First line drug — Neostigmine
Pyridostigmine

Others — Corticosteroids
Thymectomy
Plasmapheresis
IvIg.
} To remove autoantibody.

Other immunosuppressant — Azathioprine
Cyclosporine.

Monoclonal antibody — Rituximab
↓
Target CD20.

Remission / Exacerbation:

Rapid Recovery — Plasmapheresis
IvIg.

Quinine
- C/I in MG
- It is SMR
- Used in Nocturnal leg Cramps.

- Avoid Aminoglycoside in MG.

MEMANTINE – NMDA Blocker
useful for moderate to severe Alzheimer's ds.

Drug useful in cervical ripening – VALATHAMATE
↓
Anticholinergic drug
Smooth muscle relaxant.

Diphenoxylate – Opioid
Anti diarrhoeal
Addiction
↳ Atropine ↓ addiction of Diphenoxylate

Glycopyrolate – Anticholinergic
Preanesthetic
Qualernary compd.

Scopolamine – Also K/A Hyoscine → CNS depressant (Sedation)
Used in motion sickness.
DOC : Hyosine → Narco Analysis

1st Gen. (H1 + M) : Promethazine
↓ In treating Allergic condn
↓ In Motion Sickness
↓ treating EPS (Extra pyramidal Symptom

For Sea Sickness – Same t/t.
↳ Meclizine – 1st gen. long acting Anti-histamine.

Page No.
Date : / /

For Mountain sickness : Acetazolamide
(Carbonic Anhydrase Inhibitor)

Morning sickness : Doxylamine c Vit B6
↓
antiemetic Vitamin

Vit B6 (In Pyridoxine) :
- Anti-emetic
- Controls intrauterine Seizure.

Stimulant of dopa decarboxylase
C/I - Levodopa

Vit B6 should not be given c Levodopa.

Vit B6 definitely given c Anti TB drug (Isoniazid)
↓
To correct peripheral neuropathy.

Antidote for Vit B6 - 4 deoxy pyridoxine

Folic acid -
Prophylactic - 400 µg daily in pregnancy.
Previous H/o Neural tube defect - 5 mg/day.

Page No.
Date : / /

Drug having Anticholinergic activity:

- TCA's
  - Amitriptyline
  - Imipramine — Nocturnal enuresis
    DOC: Desmopressin

- Anti Psycholics
  - Thioridazone
  - Clozapine

- SMR
  - Pancuronium
  - Gallamine

- Class Ia Anti arrythmic drugs.
  - Quinidine
  - Procainamide
  - Disopyramide (Highest anticholinergic property).

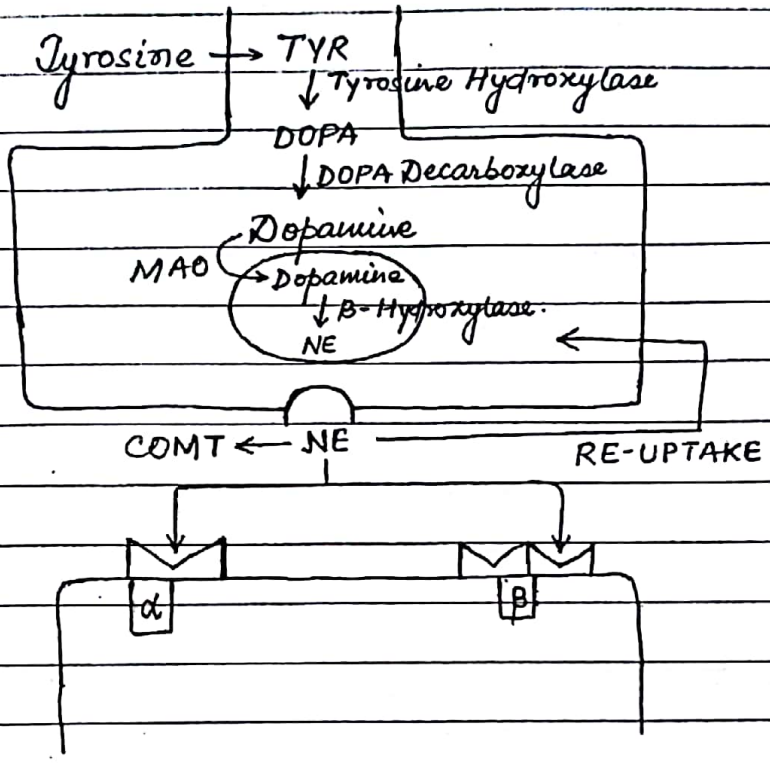
- 1st H_1 Blocker
  - Promethazine

- Amantidine

Meperidine (Pethidine)
↳ opoid analgesics
↳ C/I in MI pain
↓
Morphine is Used.

ADRENERGIC DRUGS

Synthesis, storage, Release, Metabolism of NE :



Synthesis of NE → Only in the vesicle.

Catecholamine — Dopamine
NE
Epinephrine

Monoamines — Dopamine
NE
Seratonin.

For metabolism of NE — MAO
COMT

- Even though NE undergoes metabolism by MAO & COMT, enzymatic degradation is not involved in termination.

- NE action is terminated by Re-uptake.

- Rate limiting enzyme of Synthesis of NE – Tyrosine Hydroxylase.

- Drug inhibiting Tyrosine hydroxylase – Alpha methyl para thyrosine (METYROSENE)

- Dopa decarboxylase inhibitor – Carbidopa Benseraside.

- Reserpine → Anti HTN agent
  → Vasicular uptake inhibitor.
  - S/E → Sucidal depression.

- β-hydroxylase blocker – Disulfiram (Used in alcoholism deaddiction)

Ethyl alcohol
↓ Alcohol dehydrogenase
Acetaldehyde
↓ Acetaldehyde dehydrogenase ⊖ Disulfiram.
Acetic Acid

New drug – DROXIDOPA
(Prodrug of NE)
- Used in Neurogenic Orthostatic hypotension
- Hemodialysis induced hypotension.

BRETYLIUM : Class III drug
K^+ - Channel blocker.
Also called Chemical defibrilator.

Release of NE is blocked by – Bretylium
Guanathidine.

NE Re-uptake inhibitor – SNRI, NDRI, TCA, Cocaine.

Cocaine → One & only local anesthetic causing HTN.
- Causes mydriasis by acting on α_1 on the radial muscle.

Adrenergic Receptor: < α / β
↓
(Henry Ahlquist)

α - Receptor: < α_1 → post-synaptically (location).
α_2 → pre-synaptically
→ Inhibition of release of NE.
→ auto receptor for NE

α_2 agonist:
eg: Clonidine, Methyldopa, Guanafacine > Centrally acting Anti HTN

Guanabenz
Moxonidine
Rilmonidine
Apraclonidine
Brimonidine
} Useful in Glaucoma.
MOA - decreases Aqueous Secretion

S/E - Drowziness → Not safe in children.

Tizanidine → Centrally acting SMR.

Dexmedetomidine. → Used as Sedation (ICU pts) & Pre-anesthetic medication.

Methyldopa : DOC for t/t of HTN during pregnancy.

Hypertensive Emergency :
Labetalol (β+α blocker)
Hydralazine (K⁺ channel Opener)
↳ Arteriolar dilator.

Eclampsia - $MgSO_4$.

Methyldopa may cause hemolytic anemia to mother
↓
Coomb's test +ve

Drug avoided in pregnancy : ACEi (Renal & pulm agenesis)
ARB's
Sodium nitroprusside (contain Cyanide)

Apraclonidine : Specific S/E - lid lag.
Brimonidine : S/E - Anterior uveitis.

α_2 antagonists: ↑ NE release.

Yohimbine – Used in Hypotension & Sexual stimulation

Idazoxan

α_1:

Location – Post synaptically.

① α_1 seen on vascular smooth muscle.

Action → Vasoconstriction

α_1 agonists:

Based on vascular action

Useful in t/t of Hypotension

Nasal congestion.

Selective α_1 agonists for t/t for Hypotension:

Methoxamine

Mephentermine

Midodrine.

Selective α_1 agonist for t/t for Nasal congestion:

Cause Atrophic Rhinitis (Rhinitis medicamentosa) – Naphazoline, Oxymetazoline, Xylometazoline.

α_1 Receptor – Radial muscle of iris → Mydriasis

↳ Phenylephrine

α_1 Receptor seen in internal urethral sphincter

↳ Causes sphincter constriction

↳ Retention of urine.

α_1 blocker used in BPH

Page No.
Date : / /

Vesico ureteric junction α_1 Receptor +nt.

α_1 blocker useful in t/t of – lower ureteric calculi

α_1 seen on Vas deferens of penis.
Action → Ejaculation.

S/E of α_1 Blocker – Impairment of Ejaculation.

Directly acting Sympathomimetic
α, β agonists
Adrenaline, NA.

Indirectly acting sympathomimetic:
Tyramine → Act on vesicle → Causes release of NE.
↓
Causes depletion of storage of NE
↓
Tachyphylaxis → Rapid tolerance

MAO inhibitors taking c Tyramine containing food (cheese, wine, bread) causes HTN, it is called Cheese reacn.
↓
DOC for t/t of HTN due to cheese reacn: Phentolamine
(non-selective α blocker)

Mixed action Sympathomimetic – EPHEDRINE
↓
causing hypotension
↓
Spinal anesthesia.
Safe in pregnancy.

Selective α_1 Blocker:

eg: Prazosin (PDE inhibition property).
Doxazosin > Apoptotic action on Prostate.
Terazosin

α_1A blocker → mainly acting on bladder.
- Silodosin
- Alfulosin
- Tamsulosin

Indoramine, Urapidil. > useful in Hypertensive Emergency.

PRAZOSIN:

- Vasodilation → on smooth muscle.

Use – HTN
PVD
CCF
Scorpion Bite.

S/E – Postural hypotension
(1st dose hypotension)
- Impairment of ejaculation.

Selection of Prazosin as Anti-HTN:

① HTN c dyslipidemia
② HTN c elderly male c BPH.
③ Can be used in diabetics c HTN.

HTN c dyslipidemia:

Choice – Prazosin
Anti HTN avoided – Non-selective β-blocker
Thiazide ~~use~~ diuretics

Page No.
Date : / /

No problem c → CCB, ACEi, ARB, clonidine.

HTN c diabetes :
Choice → ACEi = ARB > CCB
Unfavourable (avoid) → β-blocker
Diuretics.

Anti-HTN causing Erectile dysfunction —
Highest risk — Diuretics (Thiazides)
High risk — β-blocker (Atenolol, Carvedilol,

In BPH → Static obstruction is overcome by
Finesteride + Tamsulosine.
↓ (Rapid Benefit)
It takes 3-6 months for action.
Tamsulosine overcomes dynamic obstruction.

Pt. on Tamsulosine may cause risk of floppy iris syndrome → going for cataract.

Non-selective α-blocker:

Irreversible – Phenoxybenzamine

Reversible – Tolazoline, Phentolamine.

PHENOXYBENZAMINE:

Definitive therapy for t/t of HTN in Pheochromocytoma – Phenoxybenzamine.

For controlling intra-operative HTN during pheochromocytoma Sx – i.v. Phentolamine
i.v. Nitroprusside.

Don't use Propanolol as a 1st line drug for t/t HTN due to Pheochromocytoma.

In Phechromocytoma Sx – ~~Drug~~ Halothane is C/I
↓
sensitize the myocardium for catecholamine
↓
Causes MI.

Phentolamine:

Use – DOC → for t/t of Clonidine withdrawl HTN
DOC for t/t of HTN due to cheeze reacn.
In intra-op HTN during Pheochromocytoma Sx
Oxine induced HTN.
Useful for t/t of Erectile dysfunction (injectable drug)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

PIPE Therapy (Pharmacologically induced penile erection):
Injectable drugs used for t/t of erectile dysfunc^{n}:
- Alprostadil (PGE1 analogue)
- Phentolamine
- Papaverine (Non-selecting PDE inhibitor).

β-Receptors → G-protein couple acting via Gs pathway.

β_1 β_2 β_3

β_1 →
Location – Myocardium
Kidney.

Action (Heart) → ↑ HR
↑ Force of contraction
↑ C.O.
In kidney → Renin release.

Selective β_1 agonist:
Dobutamine (Synthetic Catecholamine)

eg. of synthetic Catecholamine
① Isoprenaline → acting on β_1 β_2 β_3
② Dopexamine → D_1, β_2
③ Dobutamine → β_1 ($t_{1/2}$ = 2 min)
④ Fenoldopam → D_1

Dobutamine Used in → Stress ECHO
D_1 receptor seen in Renal blood vessel → Renal Vasodilation

∴ Fenoldopam Used in → • iv infusion
• HTN emergency c Renal impairement.

β_2:
Location: Smooth muscle < Vascular
Visceral.

Stimulation of β_2 → Vasodilation.

Visceral —
Bronchial muscle → Bronchodilation.

β_2 agonist useful for t/t of Bronchial Asthma:
Salbutamol, Terbutaline } short acting
Useful for Acute asthma.
Salmeterol, Formeterol, Indacaterol } long acting
Useful for Chronic asthma

Salbutamol:
M/C S/E — Tremors
Palpitation.

Uterus → Action → Uterine muscle relaxation.
Tocolytics — Ritodrine (FDA approved)
Isoxuprine

β_2 agonist having anabolic action — Clenbuterol.

Phospholypase-Gq ← α_1] – G-Protein Couple receptor.
Adenyl cyclase – Gi ← α_2

Page No.
Date : / /

β_2 – Role on metabolism

Carbohydrate	Potassium	Lipid
– Hyperglycemia	– Hypokalemia	– Reducing blood cholesterol.

Hyperkalemia:
Mild → 5.5 to 6.5 m Eq/L
Moderate → 6.5 to 8.0 meq/L
Severe → > 8.0 m Eq/L

For Rapid control of potassium in Hyperkalemia (emergency) – Insulin + Glucose infusion.

For Hyperkalamia + ECG abnormalities
– Calcium Gluconate.

β_3:
Location: Adipose tissue

Selective β_3 agonist – SIBUTRAMINE
– lipolysis
– withdraw due to Cardiotoxic.

MIRABEGRON:
– β_3 agonist
– Relax detrusor
Used in – Overactive bladder.

Q Which one of the following don't have significant ~~dopamine~~ dopaminergic activity –
A) Dopamine (D_1, β_1, α_1) C) Fenoldopam (D_1)
B) Dobutamine (β_1) D) Dopexamine (D_1, β_2)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Dopamine : has D_1, β_1, α_1 action.

↓ ↓ ↓

< 2μg/kg 2-5 5-10 μg/kg.

DOC for Cardiogenic Shock — Dopamine.

Shock	T/t
Cardiogenic	NE or Dopamine
Cardiogenic c̄ oliguria	Dopamine.
Anaphylyclic	Adrenaline
Secondary	α-blocker
Adrenal insufficiency	Steroids

Blood pressure :

BP = CO X Peripheral resistance.

↓ ↓

SBP DBP

Effect of Isoprenaline on BP :

- β_1 ; β_2, β_3 action.
- No α action.
- ↑ SBP ; ↓ DBP → Reflex Tachycardia
- Wide pulse pressure.

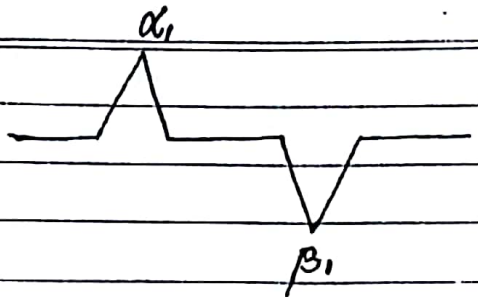
NA : α_1, α_2, β_1

No β_2 action

↑ SBP ; ↑ DBP → Reflex bradycardia

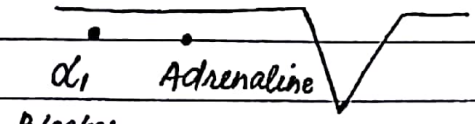
Adrenaline on BP : acting on α_1 α_2 β_1 β_2

Page No.
Date : / /



Biphasic response of Adrenaline on BP.
- Adrenaline cause initial ↑ BP & later ↓ BP.

Dale's vasomotor reversal phenomenon:



If we give α_1 blocker before adrenaline, adrenaline act only on β_2 causing fall in BP.

Q. All are lipid insoluble β-blocker except?
A) Nadalol
B) Propanolol
C) Atenolol
D) Sotalol

Lipid soluble β-blocker – Propanolol (Highly soluble)
↓
- M/commonest drug used for prophylaxis of migraine.

DOC –
- Performance anxiety
- Essential tremor
- Akathesia

Lipid insoluble β-blocker – Nadalol (Most longest acting >40hr)
Atenolol
Sotalol
↓
Long duration of action
No hepatic metabolism
Unsafe in Renal failure – Dose adjustment required.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

β-blocker

Non-selective β-blocker: 1st generation β-blocker
- Drug block both β_1 & β_2.

Cardioselective β-blocker: 2nd generation β-blocker
(Predominantly blocks β_1 blocker)

- No selective β_2 blocker.

#. 3rd generation β-blocker – β-blockers c additional properties.

Cardioselective β-blocker:
Nebivolol (Most Cardioselective; Releases NO) → Vasodilation
Betaxol - Useful in Glaucoma; Safe in asthmatic.
Bisoprolol - Useful in CCF
Atenolol
Esmolol - Most ultra short acting (~9 min), i.v., Emergency.
Acebutolol
Metoprolol - Useful in HTN, Angina, MI, CCF.
Celiprolol

3rd generation β-blocker:
① β-blocker having α blocking property –
Labetalol - β & α blocker
- Use → HTN emergency in pregnancy.
- S/E → Postural hypotension, hepatotoxic.

~~Carbi~~
Carvedilol - β & α blocker
- Antioxidant
- USE → in CCF. → Bisoprolol
Metoprolol.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

② β-blocker having NO releasing property –
Nebivolol
Nipradilol

③ β-blocker having K^+ channel opening action –
Tilisolol

④ β-blocker having K^+ channel blocking property –
Sotalol – Class III antiarrhythmic group.

BUTOXAMINE :
- Only selective β_2 blocker
- Used for research purpose, not for therapeutic purpose.

β-blocker having highest membr stabilizing
↓
Na^+ channel blocking property
or local anesthetic action.
→ Propranolol.

β-blocker having highest intrinsic sympathomimetic
→ Pindalol

β blocker having favourable effect on lipid profile
→ Pindolol.

Antidote for β blocker poisoning – Glucagon.

Uses of β-blockers:

① CNS – Performance, Anxiety
Prophylaxis – Migraine
Akasthesia
Essential tremors.

② Eye – Glaucoma
↳ β blocker – Timolol
Betaxolol
Carteolol
Levobunolol
Metipranolol
} ↓ aqueous secretion

Systemic S/E of Timolol – Bradycardia
Heart block
Bronchospasm

Betaxolol – Safe in asthma.

Local S/E of Timolol – Blepharo conjunctivitis
Nasolacrimal duct obstruction

③ Thyroid – Hyperthyroidism
↓
- propranolol inhibits peripheral conversion of $T_4 \rightarrow T_3$
- Symptom relief.

④ CVS – HTN Arrhythmia Dissection of aorta
Angina CCF TOF
MI HOCM

A/c Joint National committe guidelines

First line drugs used in t/t of HTN:

- Thiazides
- ACEi
- ARB
- CCB

↳ No β blockers.

(5) Useful for Portal hypertension (Prophylaxis)

↓

Propranalol

DOC for t/t of bleeding due to esophageal varices

- OCTREOTIDE

↓

most potent vasoconstrictor

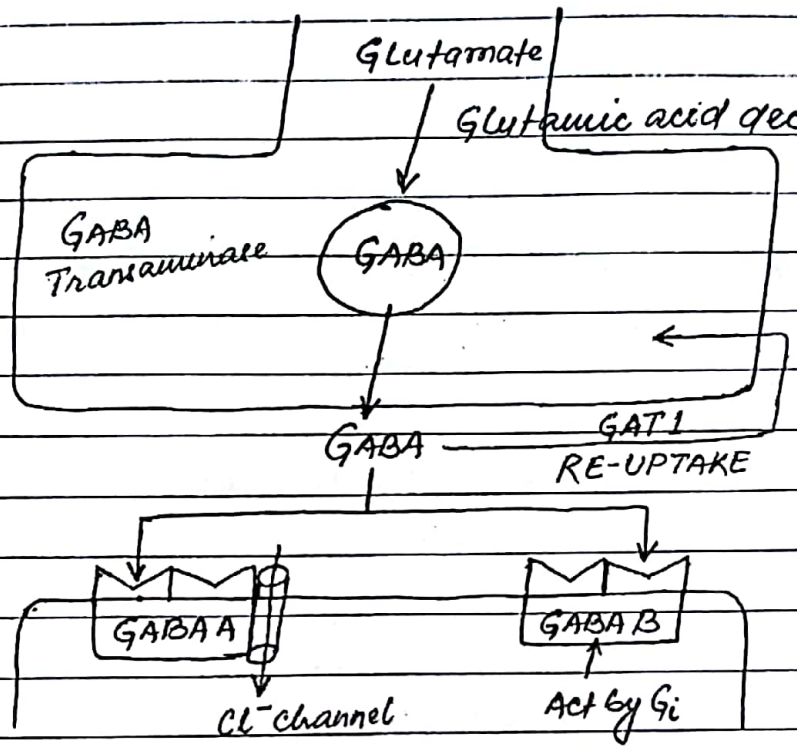
- controls bleeding

- Terlipressin – V_1 agonist can be added.

DOC for prophylaxis – Propranolol, Nadalol.

Central acting drugs

GABA :



Metabolism by — GABA transaminase.

Action of GABA : When GABA enters GABA A, Cl^- channel enters causing hyperpolarization.

Drugs acting via GABA A pathway

Benzodiazepine Barbiturates.

BZD binding to BZD receptor which is made up of α, γ unit of GABA A.

BZD = GABA facilitatory.

↑ frequency of Cl^- channel opening.

Page No.
Date : / /

MOA of Barbiturates –
– Barbiturates binding ē α, β units of GABA A.

Barbiturate : Low dose → GABA facilatatory
High dose → GABA mimetic.
↑ duration of Cl^- channel opening.

Benzodiazepine (BZD):
Action (USE) → Sedation
Anti-convulsion
Anti-anxiety
SMR.

Diazepam – DOC for Acute febrile seizure (Rectal Diazepam)
Status Epilepsy (currently DOC – i.v Lorazepam)
Delirium tremors.
Lorazepam – DOC for Status epilepsy.
Alcohol withdrawl : DOC : Chlordiazepoxide.
(Delirium tremors)

Midazolam, Remimazolam > short acting
↳ Ultra short acting.
→ Anaesthetic property.

Alprazolam – used in Insomnia, Anxiety disorder

Long term use of BZD – Addiction
Tolerance
Day time sleeping.

BZD safe in liver failure pt:
- Temazepam
- Oxazepam (Metabolite of Diazepam).
- Lorazepam.

Sleep onset Insomnia:
Z compounds — Zolpidem (Most common)
Zopiclone
Zaleplon (Shortest)
All are short acting

FLUNITRAZEPAM: Date Rape drug.
Causes Anterograde amnesia.

KETAMINE: Also date rape drug.

BZD poisoning —

Antagonist:
Competitive antagonist — FLUMAZENIL
↓
prevent binding of BZD ē
α, γ unit of GABA A.
- Specific antidote of BZD.
- Given i.v.
- $t_{1/2}$ = 60 min

BICUCULLINE — Competitive antagonist of GABA
Non competitive inhibitor of BZD.

PICROTOXIN — Direct Cl^--channel blocker.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Inverse agonist of BZD Receptor — β-Carbolin

Flumazenil used for — BZD poisoning
β-carbolin poisoning
Z-compound poisoning.

BARBITURATES :

Long acting	Short acting	Ultrashort acting
- Primidone	- Secobarbitone	- Theopentone Sodium
- Phenobarbitone	- Pentobarbitone	- Methohexitone.

Theopentone sodium — Indication
- iv induction GA
- Re distribution
- Cerebro protective

Other uses — Narco analysis
Status epilepsy.

Methohexitone — causing convulsion.
Used in Electro convulsive therapy.

Phenobarbitone — metabolite of Primidone.
↳ Useful in Anticonvulsion in pregnancy & pediatrics.
↳ In children it causes hyperkinesia.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

General properties of Barbiturates:

- Algesic property (produce pain)
- Narrow therapeutic index. (Hence – unsafe)

↓ only

∴ Used in – Epilepsy
Anaesthesia

Clinical manifestation of Barbiturates :-

- Flabby muscle
- Comatose
- Shallow & falling Respr
- Bullous eruption.

T/t:

- No specific antidote.

- Poisoning → Forced alkaline diuresis
Hemodialysis.

All barbiturates are microsomal enzyme inducer.

Since powerful enzyme inducer
∴ C/I – acute intermittant porphyria.

GABA analogues.

GABA Reuptake inhibitor: TIAGABINE

GABA Transaminase inhibitor: VIGABATRINE
SODIUM VALPROATE

Glutamic acid decarboxylase activator: VALPROATE

VIGABATRINE – DOC for infantile Spasms (Tuberous Sclerosis)

SE → Visual field defect
SE → Psychosis

For Simple Infantile Spasm – ACTH

LEVATIRACETAM: ligand for SV2A protein
↓
Synaptic Vesicle
– modify synaptic release of Glutamate/GABA.
↓
Controls Seizure

New drug – GABAPENTIN, PREGABALIN] Useful in DM neuropathy pain, Post herpetic neuralgia.

GANAXALONE
– Neurosteroid
– Direct Cl^- channel opener
Useful in – Absence seizure
Catamenial seizure.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

GABA B (G-protein Coupled Receptor)
↳ Agonist – BECLOFEN
Antagonist – SACLOFEN

BACLOFEN – Centrally acting SMR
Useful in – Hiccough
Craving of alcohol.

MELATONIN:
Sleep inducing hormone
Secreted from pineal gland.

Melatonin analogue – REMELTEON
↓
MT1 MT2
↓
Useful in sleep onset insomnia
No risk of ABUSE/ TOLERANCE.

TASIMELTEON – Useful in t/t sleep awake disorder in blind.
↓
Melatonin analogue.

AGOMELATINE – Agonist on MT1/MT2
Antagonist on 5-HT 2C
Melatonin analogue ∴ antidepressive property.

SUVOREXANT → FDA approved drug for insomnia.
ALMOREXANT → Non-selective OREXIN receptor antagonist.
↓
another orexin receptor antagonist.

Glutamate

AMPA receptor → open Na^+, Ca^{2+} channel

NMDA receptor → Opens Na^+, Ca^{2+} Channel

Both are ligand gated receptor.

T/t of epilepsy – Glutamate antagonist

AMPA blocker	NMDA blocker
Topiramate	Felbamate
Lamotrigine	Valproate
Remacemide	
Perampanel	
Talampenal	

Actions of Sodium Valproate:

- GABA agonism
- Anti glutamate
- Na^+ channel blocking action
- Ca^{2+} Channel blocking action
- Broad spectrum anti-epileptic.

Lennox Gestaut Syndrome:

℞ → FELBAMATE – S/E – Hepatic failure
Aplastic anemia.

Currently Used:
- VALPROATE
- BZD
- RUFINAMIDE (Na^+ channel blocker)

TOPIRAMATE :

Use → Epilepsy
Prophylaxis of Migraine
Alcohol (Anti craving)
Smoking (")

S/E → Renal Stone
Wt. loss

LAMOTRIGINE :

Useful in – Epilepsy
BPD depressive

Rarely cause SJS (Steven Johnson Syndrome).
TEN (Toxic epidermal necrolysis)

NMDA blockers :

Anaesthetic action:
- Ketamine : – Dissociative anesthesia
- Xenon
- N_2O (Laughing gas) → S/E – Megaloblastic Anemia.

Memantine → Useful in Alzheimers
Acamprosate → GABA agonist property, Craving alcohol.
Amantidine → Useful in Parkinsonism
Methadone → DOC for Opioid deaddiction.
Riluzole → Useful for ALS
Phencyclidine → Angel dust.

Dopamine as a Neurotransmitter :

Dopaminergic pathway :

① Meso-limbic fibre – extend upto prefrontal lobe secrete dopamine.
↑ dopamine – cause Psychosis

② Nigro-striatal neuron – (N) func^{n} is to synthesise & release dopamine in corpus striatum.
- helps in initiation of movement.

In corpus striatum – amount of Ach & Dopamine balanced.
As ↑ age – adequate amount of dopamine is not secreted & there is ↑ in Ach activity.
Muscle rigidity occurs due to ↑ Ach.
- Hypokinesia, Tremor, ~~Rigidity~~ Rigidity.

③ Tubero infundibular fibre – extend from hypothalamus to anterior pituitary.
- Dopamine analogue are used for ↓t of galactorrhoea.
- Dopamine act on D_2 receptor in the brain & causes psychosis.
- Any drug blocking D_2 & causing anti psychotic effect is called ATYPICAL ANTIPSYCHOTIC.

Two most common S/E of antipsychotic (EPS
Galactorrhea.

Levodopa & Carbidopa : long term S/E

↓

① Psychosis

② Choreoathetoid movement (Dyskinesia).

PSYCHOSIS:

- Overaction of Dopamine.
- D_2 blockers → Conventional / Typical Antipsychotic.

Conventional / Typical Antipsycholic drugs

Phenothiazine	Butyrophenones	Thioxanthenes.
Chlorpromazine	Haloperidol	Thiothixene
Trifluperazine	Trifluperidol	Flupenthixol.
Thioridazone	Droperidol	
Fluphenazine	Penfluridol-LA	

Typical antipsycholic = Neuroleptic agents.

Most potent D_2 blocker / Antipsycholic = Butyrophenone

↓

Max^{m} EPS produced

THIORIDAZINE — S/E → Corneal pigmentation
Cataract
Retinal degeneration.

Most potent Antipsycholic — HALOPERIDOL
↓
Cause Maxm EPS
Less ANS side effect.

CHLORPROMAZINE — causes Cholestalic jaundice.

Drug induced Parkinsonism:
TOC — Centrally acting Anticholinergic
↓
Trihexyphenidyl (BENZHEXOL)

Other — Benztropine
Biperiden
Procyclidine.

PROMETHAZINE — 1st gen. antihistamine
have anticholinergic action
So, used in EPS.

Extra pyramidal Syndrome:
① Drug induced Parkinsonism
② Acute muscular dystonia: PROMETHAZINE
BENZHAXAL
③ Tardive dyskinesia: No specific t/t
Symptomatic — Valproate, Vit. E.

VALBENAZINE (Newer drug)
- Acts by Vesicular monoamine transporter 2 inhibitor.

④ AKATHESIA — DOC : Propranolol

⑤ Malignant Neuroleptic Syndrome : DANTROLENE
↓
directly acting SMR.

Anti-Parkinson drug:

LEVODOPA :

↳ Protein meals reduces absorption of levodopa.
Vit-B_6 (Pyridoxine) should n't be given c levodopa bcoz it stimulate peripheral conversion.

Peripheral toxicity:

M/C S/E of levodopa — Nausea & Vomitting
Alteration in taste sensation.
↓
due to stimulation of D_2 receptor in CTZ.

D_2 receptor blocker — Domperidone
Metaclopramide.

Only domperidone is useful in t/t of vomitting due to levodopa.
Metaclopramide is not used ~~by~~ bcoz it crosses BBB & reduces efficiency of levodopa.

Causes — Cardiac arrhythmias
Excerbation of angina
— due to D_1, β_1, α_1 activation.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Page No.
Date : / /

LEVODOPA + CARBIDOPA
↳ Dopa decarboxylase inhibitor

Long term S/E → Abnormal choreo athetoid movement
→ Psychosis

Huntington's Chorea, Tourette Syndrome] movement disorder due to overaction of dopamine.

↓

T/t – DOC : TETRABENAZINE
(Dopamine Depletor
other – Chlorpromazine
Haloperidol.

Levodopa is Precursor of melanin
– C/I in melanoma

Chronic therapy of levodopa may cause On & off pheromenon
↓ ↓
dyskinesia Severe parkinsonism
↓
Rescue therapy
– APOMORPHINE (D_4)
given S/C.

Abrupt withdrawl of levodopa → Neuroleptic malignant Syndrome.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

AMANTIDINE:

Influenza

Influenza A	Influenza A & B (Bird flu)
- Amantadine	- Oseltamivir
- Rimantadine	- Zanamivir.

Oseltamivir — 75 mg / 1 BID / 5 days — Oral
↳ Prodrug — Causes Nausea & Vomitting.

Zanamivir — Intranasally — Bronchospasm

Vaccination:
PERAMIVIR (Neuraminidase Inhibitor)
↳ IV (Intravenous)

Amantidine:
- Anti cholinergic
- Dopaminergic agonist
- NMDA antagonism.

- Useful in Parkinsonism

S/E — Ankle edema
Livido reticularis. (Net like skin rashes).

Page No.
Date : / /

Ergot D_2 agonist : Bromocriptine
Pergolide
Cabergoline

Common S/E of these 3 drugs — Erythromelalgia.
Cardiac valve fibrosis.

Pergolide — Causes max^{m} Cardiac valve fibrosis.

Other uses of Bromocriptine :
- Prolactinoma.
- Acromegaly
- Type 2 DM

Non- Ergot D_2 agonist : Pramipexole] M/C S/E Psychosis.
Ropinirole]
Rotigotine (Transdermal)
Advantage : No peripheral vasoconstriction.

[Pramipexole / Ropinirole] — S/E → Compulsive shopping
Kleptomania
Sexual desire
→ Useful for t/t of Restless leg Syndrome.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

COMT inhibitors

JALCAPONE

Dangerous toxicity
- Rabdomyolysis
- Severe Diarrhoea
- Hepatotoxicity.

Urine – Yellowish Orange.

ENTACAPONE
- doesn't crosses BBB.

SEROTONIN (5-HT)

Source – Tryptophan

Func^n of 5HT1A – Inhibition of release of Serotonin.
↓
Autoreceptor of Serotonin.

Monoamine undergoes metabolism by Monoamine oxidase (MAO). They produce metabolite 5-hydroxyindole acetic acid.

In Carcinoid tumour – ↑ 5-hydroxy indole acetic acid.

Serotonin undergoes reuptake causing ↓ central serotonin.

Action of Serotonin on 5HT1 B/D – Vasoconstriction
↳ SUMATRIPTAN (Use - Migraine)
(mainly 1D ; min^m 1B)

Action of Serotonin on 5HT2 – Shizophrenia
(5HT2A/2C)
↳ Clozapine
Risperidone
Olanzapine

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Action of Serotonin on 5HT3 :- Nausea & Vomitting

5HT3 antagonist – Ondaselron
Granisetron

Action of serotonin on 5HT4 : Diarrhoea.

Selective 5HT4 agonist – Cisapride | withdrawn bcoz of QT prolongation on ECG.
Mosapride
Tegaserod

All serotonin receptors are G-protein coupled receptor. except 5HT3 (ligand gated receptor)

Acute Migraine:
Main issue – Vasodilation
For t/t of Acute migraine – Vasoconstrictor
↓
Ergot Alkaloids – Ergotamine
5HT1 B/D agonist – Sumatriptan (DOC)
Rizatriptan
Almotriptan
Frovatriptan
Zolmitriptan

Care is taken for HTN & IHD in these pts.

St. Anthony's fire → chronic treatment c ergot alkaloid cause peripheral vasoconstriction (gangrene of foot)
Poisoning – Ergotism

BUTOPHANOL – Opoid
Used intranasally for Headache.

Drug useful for Prophylaxis of chronic Migraine:
① M/c drug – Propranolol (β-blocker)
② CCB – Flunarazine
(Na⁺ channel blocking & Antioxidant property)
③ Anti-convulsant – Valproate
Gabapentin
Topiramate
④ TCA – Amitryptaline.
⑤ Clonidine
Onabotulinum toxin A
⑥ $5HT_2$ blocker
- Pizotifen
- Cyproheptadine
  - Antihistamine + Anti muscarine + Antiserotonine.
  - Primary used as appetizer
  - Used in Serotonin Syndrome.
- Methylsergide (Not used)
  - Causes retroorbital & peritoneal fibrosis

Newer drugs – Calcitonin gene related peptide (CGRP)
– Vasodilation.
CGRP antagonist → Olcegepant – i.v.
Telcagepant – Oral
↳ Hepatotoxic

LASMIDITAN – $5HT_{1F}$ agonist

↓

Undertrial

Atypical Antipsychotics
(5HT2 Antagonists)

Clozapine
Quetiapine
Olanzapine
Risperidone
Lurasidone
Ziprasidone
Aripiprazole
Asenapine (S/L)

→ Not causes Metabolic Syndrome

↳ Advantages:
- Less EPS
- Refractory Cases
- +ve & -ve symptoms of Psychosis.

CLOZAPINE – S/E → Agranulocytosis 0.8 – 1%
(dose independent)

Seizure (10%)
Ileus (Paralytic) → Constipation
Sialorrhoea
Metabolic syndrome.
– Pillow ~~wet~~ Syndrome
(wet)
– Anti-suicidal action.

QUETIAPINE – S/E – Cataract, Priapism

OLANZAPINE – USE → Mania in BPD
Adverse effect → Max^{m} wt-gain
Max^{m} metabolic syndrome.

RESPERIDONE: In addition to blocking 5HT2 it also block D_2.
- May cause EPS

LURASIDONE: Useful in BPD
may also cause EPS.

ZIPRASIDONE: M/e S/E – QT Prolongation.

ARIPIPRAZOLE: Useful in BPD (mania)
– Best drug among alypical antipsychotic

ANXIETY DISORDER:
↓ GABA activity
↑ 5HT activity.

BUSPIRONE: 5HT1A agonist
Anti anxiety agent (Chronic Anxiety)
Advantage – Non sedative
Non habit forming.
Disadvantage – Delayed in onset
(3 to 4 wks)

For acute anxiety – Temporarily – BZD

Performance anxiety = Rx: Propranolol
Anxiety & panic attack = Rx: SSRI
H1 blocker: Hydroxyzine (Anti anxiety property)
↳ 1st gen. antihistamine.
Cetrizine → Metabolite of Hydroxyzine
↳ 2nd gen. anti-histamine.

Female Sexual Stimulant : FLIBANSERIN
↓ useful in
HSDD – Hypoactive Sexual desire Order

Deficiency of Serotonin & NE – Depression

TCA, SNRI, NDRI → Inhibit reuptake of 5HT, NE
SSRI → Inhibit reuptake of 5HT.

MAO – inhibitors

MAO-A
- involved in metabolism of NA & 5HT.
- Useful in depression.
↓
Selective MAO-A inhibitor: MECLOBAMIDE, CLORGILINE

MAO-B
- Metabolism of Dopamine
SELEGELINE
RASAGILINE
SAFINAMIDE

Non-selective MAO inhibitors:
PHENELZINE
TRANYLCYPROMINE
ISOCARBOXAZID

Cheeze reaction = T/t : Phentolamine

SSRI:

Fluoxetine (longest acting → 5 to 7 days)
Fluoxamine – Shortest acting
Paroxetine
Citalopram
Escitalopram – Highly selective SSRI
Sertraline – Least drug interaction.

S/E of SSRI – · May cause HTN
– Insomnia, Anxiety, Sexual S/E.
↳ delay in ejaculation.
↓
∴ It is taken in morning.
↓
Useful in t/t of premature ejaculation.

M/c – Nausea & vomitting
– Diarrhoea.

Drug interaction:
Serotonin Syndrome – SSRI + MAO inhibitor
Rx – Cyproheptadine.
↳ Primarily 5HT2 antagonist
Anti H1 + Ach

FLUOXETINE: Least discontinuation Syndrome

PAROXETINE – Wt gain
Teratogenic
Used in Premenstrual tension Syndrome. (PMTS)
↓
FDA approved.

Drug interaction b/w Fluoxetine & Tamoxifen :

Tamoxifen – for anticancer activity needs activation.
– activated ē help of CYP2D6 enzyme.

Fluoxetine – CYP2D6 enzyme inhibitor.

Tamoxifen failure occurs.

SSRI Uses :

① Depression
- juvenile depression – Fluoxetine
Sertraline

② OCD
③ PTSD
④ Bluimia nervosa
⑤ Anxiety ē panic attack.
⑥ PMTS.

DOC : SSRI : ① OCD
② PTSD
③ Anxiety ē panic attack.

TCA
- Inhibit reuptake of Serotonin & NE (Non-selective)

CLOMIPRAMINE – T/t of OCD
DOXEPIN – Strong antihistaminic property
• Atopic dermatitis
• Lichen Simplex

All TCA have antihistaminic property.

IMIPRAMINE – Strong anticholinergic activity.
• Nocturnal enuresis
DOC: Desmopressin
All TCA have anticholinergic activity.

AMITRYPTILLINE
Used in – Antidepressant
Prophylaxis of migraine
DM neuropathy pain
↓
Gabapentin, Pregabalin

Other – Nortryline
Desipramine
Amoxapine – D_2 blocking action
Anti-psychotic
EPS, Galactorrhoea.
Maprotiline
Reboxetine

Adverse effect of TCA:
- All TCA having antihistaminic property
" " anticholinergic "
" " α_1 blocking "

- Sedation, Wt gain, Seizure
↓
∴ taken at bed time.
- Dryness of mouth, constipation, Tachycardia & Retention of urine
- Postural hypotension

TCA poisoning & t/t :
Cardiac arrhythmia → Lidocaine, Brelylium, Avoid Class Ia
Convulsion → Diazepam
Coma →
Metabolic acidosis → i.v. Sodium bicarbonate
- No role of dialysis in TCA poisoning
↳ bcoz large Vd.

Anti-cholinergic
① Avoid TCA in elderly male – Aggravate Urinary Retention.

② Alzheimer's ds.

ST JOHN'S WORT :
Natural antidepressant.
~~EE~~. HYPERFORIN
↳ Monoamine reuptake inhibitor.
- Very powerful enzyme inducer.
↓
lead to OCP failure.
Anti retroviral failure.

MIANSERIN : Presynaptic α_2 inhibitor
Useful in depression.

MIRTAZAPINE : Presynaptic α_2/5HT1 inhibitor
Useful in depression.
- NaSSA (Noradrenergic & specific serotonergic antidepressant).

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

TIANEPTIN] 5HT reuptake enhancer
AMINEPTIN]

↓

Used as antidepressant

Mechanism of action not known.

BPD (Bipolar Disorder):

Prophylaxis – Lithium

Acute mania – Valproate
Carbamazepine
Olanzapine
Aripiprazole
Diazepam

Depressive phase – Lamotrigine

For Rapid Cycler : DOC : Sodium Valproate

↳ more than 4 episodes of mania & depression in a year.

Lithium: Monovalent cation

Useful for prophylaxis of BPD.

Narrow Therapeutic index (TDM)

↓

Therapeutic drug monitoring

↓

Monitoring plasma lithium level.

↓

$T_{1/2}$ = 24 hrs.

Maintanence for BPD = 0.5-0.8 meq/L

Acute Mania = 0.8-1.2 meq/L

Toxic symptom > 1.5 meq/L

Toxicity → Hemodylasis → 4 meq/L

Adverse effect of lithium:

LI = Leucocyte count ↑ (Leucocytosis)

T = Tremor (M/c → 8-10 Hz)

H = Hypothyroidism (Inhibit release of T_3 & T_4)

IU = ↑ urination (polyurea = DI) (Rx: Amiloride)

M = Mother (Ebstein's anomaly) = Teratogen

In CVS → T wave changes

Dermatology → Exacerbation of psoriasis.

C/I: ① Pregnancy & lactation

② Sick sinus syndrome.

Drug interaction b/w lithium & SMR (Succinylcholine & Pancuronium):

↳ Lithium aggravate the action of SMR.

↳ Stop lithium 1 day before Sx.

Hyponatremia will occur in lithium toxicity.

[Diuretic aggravate lithium toxicity.

[NSAID " " " .

Opioid Receptors.

3 imp. endogenous opioid Receptor in body
- μ (Mu)
- δ (Della)
- k (Kappa)

All opoid receptor are GPCR – via Gi pathway.

Endogenous opioid peptides:
- Endorphine – more affinity toward μ
- Enkephaline – " " δ
- Dynorphin – " " k

Action of opioid:
- Due to activation of μ & δ.

P = Physical dependence, ↑ Prolactin secretion
M = Miosis — NO Tolerance
C = Constipation, convulsion (M3G)
A = Analgesic
R = Respr depression
E = Euphoria
S = Sedation

Opioid are useful in t/t of dull pain
- Continuous pain
- localised pain
- Visceral pain

Opioid (Morphine) activating Edinger westphal nucleus (III CN) causing miosis.
↓
Only systemic Morphine cause miosis.

Action of opioid due to kappa:
D = Dysphoria
M = Miosis
A = Analgesia
R = Resp^{r} depression
D = Diuresis
S = Sedation

Morphine having Histamine Releasing action.
↓
Vasodilation
↓
Shifting of pulm. fluid in systemic circulation.
↓
It is useful for t/t of Pulm. edema.

All the action of morphine may develop tolerance on repeated administration except — Miosis
Constipation
Convulsion

Enkephalins may undergo metabolism by Enkephalinase.
For the t/t of diarrhoea — Racecadotril
↓
Enkephalinase inhibitor.

Pure agonist:
Natural opioid — Morphine, codeine (CYP2D6) (Codeine converted in morphine by CYP2D6 enzyme in body.)
Semisynthetic — Diacetyl morphine (Heroin), Pholcodeine

Synthetic — Pethidine (Meperidine — Anti muscarinic, Nor-pethidine → Metabolite of pethadi → S/E — Seizure (convulsion))
↓
C/I in t/t MI pain.

Pethidine & Morphine C/I in Renal failure.

Methadone:
- Longest acting opioid
- NMDA blocking property & inhibiting reuptake of NE & 5HT.
- Useful for t/t of neuropathic pain & Cancer pain
- DOC for opioid deaddiction.

Tramadol:
- Also having property of inhibiting reuptake of 5HT & NE.

Be careful using Methadone & Tramadol in pt. using SSRI, MAO inhibitor causing Serotonin Syndrome.

Fentanyl: Fentanyl group.

	Fentanyl	Sufentanil	Alfentanil	Remifentanyl
Potency ↓ potent than Morphine	X100	X1000	X5	X100
Duration of action	30 min	30 min	5-10 min	3-5 min

Least potent: Pethidine & proposyphene (1/10)

Analgesic for day care Sx: Remifentanyl.

Fentanyl + Droperidol = Neuroleptic Analgesia

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Fentanyl + Droperidol + N_2O = Neuroleptic anaesthesia.

Fentanyl group Cause Post op truncal rigidity
(Max – Alfentanil)

Thorax muscle rigidity = wooden chest Syndrome.

Mixed agonist – antagonist:

– μ antagonist / kappa agonist:
- Nalorphine (more dysphoria, not in use)
- Pentazocine (Sympathetic stimulant) C/I in MI pain
- Butorphanol (Nasal formulation)

– μ agonist / kappa antagonist:
- Buprenorphine
  - Useful for all type of pain
  - Useful for opioid withdrawl

↓

alternate to methadone.

Pure antagonist:

Naloxone
Nalmefene } Intravenous
Naltrexone (Oral, long acting, Hepatotoxic)

Acute morphine poisoning:

Specific antidote – Nalaxone (0.4–0.8mg)

↓

i.v., repeated every 2-3 min.

– It blocks μ receptor at much lower doses than those needed to block κ or δ receptors.

→ It promptly antagonizes

Naltrexone

→ Useful to control craving for Morphine & craving for alcohol.

For t/t of constipation due to morphine (opioid)
↓
Peripheral opioid antagonist [ALVIMOPEN
                               METHYL NALTREXONE

Newer opioid:
Peripheral Kappa antagonist: ASIMADOLINE
↓
for IBS

Peripheral μ & k-agonist ; delta antagonist:
ELUXADOLINE → for IBS.

Peripheral K-antagonist:
NALFURAFINE → Antipruritic → CKD

Codeine
Dextromethorphan] Anti-tussive opioid.

Anti-diarrhoeal opioid:
Diphenoxylate (Atropine can be added to prevent addiction).
Loperamide

C/I of Morphine:
- Head injury pain (Respr insufficiency)
- Biliary colic pain (causing constriction of sphincter of oddi.)
- Severe asthma.

Ethyl Alcohol / Alcohol :

Deaddiction - Disulfiram like reacⁿ
(Aldehyde dehydrogenase inhibitor)

Drug causing Disulfiram like reacⁿ:

C = Chlorpropamide (Sulfonylurea – DM)
Cefoperazone (3rd gen. Cephalosporin)
M = Metronidazole
Praised = Procarbazine (Anti Cancer) → Alkylated
G = Griseofulvin
T = Tinidazole
Naidu = Nitrofurantoin (Causes coffee colour urine)

Chronic alcoholic generally suffer Thiamine deficiency. (Vit B_1)

Alcohol always undergo Zero order Kinetic elimination:

Zero WATT Power
W = Warfarin
A = Alcohol
A = Aspirin
T = Tolbutamide
T = Theophylline
P = Phenytoin

Excretion of Alcohol – Kidney

In acute ethanol poisoning, pt. presenting c hypoglycemia. T/t = Glucose + Thiamine.

Methyl alcohol:

Methyl alcohol
↓
Formaldehyde
↓
Formic acid (dangerous) < Ocular damage
Metabolic acidosis

Specific antidote for Methanol poisoning
↓
Fomipizole
(4-Methyl pyrazole)
↓
Acting by inhibiting Alcohol dehydrogenase.

Alternative drug – Ethanol also given.
Hemodialysis.

Anti craving drugs for Alcohol:
- Disulfiram (DOC)
- Naltrexone (1st line drug)
- Acamprosate (2nd, NMDA blocker + GABA agonist)
- SSRI (citalapram)
- Ondaselron
- Topiramate, Beclofen (GABA agonist)
- Rimonabant, a CB1 receptor antagonist.

FAS (Fetal alcoholic syndrome):
C/F – Microcephaly
Maxillofadal abnormalities
Movement disorder – Hyperkinetic.
Mental retardation

Phenytoin:
Na^+ channel blocking antiepileptic

Fosphenytoin – Prodrug of phenytoin
Water soluble (im/slow iv)
└safe for┘

Saturation Kinetics – First order → Zero order

Adverse effect:
① Acute toxicity
– On high i.v. → Cardiac arrest.
– High oral → Nystagmus
Ataxia
Diplopia
Vertigo

② Chronic toxicity
– Gum hypertrophy (M/C – 30%)
↳ Due to collagen accumulation
– Blood → Megaloblastic anemia (Folic acid deficiency)
Interfare Vit K activity (Hemorrhage)
Interfare – Vit D & Calcium activity.
↳ Osteomalacia & rickets

- Hypersensitivity reac^{n}
  ↳ Pseudolymphoma.

- In female → Hirsutism
- Inhibits release of insulin from β-cell of pancreas – Hyperglycemia (DM)

- Teratogenicity → due to Areneoxide
  ↳ C = Cleft lip & palate
  P = Hypoplastic phalanges
  M = Microcephaly.

- Extravasation of phenytoin → Purple glove syndrome.

Phenytoin – Microsomal Enzyme inducer.

Non-epileptic uses of Phenytoin:
- Trigeminal neuralgia
- Digoxin – induced VT
- Wound healing

Carbamazapine:
DOC for Partial Seizure (Focal seizure)
For Rt of Temporal lobe epilepsy.

Non-epileptic Uses:
DOC for Trigeminal neuralgia.
Useful for Rt mania in BPD
Carbamazapine having SIADH activity → Antidiuretic
↳ Use in DI

It is microsomal enzyme inducer.
It also undergo auto induction.
↓
Phenobarbitone
Carbamazepine
Neverapine

Sodium Valproate:
- Broad spectrum antiepileptic.

MOA = GABA agonism property
Anti-glutamate "
Na^+ channel blocking "
T-type CCB "

DOC for Myoclonic / Atonic / Clonic & tonic Seizure
First line drug for Absence seizure / Lennox Gestaut Syndrome.

Non-epileptic uses:
- Migraine prophylaxis
- Manic in BPD (LITHIUM)
- Rapid cycler (>4 cycles/year)
- Tardive dyskinesia

It is microsomal enzyme inhibitor

SE: V = GIT, Wt. gain (Vomitting)
AL = Alopecia / curling of hair
P = Pancreatitis, hyperammonia
R = Rashes
Q = PCOD

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

A = Allergy ← Most
T = Teratogenic (Spina bifida / CVS problem / Orofacial / digital) ← Cleft lip & palate
E = Hepatotoxicity (< 2yrs children).
↓
t/t = Carnitine (Antioxidant)

Others Antiepileptic :
- Levaliracetam (SV2A)
- Magnesium Sulfate (DOC in eclampsia)
- Acetazolamide
- ACTH (Infantile spasm)

Levaliracetam — Modify synaptic release of glutamate / GABA.

Acetazolamide :
- Carbonic anhydrase inhibitor.
- Useful for Glaucoma → Taken Orally.
- Used as diuretics — acts on PCT

Use — Acute mountain sickness
Periodic paralysis
Absence seizures] Rx - GANAXALONE
Catamenial epilepsy]

Absence Seizure :
- Ab⊖ of T-type Ca^{2+} channel (Thalamus)

Rx : T-type CCB
ETHOSUXIMIDE
SODIUM VALPROATE (1st line drug)
TRIMETHADIONE (Withdrawn — Nephrotoxic)
↳ Hemeralopia — Day blindness.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Anti epileptic having Carbonic anhydrase inhibiting property:

TOPIRAMATE] cause Nephrolithiasis
ZONISAMIDE]

RETIGABINE] Potassium channel opener
or EZOGABINE] used for partial seizure
↑ - Causing blue colour pigmentation on lip & skin.
(New drug)

GENERAL PHARMACOLOGY

Pharmacokinetics (PK):

Drug absorption:

Food interfare drug absorption

eg: Milk (Ca^{2+}) — Tetracycline
Protein meal reduces — Absorption of Levodopa.

Food inhances drug absorption
Lithium
Halofantrine
Lumefantrine
Griseofulvin
Bedaquiline
Fibrates — lowering cholesterol
more absorbed ~ cholesterol diet.

- Absorption of Iron↑ — Vit. C (Ascorbic acid)

For a drug to absorb better — Lipid soluble
& distribution. Non-ionised.

Acidic drug non-ionised in Acid medium.
Basic drug non-ionised in Basic medium.
→ Aspirin

Acidic drug – Absorbed in stomach.
Basic drug – Absorbed in Duodenum/Intestine.
→ Morphine

Strongest Acid/Alkali always seen in ionised form.

Heparin – Can't be used orally.
- Heparin ionised molecule, not cross the placenta, so not cause teratogenicity.
↓
DOC – for anticoagulation.

Lignocaine – For rapid absorption/onset of action given c Sodium carbonate.
↓
Weak basic drug. For ↑ duration given c Adrenaline.

Acidic drug poisoning –
For acidic drug poisoning if the pt. is passing acidic urine, you should alkalise the urine.
Urine alkalise c Sodium bicarbonate.

Alkali drug poisoning –
For the Tt of alkali drug poisoning if the pt. passing alkaline urine, you should acidify the urine.
Urine acidify c Ascorbic acid
↓
By injection Ammonium Chloride.

Ion-trapping – Acidic drug (Aspirin) reached basic medium get ionised & trapped in the region.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

P-glycoprotein : Permeable efflux pump.
↳ Presence of P glycoprotein decreases the bioavailibity of digoxin.

eg. of P glycoprotein inhibitor : Quinidine
Itraconazole
Erythromycin
Amiodarone
(Verapamil)

Drug undergoing high first pass metabolism on Orally :
Propranolol
Salbutamol
Theophylline
Verapamil
Lignocaine
Nitrates
Imipramine

All nitrates goes extensive 1st pass metabolism except – Isosorbide mono. nitrates.

Rectally given drug absorbed via External hemorrhoidal vein – No 1st pass metabolism
If via Internal hemorrhoidal vein – 1st pass metabolism occurs.

i.v. – 100% Bioavailibility.

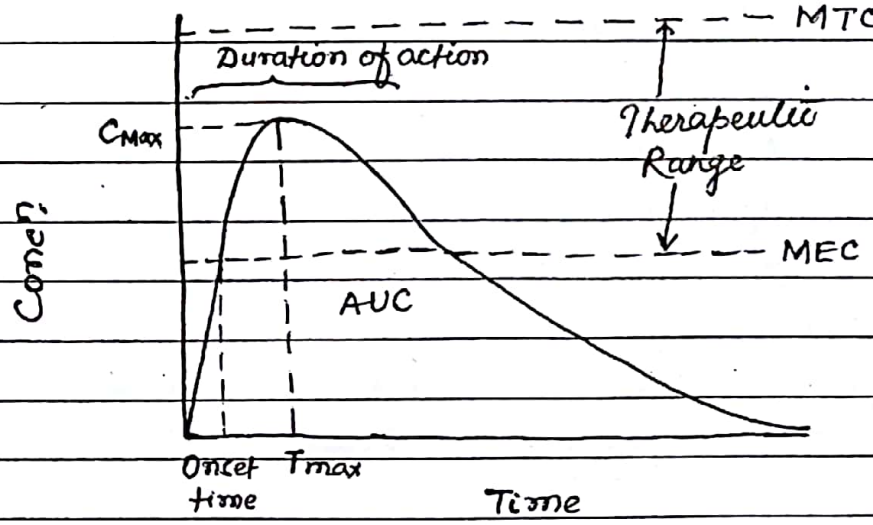
Henderson Hesselbach equation:

$$pKa = pH + \log (\text{ionized A}) / (\text{unionized A})$$

If pKa = pH
means, 50% drugs is in ionised form
& 50% " " unionised form

pKa − pH = 1 ⟶ 90% drug in absorbed form.
pKa − pH = 2 ⟶ 99% "
pKa − pH = 3 ⟶ 99.9% "

Bioavailibility curve:



Cmax = Max^m plasma conc^n
Tmax = Time to reach Cmax
AUC = Area under Curve.

Same drug, same dose, same dosage forms,
< 20% ⟶ Bioequivalent.

Orphan drug:

- A drug useful for diagnosis/prevention & Tt of rare disease.

eg:- Fomipizole (4-methyl pyrazole – Alcohol dehydrogenase inhibitor)
Protamine Sulfate (Antidote of Heparin – Chemical antagonism, 1mg = 100 U of Heparin)
Calcitonin
Digibind (Antidote for Digoxin)
Liothyronine (Active T_3 → Myxodema coma)
↳ always given c β-blocker.

Calcitonin: Useful in Hypercalcemia
Paget's ds
Osteoporosis
diagnosis for Medullary Ca Thyroid.

Pitolisant / Tiprolisant: Use in Narcolepsy (Orphan drug status).

Essential drugs:

- Drug that meet health needs of the majority of population
- Affordable & Available in all area.
- Always single compd.

Schedule H – Drug only given on prescription written by medical practioner (Registered).

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Drug distribution:

60% water
70kg → 42L

4L	10L	28L
plasma	Interstitial fluid	Cellular Compartment

If a drug only in the plasma compartment, it is called as low Vd.

If drug is ← Lipid insoluble / Ionised / Highly protein bound / Large size → drug Stays in Plasma Compartment

- Role of Hemodylasis

If a drug goes to cellular compartment it has high or large Vd.

↓

Lipid soluble
Non ionised
Free form.

Large Vd → No role of Dialysis.

Drug can't removed by dialysis :

A = Amphetamine
V = Verapamil
O = Opioids, OPC
I = Imipramine (TCA)
D = Diazoxine
Dialysis = Diazepam (BZD)

BZD — Very strong binding capacity
can't remove by dialysis.

Loding dose depend upon Vd.

For drug having large Vd — for rapid action give loading dose

Volume of distribution (Vd)

$$Vd = \frac{\text{Total i.v. dose}}{\text{Plasma conc}^n/L}$$

Loading dose = Vd × Target plasma conc^n.

Clearance (CL) = Rate of elimination / Plasma conc^n

Maintenance dose = CL × Target plasma conc^n.

$$t_{1/2} = 0.693 \times \frac{Vd}{CL}$$

Plasma protein binding:

- Acidic drug in plasma bind c plasma albumin.

- In nephrotic syndrome or in liver failure (hypoalbuminemia) plasma albumin count is low —
  Use low dose of Acidic drug.

- Basic drugs are generally binds c Alpha$_1$ Acid Glycoprotein

Drug displacement type of drug interaction:

eg: Warfarin displacing tolbutamine from protein binding site.

Sulphonamide displacing bilirubin from protein binding site.

BBB:

BBB absent — Pituitary
Pineal gland
Area Prostrema CTZ
Medain Eminence:

Do not crosses BBB — Streptomycin (Aminoglycosides)
Neostigmine (DOC for Atropine poisoning)
Glycopyrolate (Pre anesthetic medication)
Dopamine

All aminoglycosides are ionised molecule, so never absorbed orally, so not given orally.
Even though aminoglycosides not absorbed in GIT

Neomycin & Parmomycin] can given orally.

Streptomycin – C/I in pregnancy
bcoz it crosses placental barrier & causes permanent deafness.

Redistribution :
eg: Thiopentone Sodium
(Ultra short acting)
↳ Rapidly entering brain & rapidly comes out & distribute to liver, kidney etc.

Biotransformation (Drug metabolism):

Consequences of drug metabolism
① Inactivation (more water soluble)
↓
excreted easily.
② Active metabolite formation from an active drug
③ Activation of inactive drug.

Active metabolite from active drug:

Active drug		Active Metabolite
Phenacetin	→	Paracetamol

↳ causes Analgesic nephropathy so withdraw.

Codiene	→ (CYP2D6)	Morphine

↳ In some people it is deficient.

Diazepam	→	Oxazepam
Spironolactone	→	Canrenone.

Activation of inactive drug

Prodrug	Active metabolite
Levodopa	Dopamine
Methyl dopa	Methyl norepinephrine
Enalapril	Enalaprilat
	└ All ACE i are prodrug except – captopril, lisinopril
Dipivefrine	Epinephrine
Becampicillin	Ampicillin
Minoxidil	Minoxidil Sulphate.
Cyclophosphamide	Phosphamide mustard.

Drug metabolism:

Non synthetic reaction (Phase I reac^n):

1. Oxidation (M/c Phase I reac^n)
   All phase I reac^n taken care by microsomal enzyme – CYP450
2. Reduction
3. Hydrolysis
4. Cyclization
5. Decyclization

Phase II reac^n:

1. Glucuronidation (M/c) – Morphine
2. Sulfate Conjugation
3. Glycine "
4. Glutathione " (Paracetamol metabolism)
5. Acetylation
6. Methylation

Page No.
Date : / /

PARACETAMOL

PHASE I / CYP2E1

↓

N-acetyl benzoquino (Hepatotoxic immuno amine (NABQIA) metabolite)

Phase II / Glutathione conjugation

↓

Inactivation

For paracetamol poisoning → [N-acetyl cysteine / Methionine.

↓

Bcoz Glutathione generator.

Chronic alcoholic → More prone for liver damage bcoz Alcohol → CYP2E1 inducer.

End result of phase II reac^{n} → Inactivation.

Drug undergoes Acetylation:

S = Sulphonamide / Dapsone.
H = Hydralazine
I = Isoniazid
P = Procainamide

] may cause RA, SLE.

Methylation:

eg: Histamine → Methylhistamine
Noradrenaline → Adrenaline.

Microsomal enzyme :

Enzyme	Drug
CYP3A4 (M/c)	>50% of drugs
CYP2D6 (2nd)	Codiene → Morphine
Fluoxetine inhibit CYP2D6	
~~Tamoxifen activated by CYP2D6~~	
CYP2C9	Warfarin
CYP2C19	Omeprazole metabolism
	Clopidogrel
CYP2E1	Paracetamol – NABQIA

Clopidogrel : Anti-platelet
Prodrug
Activated c̄ help of CYP2C19.

Aspirin + Clopidogrel (prodrug) –
Aspirin → Causes gastritis
t/t → Omiperazole
Omiprazole shouldn't be given c̄ Clopidogrel.
– Preferred PPI given c̄ clopidogrel
↓
Pantoprazole
Rabeprazole.

Microsomal Enzyme

Inducers:	Inhibitors
G = Griseofulvin	Vit = Valproate
P = Phenytoin	K = Ketaconazole
R = Rifampicin	Can = Cimitidine
S = Smoking	Cause = Ciprofloxacin
Cell = Carbamazepine	Enzyme = Erthromycin
Phone = Phenobarbitone	Inhibition = Isoniazid (INH)
	Grape Fruit

Drug excretion:

Major source = Kidney.

Net excretion of drug = GF + TS − Tubular reabsorption.

✓ PROBENICID — by inhibiting

prolong the action of penicillin.

First order kinetics

- Constant fraction of drug excreted constant interval of time.
- $T_{1/2}$ constant
- 97% drug eliminated after 5 half life.

$100 \xrightarrow[①]{T_{1/2}=1hr} 50 \xrightarrow{②} 25 \xrightarrow{③} 12.5 \xrightarrow{④} 6.25 \xrightarrow{⑤} 3.125.$

↓

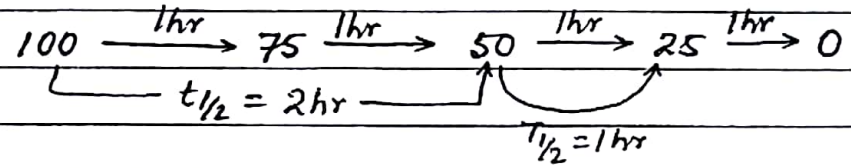
50% of drug excreted every 1hr.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Zero order Kinetics :

- Constant amount of drug excreted constant interval of time.
- No fixed $T_{1/2}$.

eg: 25 mg of drug, every 1 hr.



Common drug undergoing Zero kinetic

Zero WAATT Power

W = Warfarin
A = Alcohol
A = Aspirin
T = Tolbutamide.
T = Theophylline
Power = Phenytoin

Pharmacodynamics :—

Receptor mediated MOA

Cell membr Receptors.

- Ligand gated
  - Fastest acting receptor
- G-protein Coupled
  - Serpentine Shape
  - 7 molecule
  - most active unit of GPCR is d-unit
- Enzyme linked.

Page No.
Date : / /

GPCR (α) + GTP → G_s G_i → Adenyl cyclase – cAMP
M2&4 (d_2) (β)

→ Gq → PLC – IP3 + DAG
M_1, M_3, M_5 (d_1)

Enzyme linked receptor :

eg: Tyrosine Kinase Receptor

Insulin acting on cell membr receptor

↓

Activate Tyrosine kinase

↓

Shift GLUT4 from cytoplasm to plasma membr

↓

Influx of glucose.

PEGVISOMENT : GH receptor blocker
Useful for t/t Acromegaly.

New drug → RUXOLITINIB : JAK enzyme inhibitor
Useful in Myelofibrosis.

TOFACITINIB : JAK 1 & 3 inhibitor
Useful in RA.

Page No.
Date : / /

Intracellular receptors:

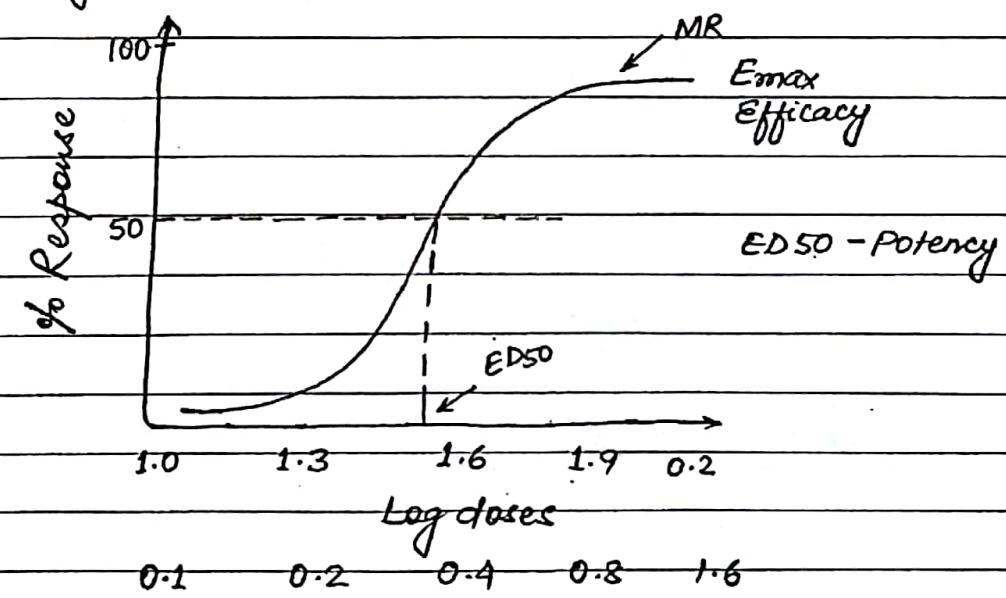
Drug acting on Cytoplasmic receptor:

- Steroid hormone
- Vit D
- Estrogen
- Progesterone
- Testosterone.

Drug acting on nucleus:

- Thyroid hormone

Log dose response curve:



Receptor Antagonism

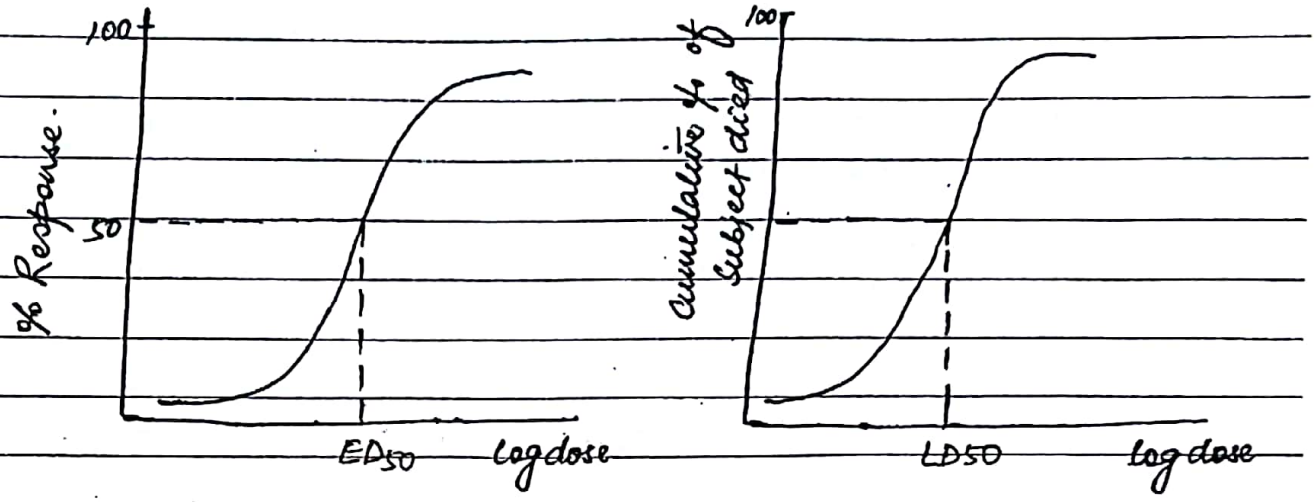
(1) In the presence of competitive antagonist DRC will be shifted parallel to right.
Efficacy → Same ; Potency → ↓

(2) In the presence of Non-competitive antagonism DRC will just come down
Efficacy → ↓ ; Potency → Same.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Page No.
Date : / /

E_{50} & LD_{50}



Lower the ED50 more potent

Lower the LD50 more dangerous drug.

Drug Safety:

$$\text{Therapeutic index} = \frac{LD50}{ED50}$$

Theophylline
Lithium
Anti epileptics
] Narrow therapeutic index.

Warfarin — assessment by INR

$$INR = \frac{\text{Patient Prothrombin (PT)}}{\text{Control Prothrombin}}$$

Heparin — assessment by aPTT

LMWH — No need for monitoring

In obese pt. or Renal failure we do assessment by Anti factor Xa.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Teratogenicity :

Preimplantation (0-2 wks)

Implantation (2-8 wks) → More teratogenicity occurs.
↳ Organogenesis.
Growth & development (9 wks - 9 months)

① Warfarin : causing Contradi Syndrome
(Fetal chondrodysplasia Punctata)

② Isotretinoin (Vit A) - Teratogenic

Lithium — Ebstein Anomaly
C/I in pregnancy.

③ THIOAMIDE :

Methimazole	Aplastic cutis
Carbimazole	Choanal atresia
Propylthiouracil	

↓
Bcoz of strongly binding c plasma protein
less chance of crossing placenta.

④ Alcohol — FAS (Fetal alcohol Syndrome)
⑤ Valproate — Valproate Syndrome.
⑥ ACEi — Renal agenesis
⑦ Indomethacin — Premature closure of ductus arteriosus.
⑧ Cyclophosphamide — Imperforate anus.
⑨ Busulfan & Chlorambucil (Chemotherapy)
— Induce cleft palate

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Page No.
Date: / /

⑩ Tetracycline — Bone & teeth defect. (Baby)
↓
In mother → Fulminant hepatic failure.

So, definitely C/I in pregnancy.

⑪ Thalidomide — Phocomelia.
↳ Category X drug.

⑫ Misoprostol — Useful for abortion
↳ Teratogenicity → Moebius Syndrome
↓
also ⓐ development of CN VI & VII.

⑬ DES — Female baby → Vaginal Ca (⊂ in 10 yrs of life), hypospadias ↳ Male baby.
↓
If taken in pregnancy.

Drug development:
Preclinical trials — We follow guidelines
↓
CPCSEA = Committee for the purpose of control & supervision on Experiments on Animals.

IAEC = Institutional animal ethics committe.

Clinical trail — Testing on humans.
guidelines — GCP (Good clinical practice).
HEC = Human Ethics committe.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Page No.
Date : / /

Phase I : Pharmacokinetics studies
Not efficacy.

Healthy volunteers (20-100)
Open label (No blinding)
- To know maxm tolerable dose (MTD)
MTD - Safety & tolerability.

Anti-Cancer drug by pass Phase I.

Phase II : Therapeutic exploratory
both efficacy & safety.

100-150 patients
Single blind
- To establish therapeutic efficacy.
- Dose ranging & ceiling effect.

Phase III : Therapeutic confirmatory.

Upto 5000 pts, from several centres
Double blind
- To confirm therapeutic efficacy.
- To establish the value of drug in relation.

Phase IV : Post marketing Surveillance.

ethical clearance is not required.
No time limits
To know rare & long term adverse effect.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Phase 0 : Micro dosing studies.

Pharmacovigilence:
- Assessing, ~~monitoring~~.
- Reporting
- Monitoring
- Adverse effect.

Longest acting insulin – Degludec.

Insulin Preparation

Fast onset & Short acting (Onset 10-20 min ; duration-3-4hrs)
- Insulin Lispro
- Aspart
- Glulisine

] For t/t of PP glucose.

Short acting (onset - 30 min ; duration → 5-8hrs)
- Regular Insulin
  - ↓
  - made of 6 molecule (Hexamer)
  - ↓
  - dimer
  - ↓
  - Monomer

] it takes 30 min. to reach monomer status.

given 30 min before meal.
given i.v.
Use in DKA, Hyperkalemia.

Intermediate (Onset 1-3hr ; duration → 16-20hr)
- NPH (Isophane Insulin) – Neutral Protamine Hagedon.
- Lente Insulin (30% semilente, 70% ultralente)

Page No.
Date : / /

Longer acting — Glargine (Acidic ⇒ pH=4) (can't mixed c̄ other insulin)
Detemir

Longest acting — Degludec

Adverse effect < Hypoglycemia
Wt. gain.

Inhalable insulin:
EXUBERA - Lack of acceptance by pts & physicians.

AFREZZA - Latest
Ultra rapid (c̄ in 15 min)
FDA approved.

MAO: Insulin acting on cell membr receptor
↓
Activate tyrosine kinase
↓
Shifting of GLUT4 from cytoplasm to plasma membr
↓
Influx of Glucose.

Insulin Release:
For release of Insulin - at least 30% of β-cell are functioning.
In Type I DM - imposible to release insulin
↓
All β cells are destroyed.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Sulphonyl urea
Maglitinide
- Rapaglinide
- Nateglinide

Newer drugs for DM:
GLP-1 analogues:

given S/c
- Exenatide
- Liraglutide
- Taspoglutide
- Albiglutide
- Dulaglutide

S/E - GIT (Nausea, Vomitting, diarrhoea)
Necrotising pancreatitis
Wt. loss.
FDA approved - Liraglutide given for obesity.

- All obtained from GILA MONSTER (Salivary gland Venom).

DPP4 inhibitors: Oral

Adverse effect
- Nasopharyngitis
- URTI.

- Sitagliptine → Excretion: Renal
- Saxagliptine — Renal/Hepatic
- Liraglitpine — Bile
- Vildagliptine — Renal
- Alogliptine.

Vildagliptine: S/E - Hepatic toxicity
pt. undergo periodic LFT.

PRAMLINTIDE: Islet Amyloid Polypeptide analog.
↳ given S/c
↳ Approved for Type 1 & 2 DM..

SGLT2 inhibitors:
- Canagliflozin
- Serligliflozin
- Dapagliflozin
- Empagliflozin

Common S/E – Recurrent UTI (Bcoz Glycosuria)
Risk of breast/bladder CA.

C/I – In Renal failure.

Diabetes – Oral medications.
- Sulphonyl ureas
- Biguanides
- Thiozolidinediones
- Alpha-glycosidase inhibitors
- Meglitinides
- Bromocriptine
- Cholesevelam.

Sulphonylureas

1st generation:
- Tolbutamide (6-12hr)
- Chlorpropamide (30-60hr) – longest acting
  - ↳ causes SIADH (dilutional hyponatremia)

2nd generation:	• Cholestatic • jaundice • Disulfiram like reacn
(Glyburide) Glibenclamide	
Glipizide	
Gliclazide	
Glimepiride	

Glibenclamide — Safe in pregnancy.
Gliclazide — Antiplatelet, antioxidant.

M/c problem of Sulphonylurea — Hypoglycaemia
Wt. gain.

Biguanides: Metformin
MOA = AMPK activator
↳ AMP - activated protein kinase.

Stimulates — Glucose utilisation
↙ ↘
Skeletal muscle | Adipose tissue.
- It is insulin sensitizer.

Supresses — Glycogenolysis
Neoglucogenesis

Useful in T/t of PCOD

Renal root of excretion so C/I in Renal failure.

Stop metformin 1 day before & 1 day after the Radiocontrast exposure.

N acetyl cysteine → t/t of Radiocontrast induced renal cell injury.

Metformin Reduces { Microvascular
Macrovascular events.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Page No.
Date : / /

ADR of Metformin : • GI toxicity
• Inhibit intestinal absorption of glucose, hexose, vit B12.

Metformin causes lactic acidosis in presence of kidney, liver or cardiorespiratory failure, alcoholism.

α - Glucosidase inhibitors : inhibit carbohydrate digestion in small intestine.
Acarbose
Voglibose
Miglitol

- Useful in PP blood glucose.

S/E - Flatulance
Abdominal distension
Diarrhoea.

C/I - in Renal failure.

Thiazolidinediones :
PPAR (Peroxisome proliferated - activated receptor)

activation-PPAR α
↓
Stimulate lipoprotein lipase
TGL (VLDL) ↓

PPAR β γ
- Insulin Sensitizer.
• PIOGLITAZONE
Older drugs :
Withdrawn [Troglitazone - Hepatotoxic
Rosiglitazone - CCF

PPAR α agonist : (↓ TG)

- Clofibrate – Not in use (Gall stone, GB malignancy)
- Fenofibrate (Prodrug, longest t½, ↓ LDL, ↓ Plasminogen, Uricosuric action)
- Bezofibrate
- Gemfibrozil

S/E: Myopathy, Hepatotoxicity

M/C S/E Pioglitazone – Wt. gain
Macular edema
Osteoporosis
Anemia
Bladder CA.

Drug activating both PPAR α & γ:
SAROGLITAZAR
↳ Approved in t/t of Diabetes dyslipidemia.

Statins :

HMG CoA + Acetate
HMG CoA reductase ⊖ Statins
Mevalonic acid
↓
Cholesterol ↓

Statins → ↓ Total cholesterol
Statins → ↓ LDL (by upregulation of LDL receptor in liver)

S/E → Myopathy
Hepatotoxic
Teratogenic

Co-enzyme Q given c statins to control muscle weakness.

Liver enzyme goes more than 3 times (N)
- Stop Statins.

COLESEVELAM
↓
Only cholesterol lowering agent in pregnancy.

#

PCSK9 inhibitor:
ALIROCUMAB, EVOLOCUMAB] Monoclonal antibodies for Hypercholesteremia.

Nicotinic acid (Vit B_3) – Niacin
↓ LDL
↓ LP(a)
↑ HDL
S/E – Cutaneous flushing → (Niacin promotes the synthesis of vasodilatory PGs)
↓
So, Aspirin added c Niacin to control flushing.
Hyperuricemia
Diabetes (causing Insulin Resistance)
Hepatotoxicity

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Page No.
Date : / /

EZETIMIBE : inhibit cholesterol absorption in intestine.

Bile acid Sequestrants :
- Cholestyramine
- Colestipol
- Colesevelam
  - ↳ approved for t/t of DM.

MIPOMERSEN : Newer drug
Given S/C Once in a week.
Useful for lowering cholesterol.

PROBUCOL : Inhibits LDL oxidation

GUGULIPID : ↓ LDL (Not use – Diarrhoea)

CETP inhibitors : (Cholesterol ester transport protein)
TORCETRAPIB
Dalcetrapib
Evacetrapib
Anacetrapib.

MTP inhibitor (Microsomal triglyceride transporter protein inhibitor)
LOMITAPIDE

AVASIMIBE : Inhibit conversion cholesterol to cholesterol ester.
ACAT-1 inhibitor.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Page No.
Date : / /

Antithyroid drugs:

Histology of thyroid gland –

Steps of Synthesis:

1. Iodide uptake
2. Oxidation of iodine & formation of Iodine
3. Organification (Iodine + Thyroglobulin)
4. Coupling — MIT + DIT = T_3
   DIT + DIT = T_4

T_3 & T_4 Stored in follicle for 3-4 days.

THIOAMIDES:

- Propylthiouracil (also inhibit peripheral conversion of $T_4 \rightarrow T_3$) → Rapid control of hyperthyroidism
- Carbimazole (Prodrug)
- Methimazole

→ active form

- inhibit synthesis of T_3 & T_4
- inhibit formation of new thyroid hormone
- lag period of 1-3 wks.

M/C S/E of Carbimazole & Methimazole : Maculopapular rash (4-6%)

Agranulocytosis (0.1-0.5%)

* Severe Hepatitis – PTU

Causing teratogenicity – Fetal aplastic cutis
Choanal atresia.

Hepatotoxic – PTU

PTU – Used in emergency hyperthyroid crisis.
– may be safe in pregnancy

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

LUGOL's IODINE :

MOA – Inhibits release of T_3 & T_4 from follicle.

- Fastest acting antithyroid drug.
- Used in post-op preparation.
- Reducing vascularity.

S/E – Iodism – Acne form skin rash.

Peripheral conversion of $T_4 - T_3$ inhibitor:

β-Blockers
Amiodarone
Propyl thiouracil
Dexamethazone
Ipodate

} By inhibiting 5-DE Iodinase.

Iodide uptake inhibitor :

POTASSIUM PERCHLORATE
THIOCYANATE

- Used in t/t of iodide induced hyperthyroidism.

Radioiodine therapy :

I^{131} → $t_{1/2}$ = 8 days
↳ emits 2 rays < γ, β

Penetrating power = 0.5 – 2mm.

γ-Ray useful for diagnostic purpose
β-Ray " " therapeutic "

C/I – Pregnancy, Young children, Ophthalmopathy.
Not useful for t/t of Medullary Ca thyroid.

Newer drug for T/t of Medullary Ca thyroid:
LENVATINIB – DTC
VANDETANIB – MC

Non-thyroid drug causing Hypothyroidism:
LITHIUM (Stop release of T_3 & T_4 from follicle)
AMIODARONE] (inhibit conversion of $T_4 \rightarrow T_3$)
PROPRANOLOL]
ETHIONAMIDE] inhibit synthesis
PAS]
SODIUM NITROPRUSSIDE – inhibit uptake of Iodide.

Growth Hormone Release inhibitor
– for t/t of Acromegaly
OCTREOTIDE] S/C
LANREOTIDE]

GH Receptor inhibitors –
PEGVISOMANT – S/C

D_2 analogue –
BROMOCRIPTINE] oral
CABERGOLINE]

Octreotide – 40 times more potent than Somatostatin
longer acting – 12hr.
Given (S/C) or i.v.
Never orally.
Uses – Acromegaly
Carcinoid [Diarrhoea]
AIDS
Portal HTN (Bleeding esophageal varices)

S/E – Gall stone
Vit B_{12} deficiency (Megaloblastic anemia)
Rarely DM also.

Dwarfism : T/t
GH releasing factor analogue :
SERMORELIN
HEXARELIN
TESAMORELIN
↳ For lipodystrophy in HIV pt.
↓ Abdominal fat.

GH analogues
SOMATREM] also used in – AIDS related wasting
SOMATROPIN] Turner Syndrome.
Pituitary dwarfism.

S/E – Insulin resistance – Type 2 DM
↑ ICT.
↳ To rule out Papiledema
→ Fundus exam^{n}

Analogue of IGF + IGF binding protein 3
MECASERMIN (S/c) ↓
to maintain stability.

S/E – Hypoglycemia

Uterus : OXYTOCIN
- ↑ force / frequency of contraction.
- ↑ contractility to fundus & body, lower segment not contracted unlike ergometrine & methyl ergometrine.
- Useful in induction of labour.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Control post partum hemorrhage
Useful in ejection of milk.

ATOSIBAN – Oxytocin Receptor Antagonist.

Tocolytic of choice in heart ds – $MgSO_4$

ZOLENDRONATE – Bisphosphonate given i.v.
once in a year
DOC for postmenopausal osteoporosis.

NATALIZUMAB – Useful for Multiple sclerosis
given once in a month.

MIPOMERSEN – ↓ cholesterol level
given s/c once in a week.

DALBAVANCIN – Glycopeptide
Antibiotics
Give once in 6-10 days.
Single dose act 6-10 days

Drugs for Osteoporosis

Drugs inhibit Osteoclast:

- Bisphosphonates
  - ↳ DOC: Zolendronate
- Estrogen & SERM
- Cinacalcet
- Calcitonin
- Thiazide diuretics
- Denozumab - Rank L antibody.
  - ↳ Monoclonal antibodies

Drugs promoting osteoblast:

- Calcitriol (Active form of Vit D)
- Androgens & Anabolic steroids
- Calcium
- Parathormone
  - (hPTH 1-34) → teriparatide.
    - ↳ PTH analogue
    - given only for 1yr (Max^{m} 2yr)
    - long term therapy cause Osteosarcoma.

STRONTIUM RANALATE

- ↳ Dual action < promoting osteoblast
  - inhibiting osteoclast.

ZOLENDRONATE:

- Anti osteoclastic activity
- Interference on mevelonate pathway - antitumour activity (CML)
- Faster acting.
- DOC in Hypercalcemia (osteonecrosis of jaw.
- Also used in Paget's ds.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Page No.
Date : / /

- Less venous irritant
- Renal toxicity.

S/E - • Thrombophlebitis
- During infusion fever + chills "Infusion reac" "
• Nephrotoxicity.
• Osteoporosis of jaw bone.

M/c drug for • steroid induced osteoporosis - Bisphosphonate.
Osteonecrosis of Neck of femur - S/E of steroid.

STEROIDS:

1. GLUCOCORTICOIDS:

CLASS A → Short acting (Duration < 12hrs)

	Gluco	Mineralo
Max^m mineralocorticoid activity → Hydrocortisone	1	(1)
Cortisone (least potent G)	0.8	0.8

CLASS B → Intermediate acting (duration 12-36 hrs)

Prednisone	4	0.8
Prednisolone	4	0.8
Methyl prednisolone	5	0.5
Triamcinolone	5	0
Deflazacort	5-6	0

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Page No.
Date : / /

CLASS C : Longer acting (> 36 hrs)

Paramethasone	10	0
Betamethasone (Most potent G)	25	0
Dexamethasone (Maxm G)	30	0

Mineralocorticoids :

- Natural.

Aldosterone	0	3000

- Synthetic

DOCA	0	20
Fludrocortisone	10	250

Maxm glucocorticoid action — Dexamethasone
Maxm mineralocorticoid action — Aldosterone
G c max min — Hydrocortisone
Least potent G — Cortisone
Most " " — Betamethasone
Maxm topical action — Triamcinolone
Selective glucocorticoid (No mineralo) — TPDB
Selective Mineralocorticoid (NO Gluco) — DOCA

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Steroid — Anti inflammatory
Anti cancer
Immunosuppressive

Anti-inflammatory action of steroid
- By inhibiting Phospholipase A_2

ZILEUTON — inhibit lipooxygenase
Not in use
Severe. hepatotoxic
NSAID — Inhibit Cyclooxygenase.

Steroid having anti-cancer activity:
- Apoptosis of T & B cells
- Useful for Lymphoma.

Steroid having Immunosuppressive action:
- Inhibit IL-1 & IL-6
- Also catabolism of IgG.

Methyl prednisolone — Used in pulse therapy.

ACTH
Cosyntropin — Infantile Spasm.

Adrenal cortex → Medulla – Pheochromocytoma
Adrenal cortex – Cushing Syndrome

Drug useful for t/t of Cushing Syndrome:
- Metyrapone (11β-hydroxylase)
- Ketoconazole
- Mitotane
- Aminoglutethimide
  ] – Chemical adrenalectomy
- Trilostane
- Etomidate (General anesthetic)

PASIREOTIDE – Somatostatin analogue
useful in t/t of Cushing Syndrome.

Erectile dysfunction:

① Selective PDE5 blocker:
- Sildenafil
- Vardenafil
- Tadalafil – longest acting
- Avanafil

- PDE5 enzyme is involved in metabolism of CGMP.
- PDE5 blocker by blocking CGMP metabolism causes vasodilation.

Acute adverse effect – Headache
Flushing
Hypotension
Nasal congestion

Long term (chronic) therapy causes Blue vision defect.
↓
blocking PDE6

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Drug interaction b/w Sildenafil & Nitrates:
Nitrates shouldn't be given c̄ Sildenafil bcoz risk of severe hypotension.

Other drug for erectile dysfunction:
Apohorphine (D4 agonist)
Trazadone (Atypical antidepressant)
Avaptadil (VIP – Vasoactive intestinal polypeptide)
Ketanserin (Serotonin antagonist)
Naltrexone (Opoid Antagonist)
~~Gingseng~~ Ginseng
Kava
Gingko

Injectable therapy for Erectile dysfunc^{n}:
Alprostadil
Phentolamine
Papaverine.

Drugs useful for t/t – Premature ejaculation.
- SSRI
- PDEV inhibitors

For delayed orgasm:
Amantidine
Buspirone
Cyproheptadine.

For sexual stimulation:
- Yohimbine
Zinc
Ginkgo biloba
~~Gingseng~~ Ginseng.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Page No.
Date : / /

ANTI ANGINAL DRUGS

Stable Angina
Unstable Angina
Vasospastic angina (Prinzmetal Angina) (variant angina)

Cause < Reduction in O_2 supply
↑ O_2 demand.

Anti-anginal drugs

Vasodialator — Nitrates, K^+ channel opener; CCB

Cardiac depressant — β-blocker

Pathway of FA oxidation inhibitors (pFox)

\# Fatty acid
↓ oxidation ← ⊖ TRIMETAZIDINE, RANOLOZINE
Free radical
↓
Cytotoxicity to myocardial cell.
Angina, Arrhythmias

TRIMETAZIDINE, RANOLOZINE → Anti-oxidant
~~Na^+ channel blocker~~

S/E – GI toxicity (M/c)
Thrombocytopenia
Liver dysfunc^n
Risk of movement disorder – C/I in Parkinsonism
QT – ~~prolongation~~ prolongation –
Excretion by Renal pathway – C/I in Renal failure

Page No.
Date : / /

NITRATES

Short acting	Intermediate acting	Long acting	Longest acting
• GTN	• Isosorbide dinitrate (2-3 hrs)	• Isosorbide mononitrate (6-10 hrs)	• Pentaerythritol tetranitrate (8-12 hrs)
• Amyl Nitrite (Shortest)			

For acute attack – GTN, Isosorbide dinitrate
S/L

Least 1st pass metabolism – Isosorbide mononitrate.

S/L drug – Lipid soluble
Non ionised

Sk in rasher – Pentaerythritol tetranitrate

MOA of nitrates:
– Nitrates acting on Cisteine receptor, they release NO. NO activate Guanyl cyclase.

↓ ↓

Vasodilation ⊖→ CGMP (2nd Messenger)

⊖→ PDES ↓

Sildenafil SMR

NO independent – direct Guanyl cyclase activators:
RIOCIGUAT
CINOCIGUAT
– Useful for t/t of Primary pulm. HTN.

CGMP normally undergo inactivation by PDES enzyme.
So, PDES inhibitor = Sildenafil group of drug.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Nitrates may get tolerance due to down regulation of receptors.

Maxm Tolerance — i.v. infusion
& Transdermal patches.

Action of Nitrates :

Visceral smooth muscle — Relaxed
↳ Useful for t/t of Biliary colic pain
↳ Useful for t/t of Achalasia cardia

Vascular smooth muscle — Vasodialator
↓
predominantly Venodialator
- Peripheral pooling of blood
↓
maxm ↓ in Preload.
mild ↓ of afterload.
↓
↓ O2 demand
↓
Reduce angina.

Uses : Cardiac uses : Angina
MI
CCF

Non-cardiac uses : Biliary colic pain
Achalasia cardia
Cyanide poisoning.
↳ By formation of Methemoglobinemia.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Page No.
Date : / /

ADR – Throubing Headache (M/c)
Hypotension
↳ Reflex Tachycardia (due to Sympathetic stimulation)
↓
So add β-blocker.
Tolerance
Methemoglobinemia
Rashes

Drug interaction b/w Nitrates & Sildenafil :
– Not combined together bcoz it cause severe hypotension.
Gap of 8–10 hrs should be maintained.

Sodium Nitroprusside :
– Only i.v. route
– Short acting <10 min
Indication – Hypertensive emergency.
Acute aortic dissection.

– Drug is sensitive to light
↳ cover c black towel.
– Containing cyanide (Thiocynate)
↓
Risk of Hypothyroidism
– C/I in pregnancy.
–

β-blockers :
• ↓ Work load of cardiac.
• C/I in variant angina.
• Abrupt withdrawal ppt. angina.
• β-blocker + GTN = to prevent Reflex Tachycardia.
• Controls catecholamine activity
↓

Role of β-blocker on MI :

Reduces size (zone) of infarction
Anti arrhythmic action
Reduces mortality.

CCB :

Chemical Type	Chemical names
Phenylalkylamines	Verapamil
Benzothiazepines	Diltiazem.
1,4-Dihydropyradines (DHP)	Nifedipine Nicardipine Nimodipine Amlodipine Nitrendipine (NO releasing property)

Nevibolol, Nepradiol] β-blocker having NO releasing property.

DHP :

Site of action – Peripheral blood vessel
↓
Vasodilatation
– Useful for t/t of HTN & PVD.

↳ Maximally arterial dilatation.
↳ maxm ↓ in PVR.

ADR → Hypotension
Reflex Tachycardia
Ankle edema (Amlodipine maxm cause Ankle edema)
Constipation

Page No.
Date : / /

Nicardipine (long acting)] Approved in Hypertensive emergency.
Clevidipine (short acting)] given i.v.

Non-dihydropyridines: Verapamil
Diltiazem.

Verapamil:
Site of action: AV node (Most imp.)
SA node

Action → Bradycardia
→ Anti arrhythmic agent.

Uses – Atrial Tachyarrhythmia (AT)
SVT (Supra Ventricular Tachyarrhythmia)

ADR – Bradycardia
Block AV conduction – Prolongation of PR interval.
Ankle edema
Constipation

C/I – WPW syndrome.

Diltiazem:
Uses – HTN
Angina
Arrhythmias (SVT/AT)

CCB having anti-arrhythmic property < Verapamil] class IV antiarrhythmic
Diltiazem]

Nimodipine: Cerebro-selective CCB
Useful for t/t of Sub-arachnoid hemorrhage (SAH)
↓
The purpose of given Nimodipine is to prevent Reflex ischemic brain damage.

≡ FASUDIL – Rho Kinase inhibitor
Use – SAH
PHT (Pulm. HTN)
Angina.

CCB useful in Prophylaxis of Migraine – Verapamil
Flunarizine
↓
T-type of CCB
Na^+ Channel blocker
Anti-oxidant.

K^+ channel openers:
Hydralazine, Minoxidil, Diazoxide – Arteriolar dilator – Anti-hypertensive

Nicorandil (Anti-anginal)

Adenosine (PSVT) → DOC

Nicoraudil: NO releasing property
Anti-anginal
S/E → Aphthous ulcer
Headache

Hydralazine :
- T/t of HTN-emergency in pregnancy
- NO releasing property
- Metabolism by Acetylation

S = Sulphonamide
H = Hydralazine
I = Isoniazid
P = Procainamide.

- Cause RA/SLE

Minoxidil :
- Prodrug
- Active form → Minoxidil Sulphate.

Uses → HTN
Alopecia

Diazoxide :
- causing hyperglycemia by inhibiting insulin release from β-cell of pancreas.

Use - HTN
Insulinoma.

Phenytoin - also inhibit release of insulin.
Poor man drug for Insulinoma.

IVABRADINE -
- Causing Bradycardia.
- Na^+ Channel blocker (Funny Current)
- Reduce HR.

Invo indication < CCF
Angina.

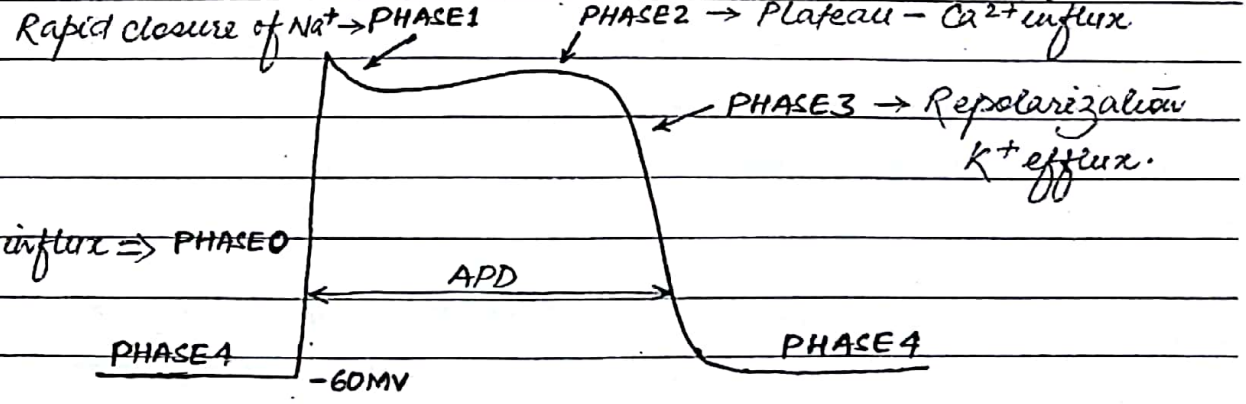
S/E - On chronic therapy — Causes Luminous phenomena.
(Visual disturbance)

Hemoralopia - Trimethadione (Withdrawl - due to Nephrotoxicity)
↓
Day blindness

Reperfusion - Thrombolysis / PTCA

Drug eluting Stent:
SIROLIMUS (Immunosuppressant)
PACLITAXAL (Anti cancer drug additional immunosuppressant)
↓
used c stent to decrease rejection.

ANTI-ARRHYTHMIC DRUGS:



PHASE 3 → T WAVE
PHASE2 → ST segment
PHASE 0,1 & mid phase of 2 → QRS
APD (Action potential duration) → QT interval.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Page No.
Date : / /

Any drug having K^+ channel blocking property
— Cause QT prolongation

- Class Ia & class III drug having K^+ channel blocking property causing QT prolongation.

Classification : Vaughan Williams
Class I - Na^+ channel blocker
↳ Class IA, IB, IC
Class II - β-blocker

Class III - K^+ channel blocker.

Class IV - CCB

Unclassified & Miscellaneous agent
↓
Adenosine
Atropine
Digoxin
Magnesium Salfate
KCl

Class IA :
- Block Na^+ channel + K^+ channel block
- Having risk of causing QT prolongation.

Eg: Quinidine
Procainamide
Disopyramide.
] Anti vagal action

Quinidine –

Origin – Cinchona bark

↳ Symptom – [redacted] Cinchonism

↓

Tinnitus

S/E → Diarrhoea

Hypotension (Bcoz α blocking property)

Hypoglycemia (Bcoz Insulin releasing property)

SMR

Thrombocytopenia.

Drug interaction: Quinidine + Digoxine

Quinidine interfare renal excretion of Digoxin.

∴ aggravating plasma level of Digoxin

↓

∴ Digoxin toxicity.

Procainamide:

S/E – Undergo metabolism by Acetylation

SLE.

Disopyramide:

Highest anticholinergic action.

Dry mouth, constipation, Retention of urine.

↓

Not safe in elderly male c BPH.

Class IB:

Na^+ block + K^+ opening.

– Never causes QT prolongation.

Site of action → Mainly acting on Bundle of HIS.

Rt. Bundle, Lt. Bundle & purkinje fibre.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Used only for t/t → Ventricular arrhythmias (Tachycardia)

eg: Lignocaine (Lidocaine)
Mexiletine
Phenytoin
Tocainide.

Mexiletine:
- Lignocaine derivative
- Useful for t/t Ventricular arrhythmias.
- Used for Diabetic neuropathy pain (Unlabeled Use)
- Used for Phantom limb pain

ADR - Severe Nausea & Tremor.

Phenytoin:
- Antiepileptic

USE - t/t of Digitalis (Digoxin) induced VT

Tocainide:
Bcoz of causing Agranulocytosis it is not used.

Lignocaine:
- Class IB drug
- Never given orally bcoz undergo extensive 1st pass metabolism
- Given i.v.
- Lipid soluble, Cross BBB.

S/E - Convulsion
↳ Sign - Nystagmus (1st sign)
1st Symptom - Circum oral paresthesia

Use — VT (Ventricular Tachycardia)
VF (Ventricular Fibrillation)
Digoxin induced VT (DOC: Lignocaine)

↳ # Class IB drug has no role in atrial arrhythmias

Class IC:
- Na^+ blocking + Negligible effect on K^+ channel.
- Maxm pro-arrhythmic property.
- Non commonly used.
- Only for [redacted] antiarrythmic drug causing arrhythmia.

Flecainide (DOC: for Acute WPW)
Encainide
Propafenone
Moricizine

PROPAFENONE:
- Also β-blocking property.

Class III: K^+ channel blocker
- Prolong APD → QT prolongation

AMIODARONE:
- Iodine containing anti-arrhythmic drug.

Multi MOA: · K^+ channel blocking
Na^+ channel blocking
β-Blocker property
CCB property.

∴ Broad spectrum Anti-arrhythmic.

Half life = 53 days.

USES : All type of arrhythmias
Ventricular & Supraventricular arrhythmias.

ADR :

PLz = Photosensitivity, Pigmentation of skin (Gray-blue)
Check = Corneal deposition (Whorl like pattern cornea)
PFT = Pulm. fibrosis, Peripheral neuropathy.
LFT = Liver damage, Pseudo alcoholic liver injury & Mallory hyline bodies.
TFT = Hypothyroidism
- due to inhibition of peripheral conversion of $T_4 \rightarrow T_3$
Hyperthyroidism

Whorl like pattern cornea — Cornea verticillata or Vertex Keratopathy.

[Pseudo lymphoma — Phenytoin
Pseudo jaundice — Rifabutin

Amiodarone causing Hyperthyroidism due to :
Hypothyroidism : inhibition of peripheral conversion of $T_4 \rightarrow T_3$.
Hyperthyroidism
① Contain Iodine → Iodine help in synthesis of T_3 & T_4
② Can cause inflammation of follicle.

In each 200mg tablet there is 75mg of iodine.
Rx : Inhibit iodide trapping
• Perchlorate
• Thiocyanate.
For inflammation — Rx : Dexamethasone (Steroids)

Class III drugs:
- Amiodarone
- Dronedarone (Noniodine)
- Bretylium (Chemical defibrilator)
- Sotalol
- New drug: Dofetilide
- New drug: Ibutilide (FDA approved for conversion of AF-SR) — i.v.
- New drug: Vernakalent

Class IV: CCB
- Verapamil (Most potent)
- Diltiazem

Miscellaneous drugs:

ADENOSINE:
- Given i.v., short acting, Rapid infusion (Bolus)

Site — Close to heart.
- DOC for SVT
- It is also called Endogenous epileptic.

Antagonist — Methyl xanthine - theophylline

Agonist — Dipyridamole
Cause ↳ Coronary Steal Phenomenon.

For Acute SVT: i.v. Adenosine
i.v. Verapamil.
↳ Prefer in Asthma & SVT.

To prevent recurrance of SVT: Oral β-Blocker
Oral Verapamil.

$MgSO_4$:

USE → ① CNS

↳ Long QT syndrome

Congenital	Acquired.
β-blocker (Propranolol)	$MgSO_4$

USE: ↳ Digitalis intoxication

↓

Hypokalemia
Hypomagnesimia → Give $MgSO_4$
Hypercalcimia

② Respr System
USE : Bronchial asthma

③ GIT (laxative property)
USE : Constipation.

④ Ortho (anti inflammatory property)
USE: Synovitis.

⑤ Obs. & Gyn.
USE: Eclampsia.

S/E – Diminished deep tendon reflex (M/c)
Rarely Respr failure.

Safety limit – 4m Eq/L
If >7m Eq/L → Patellar reflex ↓
>14m Eq/L → Respr failure.

Antidote — Calcium Gluconate.

ATROPINE:
- Anti-cholinergic agent.
- Causing Tachycardia.

USE — Bradycardia or Heart Block.

DIGOXIN: Already discuss

Cardiac glycosides:

	Digoxin	Digitoxin
T1/2	40hrs	5-7 days
Route of excretion	Renal	Hepatic
Plasma conc^{n}	0.8-1.5 ng/ml	15-30 ng/ml.

- Both have narrow therapeutic index i.e. Unsafe & need monitoring.

Digoxin S/E: Non-Cardiac S/E
- Nausea & Vomitting (M/c)
- CNS depression
- Yellow vision defect (Xanthopsia)
- Gynaecomastia (In male)

Cardiac S/E
- Atrial Tachyarrhythmia (AT)
- AV block
- VT (Ventricular Tachycardia)
- Ventricular Bigeminy (M/c)
- Non-paraxysmal AT & Variable AV block
  ↳ Most characteristic arrhythmia.

Page No.
Date : / /

For t/t digoxin induced AT — Propanalol.

Atropine → AV Block.
Lignocaine → VT

No role of Hemodylysis in digoxin toxicity bcoz large Vd.

Antidote for digoxin toxicity — Digibind.
↓
Check S. K^+, Mg^{2+}, Ca^{2+}

Page No.
Date: / /

DIURETICS.

In the PCT → Carbonic anhydrase
↓
Reabsorption of $NaHCO_3$ (85%)
Reabsorption of NaCl from urine (60%)

Thin descending limb — Absorption of H_2O
↳ Concentrating Segment

Thick ascending limb → $Na^+ - K^+ - 2Cl^-$ Symporter
↓
Absorption of $Na^+, K^+, Cl^-, Ca^{2+}, Mg^{2+}$.
(Diluting segment) (25%)

DCT → $Na^+ - Cl^-$ Symporter
↓
Reabsorption of NaCl (10%)
Reabsorption of Ca^{2+} (+PTH)
↑
c help of

CT → Reabsorption of NaCl (c help of aldosterone) (5%)
Secretion of K^+ & H^+
Reabsorption of H_2O (c help of ADH)

Primary Hyperaldosteronism (Conn's Syndrome):
↑↑ Aldosterone
C/F – HTN
Hypokalemia
Metabolic alkalosis.
For t/t HTN → K^+ sparing antidiuretic
↳ Spironolactone.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Page No.
Date : / /

Carbonic anhydrase inhibitors:

Acetazolamide
Dorzolamide
Brinzolamide
} Non-competitive & Reversible.

Site of Action – PCT
MOA – Inhibit Carbonic Anhydrase.

ADR – ① Loss of HCO_3^- → Metabolic acidosis.

Acetazolamide causing Alkaliurea
↳ So used in Alkalation of urine.

② Max^m potassium loss.

CA inhibitor also acting on collecting duct – it inhibit tubular secretion of H^+ → so cause Metabolic acidosis & massive Hypokalemia.

CA inhibitor are Sulpha derivative:
SE – Hypersensitivity
Bone marrow suppression.

C/I – liver disease (hepatic encephalopathy)
COPD
Metabolic acidosis.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Loop Diuretics : High ceiling diuretic (↑ dose → ↑ diuretic action)

site of action : Thick ascending loop of Henle

↓

MOA : Inhibiting $Na^+ - K^+ - 2Cl^-$ symport

↓

loss of Na^+, K^+, Cl^-, Ca^{2+}, Mg^{2+}

Eg : Furosemide → Vasodilatory action (USE : RF, LVF)

Bumetanide → Most potent

Mersalyl → Kidney damage (Not in use)

Ethacrynic acid → Highly ototoxic (No CA enzyme inhibition)

Torsemide → Longest $t_{1/2}$

Role of Furosemide in Renal failure :

Furosemide promote the synthesis of vasodilatory PG

↓

By ↑ intra renal blood supply

↓

Improving Renal failure

NSAID + Furosemide → NSAID is not given c Furosemide in Renal failure pt. bcoz it inhibit synthesis of PG.

Diuretics of choice in the presence of RF

Choice – Furosemide

ineffective – Thiazides

Exception – Metolazone

C/I – K^+ sparing drugs.

Role of loop diuretics in heart failure:

Furosemide – Only Relief symptoms of CHF.
↓ diuretic action
Main mech^ : Vasodilation
↓
Bcoz of vasodilation furosemide (i.v.) rapidly relief breathlessness in CHF.

S/E of loop diuretics:

Water loss	Electrolyte imbalance	Metabolism	Miscellaneous.
Profound ECFV Depletion	Loss of Na^+, K^+, Cl^-, Ca^{2+}, Mg^{2+} ↓ Calciurea (Risk of kidney stone)	(Hyperuricemia) Hyperglycemia Hyperlipidemia. ↓ Exception: INDACRINONE (Ethycrinic acid derivative) ↓ Uricosuric agent.	Metabolic alkalosis Ototoxicity (Irreversable) → Other drugs: Aminoglycosides Cisplatin Vancomycin Erythromycin

Drug interaction: Loop diuretics + Arrhythmia
– loop diuretics by causing hypokalemia & hypomagnesimia → causing digoxin toxicity.

Thiazide diuretics:

Site of action : DCT

MOA : ① Inhibiting $Na^+ - Cl^-$ Symport.

② Promotes Reabsorption of Ca^{2+}

↓

Causing hypercalcemia (Urine Ca^{2+} ↓)

↓

Safe for Renal stones.

③ Also having antidiuretic activity.

eg: Indapamide → Vasodilatory action (No CA enzyme inhibition)
Chlorthalidone → longest acting
Metolazone → Useful even in severe RF.

A/c to JNC guidelines, the 1st line drugs are:

Thiazides - type diuretic
CCB
ACE inhibitors
ARB's

Therapeutic effect:

As a diuretic — ① T/t of Mild edema
② T/t of HTN

As a anti-diuretic — T/t for Nephrogenic DI.

If ↓ Ca^{2+} Excretion → Idiopathic hypercalciuria or William Syndrome
→ T/t of Calcium Nephrolithiasis

Adverse effects:

Water loss	Electrolyte abnormality	Metabolism	Miscellaneous
ECFV depletion	Hypokalemia Hyponatremia Hypercalcemia ↓ Use in t/t: Osteoporosis	Hyperuricemia (Hyperglycemia) ↑ LDL ↓ Thiazide causing insulin resistance as well as inhibiting Insulin release ↓ HTN c̄ Hyperlipidemia (So don't use thiazide)	Metabolic alkalosis Impotency (Erectile dysfunc^n) ↑ β-blocker also

K^+-Sparing diuretics

Aldosterone antagonist
- Spironolactone (M/c) ←
- Canrenone (Active metabolite)
- Eplerenon (No gynaecomastia)
- Drospirenone (Progesterone)

ENa channel inhibitor → Causing Hyperkalemia.
- Amiloride
- Triamterene.
- Pentamidine
- Trimethoprim.
  - → Anti-microbial having ENa channel inhibitor property.

ENaC:
- Na^+ from urine in CD is absorbed by ENaC.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Spironolactone:

MOA: One & only drug acting on interstitium.

MOA of Amiloride: Amiloride acting from lumen & blocking ENaC.

Therapeutic uses of Spironolactone:

↓

Blocks Aldosterone

1. T/t for Primary Hyperaldosteronism (Conn's)
2. (DOC) T/t for Edema of liver cirrhosis (Ascites)
3. T/t for Heart failure.

Disease modifying HF → Spironolactone.

Adverse effects:

(M/C) < Hyperkalemia
Metabolic acidosis.

Long term effect in male – Impotence, Gynecomastia ← Beos of Anti androgenic action.

in female – Menstrual irregularities.

Drug causing Gynecomastia:

D = Digoxin
I = INH
S = Spironolactone
C = Cimetidine
K = Ketoconazole
O = Oestrogen / anti-androgen → Finasteroid

↓

T/t of male pattern baldness.

Drug useful in painful Gynaecomastia — Tamoxifen. (DOC)

Therapeutic effect of Amiloride :

↓

Block Na^+ channels

① T/t of Liddle's Syndrome (↑ ENaC)
② T/t of lithium induced DI
③ T/t Aerosol — Cystic fibrosis. (Mechⁿ not known)

Mannitol — Osmotic diuretics
Site — LOH & PCT
Useful for T/t of ① Glaucoma (Given i.v.)
② Cerebral edema
③ Cisplatin toxicity.
↳ Antidote — Amifostine.
Mannitol added c cisplatin to control Nephrotoxicity.

C/I — Pulm. edema (LVF)
Cerebral Hemorrhage

S/E — Hyponatremia
Headache.

ANTIDIURETICS

- ADH (Vasopressin)

V_2 Receptor:

location → V_2 seen on medullary portion of collecting duct

Action → Water Reabsorption

• Also seen on Vascular epithelium

Action → Releasing VWF & factor VIII

Desmopressin:

- Synthetic analogue of Vasopressin acting on V_2

USES: DOC for Cranial diabetes insipidus

DOC for Nocturnal Enuresis.

Useful for Hemophilia

" " Bleeding due to deficiency of VW-factor.

V_1 Receptor:

- Seen on Vascular smooth muscle

Action → Vasoconstriction

V_1 analogues: Synthetic

Terlipressin, Felypressin, Lypressin — Useful to control esophageal varices

DOC: Octreotide

Prophylaxis DOC: Propranolol

Terlipressin added c Lignocaine to prolong the action.

Selective V_2 antagonist:

Oral — Lixivaptan, Mozavaptan, Tolavaptan — DOC for SIADH

Selective V_1 antagonist:

Relcovaptan – Useful for HTN

Nelivaptan – V1b blocker

↓

Undergo clinical trail for t/t of Anxiety.

Non-selective V_1 & V_2 antagonist:

CONIVAPTAN ($V_2 > V_1$)

↳ USE: SIADH

Given i.v.

HEMATOLOGY

Thrombolytic Agents:

MOA – Plasminogen activator ⟶ PLASMIN
(Profibrinolysin) (Fibrinolysin)

eg:
- Streptokinase
- Urokinase
- Alteplase
- Reteplase
- Tenecteplase

M/C S/E – Bleeding

Antidote of Thrombolytic drugs:

EACA (Epsilon Aminocaproic Acid)

Tranexamic acid

Aprotinin.

WARFARIN : Inhibiting vit K dependent clotting factor (II, VII, IX, X)

Protein	Half life
Factor II	72 hrs
VII	4-6 hrs
IX	24 hrs
X	44 hrs
Protein C	8 hrs
Protein S	30 hrs.

- For full benefit of warfarin occurs, wait for 3 days.
- Not used in Acute DVT
- Useful in prophylaxis of Chronic DVT.
- Normal func^{n} of Protein C → inhibiting Factor V & VIII

↑⊖ ↓

SE of warfarin → Hypercoagulation.

↓ → Dermal Necrosis.

due to Protein C inhibition. → Purple toe syndrome

Warfarin therapy:

Narrow therapeutic index (Only INR done)

Two isomers < R
S (Active)

CYP2C9 → involved in metabolism of Warfarin
Duration of action → 5 days.
It undergo Zero Order Kinetic

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Warfarin: INR = Patient PT / Control PT

(N) → 2-3

Prosthetic Valve → 2.5-3.5

Long term → 1.5-1.9

C/I in Pregnancy → Teratogenic

↓

Contradi Syndrome

Fetal Chondrodysplasia Punctata.

Antidote of Warfarin —

Natural Vit K_1	Vit K_2	Vit K_3
Phytonadione	Menoquinone	Menadione

↓

Takes about 24hrs to reduction INR

For immediate hemostasis — Fresh frozen plasma (FFP)

New Oral drugs — direct IIa inhibitor

Ximelagatran (Cause severe hepatotoxicity) - Not used.

Dabigatran

New oral drugs : Direct Xa inhibitors

Apixaban

Rivaroxaban

Edoxaban

Betrixaban

Injecting Anticoagulant acting Via Antithrombin III pathway:

Heparin (inhibit Xa; IIa)
LMWH (inhibit Xa)
↳ eg: Enoxaparin
Dalteparin
Tinzaparin
Nadroparin

Other injectable drugs acting via Antithrombin III but only inhibiting Xa:
Fondaparinux
Idraparinux
Idrabiotaparinux —Antidote→ Avidin

Specific antidote for Heparin — Protamine Sulphate
It is chemical antagonism.
1mg of Protamine sulfate
↓
Neutralizes 100U of Heparin.

Direct Xa inhibitor — Otamixaban
(Undertrail)

Injectable — Direct Thrombin (IIa) inhibitor

Bivalent:	Monovalent
Hirudin	Argatroban (Biliary excretion)
Bivalirudin	Melagatran
Lepirudin	

- These drugs are used in pt. who developed Heparin induced Thrombocytopenia.

Adverse drug reac^{n} :

Heparin	Warfarin
A = Alopecia	A = Alopecia
B = Bleeding	B = Bleeding
O = Osteoporosis (Supplement Ca)	O = Oral (GI intolerance)
U = Uticaria (Hypersensitivity)	U = Dermatitis
T = Thrombocytopenia	T = Teratogenicity.
Rarely Hyperkalemia	

Monitoring :

Anti platelet drugs (Aspirin) — Prolongs BT
Heparin (Intrinsic pathway) — Prolongs aPTT
Warfarin (Extrinsic ") — Prolongs PT
LMWH — No need of monitoring
If monitor then Anti factor Xa ↓
In Renal failure & Obese pt.

ANTI PLATELETS

Drugs inhibiting Synthesis of TX-A_2 :

Selective COX-1 inhibitor — Low Dose Aspirin (50mg-160mg)

Thromboxane synthase enzyme inhibitor — DEZOXIBEN

Drugs inhibiting TX-A_2 Receptor :

IFETROBAN
SULTROBAN
DALTROBAN
LOSARTAN (ARB having Antiplatelet action)
VAPIPROST

Drugs inhibiting synthesis of TX-A_2 & blocking action of TX-A_2 receptor: Dual action
PICOTAMIDE

Newer drug: SERATRODAST (Thromboxane A_2 antagonist).

ADP ($P2Y_{12}$) blockers:
- Ticlopidine – Prodrug
- Clopidogrel – Prodrug
- Prasugrel – Prodrug
- Ticagrelor
- Cangrelor – Given i.v.

Ticlopidine – ~~Non~~ Not commonly used becoz thrombocytopenia & Hepatotoxicity.

Clopidogrel – Activated by CYP2C19.

Omiperazol should n't be given c clopidogrel.
Pantaprozol & Rabeprazol don't have drug interaction c clopidogrel.

Glycoprotein IIb/IIIa blocker:
Given i.v:
- Abciximab – Monoclonal antibody.
- Eptifibatide
- Tirofiban

PAR 1 blocker (Protease activated Receptor blocker)
- Vorapaxar
- Atopaxar.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Essential Thrombocytosis:

ANAGRELIDE → Platelet maturation inhibitor.

DOC for Sickle cell Anemia — HYDROXYURIA

↓

useful in Essential thrombocytosis.

Drug used for T/t of CCF:

Drugs inhibiting release of Renin:

- β-Blocker
- Clonidine
- Methyl dopa.

Renin inhibitors:

- Aliskiren (FDA approved)
- Remikiren
- Enakiren

ACE inhibitors:

- Captopril
- Ramipril
- Lisinopril
- Fosinopril (Renal & Bile excretion)

All ACE inhibitors are Prodrug except Captopril Lisinopril.

All ACEi are having Renal excretion.

Action → Vasodialation (Equally dilates Artery & Vein)

Useful for → HTN, CCF, MI, DM, Proteinuria, Scleroderma.

↓

Nephroprotective.

C/I – ① Pregnancy
② B/L Renal stenosis
③ Severe Hyperkalemia

Bradykinin antagonist : Icatibant
↓
Useful for angioedema & dry cough.

Hereditary angioedema:
C1-esterase inhibitor deficiency.

ICATIBANT
RUCONEST → Human Recombinant C1-esterase inhibitor
Ecallantide, Aprotinin] Kallikrein inhibitor.

DANAZOL → Antigonadotropin & anti-androgen action
(Impeded androgen)

Sampratilat, Omapatrilat] – inhibit Vasopeptidase – ACEi

Vasopeptide :

PEPTIDE

ANP · BNP · URODILANTIN

Func^{n} – Natriuresis –
Diuresis
Vasodilation

Synthetic Analogue: Carperitide, Nesiritide, Ularitide

Nesiritide:

Synthetic analogue of BNP

Action → Diuresis
Natriuresis
Vasodilation

Useful for t/t of CCF.

- Given iv, Never oral
- Metabolism → Vasopeptidase
- Shorter ~~bio~~ half life – 20 min

S/E – Severe Hypotension

Other name of Vasopeptidase – Neprilysin (Neutral endopeptidase).

Selective Vasopeptidase inhibitor:

Ecadotril
Sacubitril

Omapatrilat – inhibit Vasopeptidase, ACEi } Dual enzyme inhibitor.
Sampatrilat – inhibit Vasopeptidase, ACEi } Dual enzyme inhibitor.

ARB's:

Losartan
Valsartan
Telmisartan
Olmisartan
Azilsartan

- Indication & C/I same as ACEi.

Losartan:
Action → Uricosuric action
TXA_2 antagonism

Telmisartan
- Agonistic action on PPAR γ_2
(Peroxisome proliferator – activated receptor)
So used in T/t of DM.

Aldosterone Antagonist:
Spironolactone
Canrenone
Eplerenone
Drospirinone

ACEi + Spironolactone ⇒ Severe Hyperkalemia.
Any drug blocking RAAS pathway will cause hyperkalemia

Other drug useful for t/t of CCF
Phosphodiesterase 3 inhibitors:
Amrinone (Inamrinone)
Milrinone
Levosimendan
] Inodialator.

→ M/C S/E – Thrombocytopenia
M/C S/E of Milrinone – Arrythmia

Heart failure :-

Na^+-K^+ pump inhibitor : Digitoxine.

Direct myosin activator : Omecamtiv mecarbil
(+ve inotropic)

Calcium sensitizer :
Pimobendan
Levosimendan (PDE-3 blocker)

Disease modifying drug /
Drug reducing mortality in CCF :
β-Blocker (Carvedilol, Bisoprolol, Metoprolol)
ACEi
Angiotensin Receptor Blockers (ARBs)
Spironolactone
ISDN + Hydralazine.
↓
Isosorbide dinitrate

↳ Except these drugs, all other drugs control symptoms only in CCF.

GIT

Drug useful for Acid peptic disease (APD):

H_2 Antihistamines:

- Cimetidine – Least potent.
- Ranitidine
- Famotidine – Most potent
- Roxatidine
- Nizatidine
- Loxalidine.

↳ Basal acid output & Nocturnal (more effective)
So, give at Bedtime.

↳ Renal excretion.

Cimentidine – Antiandrogenic
CYP enzyme inhibitor
Least potent.

PPI (H^+–K^+ ATPase inhibitors):

- Omeprazole (Metabolism by CYP2C19, CYP3A4)
- Esomeprazole
- Pantoprazole
- Lansoprazole
- Rabeprazole

Short half life for less than 2hr → But acting for longer duration → Hit & Run drug
(Irreversible inhibition of Proton pump).

Omeprazole not given c clopidogrel.

Rabeprazole, Pantoprazole → No significant drug interaction (preferred c clopidogrel).

Antacids:

Sodium Bicarbonate

Calcium Carbonate – Shouldn't be taken c̄ milk

↓

bcoz Milk alkali Syndrome.

GELUSIL:

Combination of Aluminium Hydroxide (Constipation)
+ Magnesium Hydroxide (Diarrhoea)

Ulcer protective drugs:

Sucralfate (Sucrose + Sulfated Aluminium hydroxide)

- Acts only in Acid medium (pH below 4)
- It shouldn't be combine c̄ H_2 blocker/PPI/ antacid.

Bismuth

- Black stool & tongue.

C/I – Renal failure.

Ulcer healing drugs:

Carbenoloxone

↳ S/E – Displaces aldosterone from protein binding.

Prokinetic drugs:

Drugs promoting GI motility.

D_2 antagonist:

Domperidone

Metaclopramide

5HT4 agonist :

Cisapride, Mozapride, Tegaserod, Iveosulpride — Cause QT prolongation ∴ Withdraw

Cholinergic agonist (M3 agonist)

Bethanechol

Neostigmine.

5HT3 blocker :

Ondansetron.

Antibiotic having Prokinetic action : Macrolide.

↓

acting on motilin receptor of small intestine cause diarrhoea.

Among Macrolide — max^m Prokinetic

Erythromycin

Drug used in Anticancer / Radiation — drug induced vomitting

5HT3 antagonists :

Ondansetron M/C S/E — Headache.

Granisetron

Tropisetron

Dolasetron → QT prolongation

Palonosetron → Highly selective 5HT3 antagonist

Long acting ($T_{1/2}$ = 40hrs)

Supportive drug : For better efficacy

Ondasetron / mixed ☆ → D2 blocker, BZD, Steroids

- D2 blocker → Domperidone
- Steroids → Dexamethasone, Methyl prednisolone.

Antiemetic belonging to Cannabinoids

Nabilone, Dronabinol — Antiemetic + Apetite stimulant.

2-3 days after Chemotherapy → Late phase Vomitting

T/t → ① Aprepitant (oral)
② Fos aprepitant (i.v.)

↓

Neurokinin 1 antagonist

③ Palonosetron.

IBS

T/t of Constipation dominant IBS:

Magnesium hydroxide
Methyl cellulose
Lactulose syrup. → Also useful for Hepatic encephalopathy.

Tegaserod, Prucalopride — 5HT4 agonist

Lubiprostone
→ ClC-2 (Type-2 chloride channel activator)

Linaclotide (Guanylate-cyclase-C activator)
↳ Cystic Fibrosis transmembrane conductance regulator Activator (CFTR activator)

↓

Crofelemer — Inhibitor of CFTR
↳ USE — HIV drug induced diarrhea.

Antibiotic used for t/t of constipation in IBS:
Neomycin (Orally) → For t/t of Hepatic encephalopathy
Rifaximin → Pre-op Bowel Sterlization
Probiotics.

Rifaximin:
Useful for — ① IBS
② Hepatic encephalopathy
③ Traveller's diarrhea
④ Pseudomembranous colitis.

For t/t of opioid induced constipation:
Methyl nalltrexone (S/c)
Alvemopan (oral)

Diarrhea in IBS:
5HT3 antagonist for t/t of diarrhoea in IBS:
Aloselron
Ramoselron
Cilanselron

Aloselron — Rarely cause dangerous problem
It cause Ischemic colitis
↳ So withdrawn

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

- But if use - give c great caution & Informed consent.
- Only in female

Other drugs for diarrhoea:
Cholestyramine resin

Opioid for diarrhoea:
Loperamide
Diphenoxylate + Atropine ⇒ Control addiction.
Codeine.

For t/t Abdominal pain:
Anticholinergic drugs] Muscle relaxant property.
Imipramine]

Cholecystokinin antagonist:
Lorglumide, Loxiglumide > Inhibits GI motility
↓
Useful for IBS (diarrhoea)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

BRONCHIAL ASTHMA.

Methyl Xanthines — Aminophylline, Theophylline > Bronchodilator.

MAO — Adenosine antagonism — lead to seizure.
Non-selective PDE inhibition

Side effect	Proposed mechanism
Nausea & Vomiting, Headaches, Gastric discomfort	→ PDE4 inhibition
Diuresis, Epileptic seizures	→ A_1 receptor antagonism
Cardiac arrhythmias	→ PDE3 inhibition, A_1 receptor antagonism.

M3 Blocker, β_2 agonist > Bronchodilators
M/c for acute Asthma

Leukotriene antagonists:

Arachidonic Acid
↓ 5 lipooxygenase
LTA_4

LTB_4 → BLT Receptor

LTC_4 → LTD_4 → LTE_4
(Cysteine LT_2 Receptor)
(Cysteine LT_1 Receptor)

Lipooxygenase Inhibitor
Zileuton
↳ Not used bcoz Hepatitis.

Leukotriene antagonist:
Zafirlukast
Montelukast
Pranlukast

Chronic therapy cause — Churg strauss Syndrome
↓
Headache
Eosinophilia
Vasculitis.
↓
For t/t : MEPOLIZUMAB
(IL-5 antagonist)

Mast cell stabilizers:
Sodium chromoglycate
Nedocromil
Ketotifen (Additional Antihistaminic property)

Monoclonal antibodies:
Omalizumab → IgE antibody agonist.
↳ S/c, Hypersensitivity.

Newer drug — Reslizumab
Mepolizumab (IL 5 antagonist)

PDE inhibitors:

PDE inhibitors		
Methyl xanthines	PDE I, II, III, IV	Asthma
Cilomilast, Roflumilast	PDE IV	Asthma
Apremilast	PDE IV	Active Psoriatic aethritis
Amirinone, Milrinone	PDE III	CCF
Sildenafil, Verdenafil, Tadalafil	PDE V	Erectile dysfunction
Pentoxyphylline	Non-selective	PVD
Cilastazol	PDE III	PVD
Vinpocetine	PDE1, Vasodilator	Parkinson, Alzheimer's ds.

EXPECTORANTS

Mucolytics:
- Carbocysteine
- Methyl cysteine
- Erdosteine
- Bromohexane
- Dorsane alpha
- N-acetyl cysteine.

Cough suppressant:
- Codeine
- Phol codeine
- Dextromethorphan.

Antihistamines

1st Generation

→ Antihistaminic + Anti cholinergic action

USE : Allergic cond^{n}
Insect bite
EPS
Motion sickness

1 Generation drugs :

CPM (chlorpheniramine Maleate)
Promethazine (Most sedative, Highest anticholinergic)
Diphenhydramine
Cyclizine
Meclizine (Useful for Sea sickness)
Cyproheptadine (Antihistaminic + Anticholinergic + Antiseritonergic action)
↓
Appetizer, Useful in migrane
Cause Serotonin Syndrome.
Hydroxyzine (Antihistamine + Anti-anxiety)
↳ produces metabolite – Cetrizine.
Doxepin → Given topically (for itching)
↳ TCA – Atopic dermatitis, Lichen simplex
Cinnarizine (H_1 + M + 5HT2)
↳ Use in Vertigo
↑
Betahistine (Histaminergic drug)

2nd Generation

2nd Generation drugs:

Terfenadine, Astemazole – Causes QT prolongation → Withdrawn

Metabolite → Ebastine → Still available

Fexofenadrine

Cetirizine (Metabolite of Hydroxyzine)

Levocetirizine

Azelastine (Maximum topical, nasal spray)

Mezlastine

Acrivastin

Active form → Loratidine (longest) → Desloratidine

Rupatidine (Platelet activating factor antagonism)

↓

Lexipafent, Apafaint → For t/t of Acute Pancreatitis

Topical antihistamines:

Azelastine – Nasal spray

Olopatadine – Nasal spray, Ophthalmic drop, Oral

↓

Mast cell stabilizing

Alcaftadine, Epinastine – Eye drop.

H3 antagonist / inverse agonist:

Pitolisant (Tiprolisant) → Orphan drug.

↳ T/t of Narcolepsy

Prostaglandins

PGE_1:

Misoprostol:
- Useful for T/t gastric ulcer (NSAID induced)
- Used for abortion
- Teratogenicity → Mobeious Syndrome

Alprostadil
- Vasodilator
- Useful for Erectile dysfunc^n (Given injectable)
- Useful for maintain patency of ductus arteriosus.

PGE2:

Dinoprostone
↳ Uterine contracting agent
Useful for abortion.

Enprostil, Rioprostil
- Useful for t/t of Gastric ulcer.

PGF2α:

Carboprost
↳ USE: Post partum Hemorrhage (PPH)

Dinoprost
↳ USE: Uterine contracting agent for abortion.

Latenoprost, Bimatoprost, Travoprost, Unoprostone
- Useful for Glaucoma
  ↓
  By promoting drainage via Uveoscleral route.

Cause Iris pigmentation

Causes Hypertrichoses of eyelash

PGI_2 : Prostacyclin

Epoprostenol
Treprostinil
Beroprost
Iloprost
} – Useful for 1° pulm. HTN

Drug used for 1° pulm HTN:

① Inhaled NO – Vasodilator
② CCB (Nifedipine, Diltiazem)
③ PDE5 blockers → Sildenafil, Tadalafil.
④ Endothelin receptor blocker (ERBi) → Bosentan
Ambresentan
Macitentan
} Hepatotoxic
⑤ Direct guanylate cyclase inhibitor → Riociguat
Chinociguat.
⑥ PGI_2 → Epoprostenol
Treprostinil
Beroprost
Iloprost.
⑦ New drug → Selexipag (Prostacyclin receptor agonist)
↳ Useful for t/t of 1° pulm HTN.
⑧ Rho kinase inhibitor → Fasudil

NSAID

Blocks both

COX-1 COX-2

Aspirin:

- Analgesic
- Anti pyretic action
- Anti inflammatory

— All are property of all NSAID.

Prevent Colonic & rectal cancer

Aspirin + Nicotinic acid ⇒ Prevent flushing.

C/I — in t/t viral fever in children < 12yrs.

↓

Cause Reye's syndrome.

- Liver damage
- Encephalopathy
- Febrile illness

M/C S/E of Aspirin & other NSAID:

- Gastric ulcer.

Non-selective COX inhibitor

Indomethacin — Anti inflammatory

Use:
- Frontal headache
- Closure of ductus arteriosus
- Batter's syndrome

Phenylbutazone
- may cause bone marrow ~~depression~~ suppression.

Ibuprofen - Safe in children

Mefenamic acid - Useful in dysmenorrhoea.

Piroxicam - longest acting NSAID.

Preferable COX2 inhibitor:
- Nimuselide
  ↳ Cause severe hepatotoxity in children (Unsafe)
- Nabumetone
- Etodolac
- Meloxicam

Highly selective COX-2 inhibitor:
- Rofecoxib
- Celecoxib
- Valedecoxib
- Etoricoxib
- Parecoxib
- Lumiracoxib.

] Risk of developing HTN & CCF

COX-3 blocker
Paracetamol
Overdose ↳ Causes liver toxicity.

Other analgesic: Other than NSAID & opioids.
Ziconotide (Conotoxin)
- N type CCB
- Intrathecal given

For anti inflammatory action of Aspirin → 300 - 400mg
aspirin required ≤ cause Turic acid.
& > 2gm → Gastric perforation.

Page No.
Date : / /

Nefopam – Amine uptake inhibitor
Na^+ channel blocker

Salivex – Cannabinoid
↳ use – Cancer pain

~~Eno~~ Entonox – $N_2O + O_2$
↳ for painless labour.

Drug useful for t/t of Gout:

Acute Gout:
Give NSAID or, Steroids or, colchicine

Cholchicine → Acting by disruption of microtubule
↓
Neutrophil drunken walk.
S/E – Diarrhoea (Bloody)
Unsafe in RF

NSAIDs → Naprexen
Indomethacin
Sulindac
Aspirin is C/I for gouty arthritis.

Drug used for chronic gout:
Xanthine oxidase inhibitor:
Allopurinol
Febuxosat.
6-Mercaptopurine.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Uricosurics:

Probenacid (Unsafe in RF)
Sulfinpyrazone
Benzbromarone
Lesinurad.

Other drug having uricosuric actions are –
Losartan
Fenofibrate
Amlodipine

Newer drug :–

For aggressive control of Gouty arthritis
↳ Give intravenously
- Rasburicase] cause Rapid metabolism
- Pegloticase] of uric acid.

Newer drug for T/t of RA :

Normal – cytokine balance

Pro-inflammatory Cytokines = Anti-inflammatory cytokines.

↓

TNFα, IL-1, IL-6

TNF α blocker :

Immuno suppressant
- Infliximab (i.v)
- Etanercept (S/C)
- Adalimumab (S/C)
- Golimumab (S/C)
- Certolizumab (S/C)

Test
Before giving TNFα blocker TB should be ruled out.
-PPD test
↳ Purified Protein derivative skin test

- All are unsafe in Hepatitis B virus infected pt.

Analogue of Interleukin 1 (IL-1) Receptor Antagonist:
ANAKINRA

IL-6 blocker:
Tocilizumab
Sarilumab

Newer drug – Rituximab (CD20 receptor antagonist)
↳ Cause PML (Progressive Multifocal Leucoence-phalopathy.

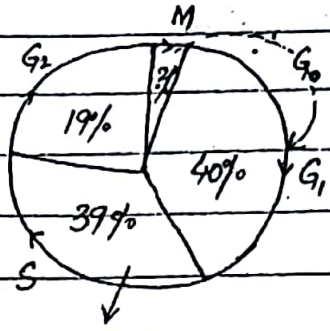
Abatacept, Belatacept → Targeting against CD80/86 Receptor
↳ USE – RA

Tofacitinib – JAK 1 & 3 blocker
↳ USE – RA.

Leflunomide
↳ Inhibit dihydro orotate dehydrogenase
S/E – Hepatotoxic
C/I – Pregnancy.

ANTI CANCER DRUGS

Cell cycle:



G_1 (40%) → Minor development take place.

S-phase → DNA synthesis
(39%) By < Topoisomerase II enzyme
Folic acid, Purine, Pyrimidine.

G_2 (19%) → Extra development take place.
By Topoisomerase

M (2%) → Multiplication

Drugs acting on G_1 phase:
L-Asparaginase (enzyme)
Steroids

L-Asparagine – Origin from E.Coli (Naturally occuring)
– Useful for ALL
S/E – Hemorrhagic pancreatitis
Hypercoagulation
No significant Myelosappression.

Thromboembolic Complications.

Drugs acting on S-phase:
Anti metabolites
Epi podo phyllo toxins
eg: ETOPOSIDE
TENEPOSIDE

Drugs acting on G_2 phase: Topoisomerase-I inhibitor.
Camptothecins < IRINOTECAN – cholino mimetic property.
TOPOTECAN ↓
SE – Diarrhoea.
(dose related toxicity)

Bleomycin (Anticancer + Antibiotic)

– All anticancer + antibiotics are C-cycle non-specific except Bleomycin.

Drug inhibiting mitosis:
Vinka alkaloids – Vinblastin, Vincristine, Vinorelbine] plant origin.

Taxanes – Paclitaxel
Docetaxel
Cabazitaxel.

Newer drug – Ixabepilone, Eribulin > Useful for Breast Ca.

For HER2 +ve Breast Ca – TRASTUZUMAB
For Rx HER1 & HER2 – TK Blocker – LAPATINIB.

Newer drugs in cancer therapy:

Tyrosine Kinase inhibitor (TKi's):

Tyrosine Kinase Receptor – EGFR (HER-1)
VGFR
PDGFR

TKi's acting EGFR blocker:

Gefitinib, Erlotinib, Afatinib – Useful for t/t of Metastatic Small cell lung Ca.
↳ Also useful for Pancreatic Ca.
↓
DOC: Gemcitabine

S/E – Dysmorphic eyelashes (Erlotinib)

VGFR blocker:

Sorafenib – Useful for RCC, HCC
Sunitinib – Useful for RCC, GIST
Lenvatinib – Useful for DTC

PDGFR blocker

Imatinib – DOC for CML
↑ 1st gen. TKi
Useful for GIST (C-kit)
↓
due to alteration of c-kit – Resistance
↓ T/t of Resistance CML
DASATINIB, NILOTINIB – 2nd gen. TKi

Multi-targeted TKi:

Vandetanib – Useful for Medullary Ca Thyroid.
↳ Target against EGFR & VGFR.
Axitinib, Pazopanib – Targeting against VGFR & PDGFR
Useful for RCC

TRASTUZUMAB → For HER-2 +ve Breast Ca.

LAPATINIB → Against HER-1 & 2 +ve Breast Ca.

All the TKi are taken orally.

Common S/E – GI toxicity
(Nausea, Vomitting, Diarrhoea)

Any drug block EGFR causes HTN.

Monoclonal antibodies (MABs)

TRAS (TU) (ZU) (MAB)

Target Source

TU = Tumor Zu – Humanised

Li = lowering immunity Xi – Chimerical (Non human eg Mice)

Ci = Target circulation.

Vi = Virus.

BASILIXIMAB – Target against IL-2

ABCIXIMAB – Target against GP2B3A.

PALIVIZUMAB – Target against RSV.

Trastuzumab –

Target against HER-2 receptor

Useful for HER-2 +ve Breast Ca.

Most of MAB given by i.v. infusion

Specific S/E → Cardiomyopathy

Infusion reaction.

Rituximab :

Target against CD20 on B-cell.
Useful for B-cell lymphoma
Other uses : C = CLL
H = Hemolytic anemia
I = Idopathic thrombocytic Purpura (ITP)
N = NHL (Non-hodgkin Lymphoma)
A = Arthritis (RA)
Myasthenia Gravis.

M/C S/E – PML

Bevacizumab : Target circulation.

Target against VGFR
Useful for Metastatic colorectal CA (iv)
↓
M/C → 5FU
Useful for RCC & Diabetic Retinopathy.
↓ ↓
i.v. Intravitreous

S/E – HTN

Newer drug : RAMUCIRUMAB

- Target against VGFR
- Useful for Gastric Cancer.

BRENTUXIMAB

- Target against CD30 on B cell.
- Useful for Hodgkin lymphoma.

Omalizumab – Target against IgE → USE: Bronchial Asthma (BA)

Resilzumab, Mepolizumab – Target against IL5 → USE: BA

Denozumab – Target against RANK-L → Osteoporosis.

Eculizumab – Target against C5 → Paroxysmal nocturnal hemoglobinuria.

Evolocumab, Alirocumab – Target against PCSK9 → Lipid lowering.

Ibalizumab – Target against HIV (entry inhibitor)

Macular degeneration (MD)

Dry type	Wet type
less blood supply	Age related MD (ARMD)

Drugs useful for Wet type MD:

Photodynamic therapy

VERTEPORFIN – i.v.

VEGF inhibitor:

Bevacizumab, Ranibizumab, pegaptanib, Aflibercept – Intravitreal inj.

Drug for Vitreomacular degeneration :
Ocriplasmin (Newer drug).

Bull's eye Retinopathy – Caused by chloroquine.
Crystalline Maculopathy – Caused by Tamoxifen.
Field of Vision defect – Vigabatrin.
Whorl-like pattern – Already done.

Kayser-Fleischer ring – Wilson's ds (Ceruloplasmin deficiency).

Chelating Agents.

Metal	T/t
Copper	Penicillamine (SLE, optic Neuritis)
	Trientine
	Zinc sulphate (Safest)
	Potassium Sulfide
Hepatitis or cirrhosis c decompensation	Zinc
Mild – Moderate hepatic decompensation	Trientine + Zn
Neurological or Psychiatric Symptom	Tetrathiomolybdate + Zn.
For maintanence in pregnancy & Children	Zinc

Metal	T/t	
Lead	BAL	C/I in Iron & Cadmium poisoning.
Arsenic	BAL	
Mercury	BAL	
Iron	Desferrioxamine Deferiprone Dexrazoxane.	

DOXORUBICIN

S/E - Cardiomyopathy

Antidote for Doxorubicin poisoning — Dexrazoxone.

Anti-metabolites:

Anti cancer + Immunosuppressive.

Drug acting against folic acid:

Methotrexate

Pemetrexate } - Useful for Mesothelioma
Trimetrexate } NSCLC

Pralatrexate. - For T-cell lymphoma.

Methotrexate:

(N) DHFA $\xrightarrow{DHFR}$ THFA

MAO: Methotrexate actively penetrate into cancer cell it inhibit DHFR, Ultimately inhibiting DNA synthesis, So stop S-phase of cell cycle.

Resistance due to alteration/mutation of DHFR.

Page No.
Date : / /

Specific antidote — Folinic acid or Leucovorin
antagonist.

Folinic acid can't be given in Renal failure.

GLUCARPIDASE — Newer drug useful for t/t of Methotrexate toxicity in a pt c impaired kidney func^{n}.

USES of MTx : Anticancer :
DOC for Choriocarcinoma.
Useful for Osteosarcoma

Immunosuppressant :
RA (DMARD, low dose 7.5 mg/wk)
Psoriasis ↓
long term therapy.

C = Chorio CA
A = Abortion
N = NHL
C = Chron's ds
E = Ectopic pregnancy
R = RA.

S/E — Myelosuppression (M/C)
Alopecia
Mucosal damage. (GI toxicity)
Liver damage (on chronic therapy — in RA)
↳ Undergo LFT
Crystaluria
↳ TT — Hydration & Alkalinization

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Page No.
Date : / /

Antibiotic causing Crystal
- Ciprofloxacin (Alkaline)
- Sulfonamide (Acidic)

Antiviral causing Crystal
- Indinavir → HIV
- Acyclovir

C/I of MTx — Pregnancy.

Purine Anti metabolites:
- 6-Thioguanine
- 6-Mercaptopurine
- Fludarabine → DOC: CLL — Useful for Hairy cell Leukemia
- Cladribine → DOC — Hairy cell Likemia (also useful for Multiple Sclerosis.)
- Pentostatin → Inhibiting Adenosine deaminase.

6-Mercaptopurine:

6-Mercaptopurine
↓ HGPRT enzyme.
6-Thiosinic Acid

Cause of Resistance — Deficiency of HGPRT enzyme (Lesch-Nyhan Syndrome)

6-MP normally undergoes evacuation (metabolism) by HGPRT.

If we give Xanthine oxidase inhibitor — ↑ plasma level of 6MP.

When we give Allopurinol ∈ 6MP reduce the dose 50-75% of 6MP.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

INFα – USE: HBV, HCV
INFγ – USE: Chr. granulomatous ds.
↳ Immunostimulant.

Drugs useful for Multiple Sclerosis (MS):

Disease modifying drugs:

- Interferon Beta 1A & 1B
  - Glatiramer Acetate
  - Natalizumab (α4β1 integrin) (i.v. once in month)
    - ↓ cause PML
  - Acrelizumab (anti CD20)
  - Alemtuzumab (Anti CD52)

Mitoxantrone (Anti cancer + Antibiotic)
↳ Cause Cardiotoxicity.

Fingolimod (oral)
↳ Cause Bradycardia.

Dalfampridine (oral)
↳ Useful for Lambert Eaton Syndrome.
↳ Useful in MS in improving walking.

Cladribine (oral)

Teriflunomide (oral)
↳ derivative of Leflunomide
↳ Di-hydro orotate ....
↳ Useful in pregnancy & MS

Dimethyl fumerate.

Pyramidine Antimetabolites:

Cytarabine (Cytosine arabinoside)
↳ Cause Cerebellar ataxia.

5FU
↳ M/c use – Colorectal cancer
• Given c Levamisole

Floxuridine

Gemcitabine (DOC for Pancreatic CA)

Capacitabine. (Cause Hand foot Syndrome)

Gemcitabin — Myelosuppression
Flu like symptom
Very potent Radio sensitizer.
DOC for Pancreatic CA

Drug causing Hand foot Syndrome:
Capecitabine
5-FU
Doxorubicin
IL-2
Pemelexed.

Anti cancer Antibiotics:
Actinomycin D (Dactinomycin)
↳ Causes Radiation recall phenomenon.

Daunorubicin
Broadest Spectrum → Doxorubicin
Mitoxantrone
— Anthracyclines
Inhibit Topoisomerase II
↳ may cause Blue colour fingernails, sclera & urine.

Mitomycin
Bleomycin
Mithramycin (Plicamycin)
↳ Useful for Hypercalcemia.

Doxorubicin:
- Causes dilated Cardiomyopathy (DCMP)
- Doxorubicin in presence of Iron form free radical injured myocardium.

T/t — Dexrazoxane + Alpha tocopherol (Vit E)
↓ Iron chelator
↳ Antioxidant

Mitomycin:

- Useful for Urinary bladder Ca.
  - Usually Intravesical therapy: BCG
  - For BCG resistance — Mitomycin
    Valrubicin
- Useful for laryngotracheal stenosis.
  due to Antifibroblastic action.

Bleomycin:

Cell cycle specific acting on G_2 phase of Cell cycle.
M/c S/E — Pulm. fibrosis.

Bleomycin hydrolase is not seen in lung.
↓
so large accumulation of Bleomycin in lung.

Type I pneumocytes — Necrosis / destruction
Type II " — Hyperplasia / Metaplasia.

Anticancer drug ↓ No severe myelosuppression:

Vincristine → Cause Peripheral neuropathy.
Bleomycin
Asparaginase —Cause→ Pancreatitis
Hypercoagulation

Alkylating agents.

Busulfan

Nitrosoureas → Lomustine, Semustine, Carmustine → Delayed Myelosuppression last.
- Highly lipid soluble → Useful for Brain Tumor

Temozolamide → also for Malignant Melanoma.

Streptozocin (Chemical Pancreatectomy).

Chlorambucil (USE: CLL)

Cyclophosphamide, Ifosfamide

Melphalan (Use for Multiple myeloma)

Procarbazine, Dacarbazine.

Thiotepa

Mechlorethamine.
- ↳ Cause skin Vesicant

Procarbazine –
- Disulfiram like reac^{n}
- Among the alkylating agent Procarbazine & Melphalan cause Secondary Cancer.
  - Cyclophosphamide – less Secondary cancer.
- MAO inhibitory action

Drugs for Multiple myeloma:
- Melphalan
- Thalidomide
- Lenolidomide
- Bortezomid (Proteosome inhibitor)
  - ↳ DOC

– Punch out lesion.

Cyclophosphamide (Anticancer + Immunosuppressive):
- Prodrug.
In liver it forms Aldophosphamide
↓
Phosphoramide mustard + Acrolein (Toxic)

DOC for Wegner's granulomatosis.
M/C S/E - Hemorrhagic cystitis
↳ Due to Acrolein
Antidote - MESNA
Supportive drug - Formalin
↳ N acetyl cysteine
Carboprost (PGF2α agonist)
↳ USE:
↳ Paracetamol poisoning
Radiocontrast
Nephrotoxicity
Mucolytic

Cyclophosphamide cause ↳ SIADH
Cardiotoxicity.

Ifosfamide:
Active form - Acrolein
↓ Antidote
MESNA

Drug of C/I in Malignant Melanoma - LEVODOPA

Drugs for Multiple myeloma :
- Temozolamide
- BRAF V600E inhibitor — Vemurafenib
Dabrafenib
Trametinib

Newer drug. — Nivolumab
Ipilimumab

Aldesleukin - IL2
↳ USE : RCC, Multiple Myeloma.

Busulfan :
Used for CML
S/E — Pulm. fibrosis
Adrenal insufficiency. (Addison's ds)
↳ Hyperpigmentation.

All alkylating agent action — N7 Guanine Residue
All " " are cell cycle non specific.

S/E of Alkylating agent — Veno occlusive ds of liver.
(Budd chiari Syndrome
↓
Minimised by DEFIBROTIDE

- Permanent sterility

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Least emetogenic – Vincristin
Chloroambucil

Cisplatin:
Highest emetogenic
S/E – Ototoxicity
Nephrotoxicity (dose limiting toxicity)
Neurotoxicity

Antidote – Amifostine.

Carboplatin:
S/E – Myelosuppression

Oxaliplatin:
S/E – Neurotoxicity
Pharyngeal paraesthesia.

Vincristine:
S/E – Peripheral neuropathy. (Sensory & motor).
SIADH
Vesicant.

Advantage – less myelosuppressant
less nausea.

Vinblastine:
- Myelosuppression

Taxane (Paclitaxal, Docetaxal):
- Myelosuppression
- Peripheral neuropathy (Glove & SOCK Neuropathy
- Allergy.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Role of hormones in cancer:
For all premenopausal women c ER +ve Breast cancer
1st line choice is SERM.
If Resistance give SERD.

For postmenopausal women c ER +ve Breast cancer
give Aromatase inhibitor.

#

SERM useful for t/t of Breast Ca:
Tamoxifen
Toremifen
Doloxifen
Raloxifene.

Tamoxifen –
Antagonistic action only on ER of Breast → Useful for t/t ER +ve Breast Ca.

Agonistic action on blood vessel

ADR – Hot flushes
Endometrial cancer
DVT

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Raloxifene :

Antagonistic action on Breast → So use in Breast Ca.
" " " Uterus

S/E – Flushing
DVT
Not cause Endometrial CA.

Aromatase Inhibitors :

Aminoglutethimide (Chemical adrenalectomy)
Formestane
Exemestane
Vorozole
Fadrozole
Letrozole
Anastrazole.

Extra information :

SERMs for DUB : Ormeloxifene
(Centchroman)
-Use as Contraceptive pill.
Twice in wk ☐ gap of four day – First
3 month. Later once in a week.

SERMs for Dyspareunia – Ospemifene.

SERMs for induction of Ovulation – Clomiphene.

SPRM:

Ulipristal – Emergency Contraceptive (Can take 5 days after coitus)
Asoprisnil
Jelapristone – Useful in Uterine fibroid
Endometriosis

Prostatic Cancer:

Becoz of excess androgenic action.

Hypothalamus
(GnRH) – Pulsatile release
(60-120 min)
↓⊕
Pituitary
(Gonadotropins – LH/FSH)
↓⊕
Testis

FSH → Spermatogenesis ← Seminiferous cell.
LH → Leydig cell – Testosterone production
↓
overproduction cause Prostatic Ca.

Drugs ↓ Testosterone production:

(A) GnRH agonist (In continuous manner):
Leuprolide
Goserelin
Busorelin
Naferelin
Desorelin
Histrelin
Tritprelin

GnRH antagonist:
- Genirelix
- Celtorelix
- Abarelix
- Degarelix

Comparision:

Agonist	Antagonist.
Initial flare up	No initial flare up.
Histamine release	No histamine release.

↓ Testosterone cause:
- Hot flush
- Loss of libido
- Impotence
- Sarcopenia (Reduce muscle mass)
- Osteoporosis
  - t/t → Supplement Vit D
    - Bisphosphonates.
    - Denosumab.

Drugs having histamine releasing property:
- d-Tubacurarine
- Morphine
- Dexferioxamine
- Amphotericin B
- Polymyxin B
- Vancomycin. (Red Man Syndrome)

Anti androgen/:

Flutamide
Nilutamide
Bicalutamide
Enzalutamide
Cyproterone
Abiraterone.

Thalidomide:

Sedative + Anti emetic
S/E – Phocomelia
C/I – Pregnancy.
Category X!

– It has Anti cancer + Immune modulation property.
Indication: Multiple myeloma
ENL
Apthous ulcer
SLE.

Isomer { R (Therapeutic use & Teratogenicity)
S (Sedation)

M/C S/E – Constipation
Severe peripheral sensory neuropathy.

Drug	Antidote
Methotrexate	Folinic acid
Doxorubicin	Dexrazoxane
Cyclophosphamide	Mesna
Cisplatin	Amifostine.
Paliferamin	Mucositis.

Drugs useful for ↑↑ neutropenia:

Colony stimulating factor (CSF)

rG-CSF	GM-CSF
Filgrastim	Sargramostim
Pegfilgrastim	Molgramostim.
Lenograstim	

Drug useful for Anemia:
- Epoietin (Recombinant – Erythropoietin)
- Darbopoietin
- Peginesatide (Erythropoietin Receptor Stimulant)

Drug useful for Thrombocytopenia:
- Oprelvekin (IL-11)
- Thrombopoietin

Newer drug:
- Romiplostim (S/C) for ITP → by plasma exchange.
- Eltrombopag → Oral

Anti-emetic useful for Anticancer t/t :
Already done.

Immunosuppressant :
Cyclosporin
Tacrolimus (FK506)
Sirolimus
Everolimus

Drugs inhibiting synthesis of IL-2 :
Cyclosporin, Tacrolimus (FK506) > Calcineurin inhibitor.
↓
Both cause Nephrotoxicity
Tacrolimus > Cyclosporin

Tacrolimus – Macrolide compd.

Common problem – Nephrotoxicity (Dose limiting).
Neurotoxicity
Hepatotoxicity
DM
Diarrhea
Alopecia

Specific S/E of Cyclosporin – Hypertrophy of Gum
Hirsutism
HTN → T/t : Nefidipine.
Hyperkalemia

Hypokalemia — caused by → Cisplatin
Amphotericin B.

m-Tor blockers:
Sirolimus, Everolimus] -S/E - Thrombocytopenia
Hyperlipidemia (High TGL)

Azathioprine:
Purine anti metabolite
Immunosuppressant action (CMI)
No anti cancer action.

USE — RA
IBD (U. colitis)
Organ transplantation.

S/E - Myelosuppression

Azathioprine — converted in body → 6-Mercaptopurine.
↓
Metabolism by Xanthine Oxidase.

Immunostimulants:
Cytokines
Aldesleukin (Recombinant IL2) (for RCC & MM)
Interferon γ (Chronic granulomatous dz).
BCG vaccine (Intravesicle - Urinary bladder Ca)
↓
Valrubicin, Mitomycin
Laryngotracheal Stenosis

Levamisole (Anti helminthic property)
↳ Immunostimulant.

IL- modulators:

Analogues of IL-1 receptor antagonist: Anakinra
(USE-RA)

IL-3 & 4 antagonist: Pitrakinra
(USE - BA)

Analogue of IL-2: Aldesleukin
(USE - RCC, Malignant Melanoma)

IL-2 receptor blocker: Basiliximab
Daclizumab.

IL2 + Diphtheria toxin: Denileukin diftitox
↓
USE: Cutaneous T cell lymphoma.
↓
Histone deacytalase inhibitor
Vorinostat
Romidepsin.

IL-5 blocker: Resilizumab (Severe eosinophilia, BA)
Mepolizumab
↳ Hypereosinophilic syndrome
Churg strauss syndrome.

IL-6 blocker - Tocilizumab
↳ USE - RA

IL-1,6 antagonist - Steroids

Analogue for IL-11 - Oprelvikin
↳ USE - Thrompocytopenia.

IL-17 Blocker - Ixekizumab, Brodalumab } Use: Plaque Psoriasis.

IL 12 & 23 – Ustekinumab
↳ USE – [redacted] Psoriasis.

Apafant, Lexipafant (PAF Blocker) – For Acute Pancreatitis
Ivicaftor – For cystic fibrosis.
Imiquimod – For Condylomata accuminata (HPV)
Alefacept – For Psoriasis
Resiquimod – For HSV
Lu-Dotatate – For Midgut endocrine tumor.
Anagrelide – For Essential Thrombocytosis
Belimumab – For SLE
Defibrotide – For Budd Chiari Syndrome.
Hydroxyurea – For Sickle cell anemia.
Olaparib – For ovarian Cancer
• Acting by Poly ADP ribose polymerase (PARP) inhibitor.
Palbociclib, Amebaciclib, Ribociclib – For Breast Cancer
↳ CDK 4/6 (cyclin dependent kinase) inhibit
Edaravone – (Antioxidant) For ALS.

Mycophenolate mofetilate – Inhibit Inosine monophosphate dehydrogenase
(Immunosuppressant)
Pentostatin – Inhibit Adenosine deaminase.
Vorinostat – Inhibit Histone deacetylase.
Leflunomide – Inhibit dihydroorotate dehydrogenase

Toxicity caused
Cyclosporine – Nephrotoxicity
Leflunomide – Hepatotoxicity
Sirolimus – Bone marrow suppression
Azathioprine – Hypertriglyceridemia
Muromonab – Cytokine release syndrome.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

ANTIMICROBIAL DRUGS

Antibiotic acting by inhibiting cell wall synthesis:

N acetyl muramic acid → N-acetyl muramic Acid peptidase.
N acetyl glucosamine →

Step 1:

The first enzyme initiating cell wall synthesis
- Alanine ligase / Racemase
  ↑⊖
  Cycloserine
  ↳ 2nd line drug of TB
  - Bacteriostatic
  S/E - Psychosis.

Step 2:

Enolpyruvate transferase ←⊖ Fosfomycin
↳ For UTI
Cause severe diarrhoea
So not in use.

Step 3:

Dephosphorylation of Bactoprenol ←⊖ Bacitracin
↓
polypeptide group of Antibiotic
USE: Wound / Ulcer healing
(Given topically)

Step 4:

Elongation of peptide chain
↳ c/c help of Transglycosylase ←⊖ Vancomycin
↓
If Alter → VRSA

Step 5:

Cross linking of elongated peptide chain

↓

by Transpeptidase ⟵ Beta Lactam
(Penicillin binding protein) (Penicillin)

↓

If altered → MRSA
(Resistance)

Antibiotics acting by inhibiting protein synthesis:

Aminoglycosides & Tetracycline binding c 30s Ribosome & inhibit protein synthesis.

Drug acting on 50s Ribosome & inhibit protein synthesis:

Chloramphenicol — Resistance due to enzyme degradation → Acetyl transferase
Linezolid

(M) = Macrolides
(L) = Lincosamides (Clindamycin)
(S) = Streptogramin.

MLS resistance → Methylation of 50s ribosomes.

Tetracycline resistance → Development of Efflux pump.

↓

Tigecycline – Resistance to efflux.

Due to enzymatic degradation → Aminoglycosides Resistance

↓

Do not develop resistance. [Amikacin
Netilmicin

All antibiotics acting by inhibiting protein synthesis are bacteriostatic exception – Aminoglycoside
Streptogramine.

Antibiotics

Penicillin:

Commercial source – Penicillium chrysogenum.

Acid Resistant: Orally.

V = Penicillin V
O = Oxacillin
D = Dicloxacillin
C = Cloxacillin
A = Ampicillin/ Amoxicillin

Penicillinase resistant:

C = Cloxacillin
O = Oxacillin (hepatitis)
N = Nafcillin (Neutropenia)
D = Dicloxacillin
U
M = Methicillin (Interstitial nephritis)

β-Lactamase inhibitor:

Clavulanic Acid + Amoxycillin
Sulbactam + Ampicillin
Tazobactam + Piperacillin

FDC (Fixed drug combination):

Same volume of distribution
or Same half life

Extended spectrum Penicillins :

Aminopenicillins → Enteroactive
- Becampicillin
- Ampicillin → Causing dirrhea due to incomplete absorption.
- Amoxicillin.

Carboxy penicillins (Enteroactive + pseudomonas)
- Carbenicillin → Cause bleeding due to disturbing platelet.
- Ticarcillin

Ureidopenicillins
(Enteroactive + pseudomonas + Klebsiella)
- Azlocillin
- Piperacillin
- Mezlocillin

Aminopenicillins are C/I in Infectious mononucleosis bcoz of risk of severe skin rash.

2nd line Anti TB C/I in HIV pt c TB : Thiacetazone
↓
may cause Steven Johnson Syndrome
↓
Skin Rash.

OCP + Ampicillin → Risk of OCP failure
↓
By interfaring OCP enterohepatic circulation.

S/E of Penicillin in syphilis pt.
↓
Jarisch herxheimer Reacn.
↓
Secondary Syphilis
No treatment
Only symptomatic — Aspirin & Sedation.

Atypical bela lactam antibiotics:
Carbapenams:
• Imipenam
- Brodest spectrum
- Shortest acting
↳ Rapidly undergo inactivation by Dehydropeptidase 1 enzyme.
↑⊖
Add Cilastatin
S/E - Seizures

• Meropenam
• Ertapenam

Monobactams:
• Aztreonam
↳ No cross reactivity.
↳ Useful for Aerobic gm +ve infection.
Similar to aminoglycosides.

for Anaerobic infection — Metronidazole
Clindamycin
↳ S/E - Pseudomembranous Colitis.

Cephalosporins.

Fourth generation drugs:

- Cefepime
- Ceftpirome
- Cefclidin

Fifth generation drugs:

Ceftobiprole Ceftaroline

→ USE – MRSA
Community Acquired Pneumonia.

Glycopeptide Antibiotics : Vancomycin
↓
t/t of Gm +ve infection.

Oral Vancomycin – Useful for Pseudomembranous colitis

i.v. Vancomycin – DOC for MRSA.

caused by Clostridium difficile.
↓
Caused by 3rd gen. Cephalosporin.

Newer drug for PMC – Rifaximin
Fidaxomicin

ADR of Vancomycin: Red Man Syndrome (M/c)
Ototoxicity
Nephrotoxicity

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Other Glycopeptide antibiotics :
Teicoplanin
Oritavancin
Telavancin
Dalbavancin - longest acting (6-10 days)

Drugs used for T/t MRSA/VRSA :

VRSA → Linezolid -
S/E - Thrombocytopenia (M/C)
Optic & peripheral neuropathy.
Also used for MDR TB.
MAO inhibitory property.

VRSA → Streptogramine
Quinupristine : Dalfopristine = 70:30.
S/E - Infusion reac^{n}
Arthralgia.

VRSA → Daptomycin
↳ causing myopathy.

VRSA → Tigecycline
given i.v. tetracycline.
Resistant to efflux
Excretion - Bile
Safe in Renal failure.

Sulfonamides:

Sulfasalazine
↓ In GIT split in 2 component

Sulfa pyridine → Useful for RA.

5 amino salicylic acid. → Useful for ulcerative colitis

ADR – Allergy
Oligospermia (In male) → Infertility.

Topical – Sulfacetamide – For eye drop.
Silver sulfadiazine] – has anti-pseudomonal action
Mefanide]
↳ CA inhibitory action
↓
Metabolic acidosis.
useful for Fungal Keratomycosis.

Sulfadoxine + Pyrimethamine → For T/t of Malaria.

Toxoplasmosis:
For t/t : Sulfadiazine + Pyrimethamine + Folinic acid.

Safest drug For t/t of Toxoplasmosis in pregnancy – Spiramycin (Macrolide)

Cotrimaxazole : Sulfamethaxazole (400mg) + Trimethaprime (80mg).
Cotrimaxazole DS : Sulfamethaxazole (800mg) + Trimethaprim (160mg)
↓
DOC : Pneumocystis carinii pneumonia.

Aminoglycosides.

For t/t of TB → Streptomycin (1st line drug)
Kanamycin
Capreomycin
Amikacin
] 2nd line drug.

- All are ionised molecule so not absorbed via orally.

Streptomycin – DOC for Plague (mass prophylaxis)
↓
Doxycyclin

Also useful in – TB
Tularemia.

Aminoglycoside useful for Pseudomonas:
T = Tobramycin
A = Amikacin
G = Gentamycin

↓

Among Cephalosporin
– Ceftazidime
Cefoperazone.

For severe Pseudomonas infection – TOC is combination of Cephalosporin c Aminoglycosides.
eg: Ceftazidime + T or A or G.

Last option for severe resistance case of Pseudomonas

↓

Polymyxin B.

Paramomycin –
Oral – Amoebiasis
i.v – Kala azar.

Neomycin :
generally parentrally
Oral – Gut sterilization
Hepatic encephalopathy.

Aminoglycoside follow conc^{n} dependent killing pattern so given OD dose.

Beta Lactam follow time dependent killing so given TDS / QID.

Post antibiotic effect of Aminoglycoside :
Even though the ~~blood~~ drug level is lower than the MAC value still produce action.

Common S/E of Aminoglycoside :
Nephrotoxicity
Ototoxicity
Neuromuscular block (Neomycin)

Among the Aminoglycoside – Gentamycin, Tobramycin, Neomycin → Highly Nephrotoxic
Least Nephrotoxic – Streptomycin

Max^m deafness caused by – Kanamycin
Amikacin Max^m.
Neomycin

Deafness 1st high frequency sound → lastly low frequency sound.
First damage Base of hair cell → lastly apex of hair cell.

Vestibular damage – Streptomycin
Gentamycin.

Equal – Tobramycin
Least – Netilimycin.

Quinolones:
MOA: inhibits DNA Gyrase in Gram -ve
inhibit Topoisomerase IV in Gram +ve.

Route of Excretion – Kidney.
↳ So not given in Renal failure.

Excretion via liver – Prefloxacin
Trovafloxacin
Moxifloxacin
} Used in RF (Safe)

Ciprofloxacin:
DOC for Typhoid
↳ Currently 1st line choice
– Ceftriaxone (i.v.)
(In children/Pregnancy)
or in Ciprofloxacin Resistance.

Drug interaction ~ theophylline:
Ciprofloxacin is microsomal enzyme inhibitor, when ~~~ given ~ theophylline, theophylline level ↑ in plasma which causes convulsion/seizures.

Withdrawn Quinolones:
Trovafloxacin — liver toxicity.
Grepafloxacin — QT prolongation
Gatifloxacin — Unpredictable glucose profile.
↳ Only systemic use was withdrawn
Eye drop available.
Clinafloxacin — Phototoxic

available Quinolones. < Sparfloxacin (longest action)
Lomefloxacin

Macrolides.

Clarithromycin:
Useful for — MAC
H. pylori
Leprosy.

Azithromycin:
Useful for — MAC
Gonococci/Syphilis/Chancroid
Chlamydia
Legionella
Campylobactor jejuni

Common S/E of Microlides —
- GI toxicity → due to motilin
- Hearing impairment.
- Hepatitis
- Cholestatic jaundice caused by erythromycin estolate.
- ~~Erythromycin estolate~~

Drug interaction :
- All microlides are microsomal enzyme inhibitor

Erythromycin – Max^m microsomal enzyme inhibition so max^m drug interaction

Azithromycin – Least microsomal enzyme inhibition

Azithromycin may cause QT prolongation.

Erythromycin aggravates pyloric stenosis.

Tetracycline.

Tigecycline –
Given i.v.
Useful for MRSA/VRSA
Excreted by bile so safe in Kidney failure.

Doxycycline –
Excreted via bile, safe in RF

Demeclocycline –
Photofoxic
Cause DI
Useful for SIADH.

Minocycline :
Used for leprosy.
↳ Rifampicin
Ofloxacin
Minocycline.
S/E - Vestibulo toxicity.

All tetracycline having risk of causing elevation of ICT called Pseudotumour Cerebri.

Outdated tetracycline may cause Fanconi Syndrome.

Tetracyclines are DOC for ① Rikettesial infection
② Chlamydia infection
③ Lymphogranuloma Venerum. (LGV)

Tetracycline used as Prophylaxis of : Cholera
Brucellosis
Plague.

C/I in pregnancy - Fulminant hepatic failure
Baby < Bone & teeth problem.

Most safest antibiotics in pregnancy → β-lactam
↓
Cephalosporin & Penicillin > Azithromycin

Antibiotic & Colour association:
Grey baby – Chloramphenicol
Yellow baby – Sulfonamide
Red man Syndrome – Vancomycin
Discoloured teeth – Tetracyclines.
Coffee coloured teeth – Nitrofurantoin
Loss of Red/green perception – Ethambutol.
Reddish black – Clofazimine.

Tuberculosis

Anti-tubercular drugs:

Isoniazid (INH):
- activated by the help of INH A gene & catalase peroxidase.

MOA: Inhibiting mycolic acid synthesis.

- Undergoes metabolism by acetylation.

S/E – Hepatotoxicity (M/c)
↳ due to formation of Acetyl hydrazine
Neuropathy
↳ t/t – Slow administration of Vit B6
Prophylactically – 10mg/day
Neurotoxicity – 100mg/day.
Memory impairement
Psychosis.
Shoulder hand syndrome
SLE
Cheese Reac^{n}.

It is micro enzyme inhibitor.

Doesn't require dosage adjustment in pts c Renal disease.

Useful for prophylaxis of TB
Maxm CSF penetration.

Iproniazid → derivative of Isoniazid.
Used for elevating mood.

Rifampicin:
- Activated c help of Repo B gene.

MOA: Inhibit DNA dependendent ~~RNA~~ RNA polymerase.

- Excretion via Bile & faces
So safe in RF.

S/E - Non serious:
Reddish orange colour (Urine, Sweat & tears)
Staining of contact lenses.

Serious:
Hepatitis
Respr syndrome
Hemolysis
Purpura.

It is microsomal enzyme inducer
pt c HIV Receiving antiviral drug, if we use Rifampicin for TB, Ht failure occurs.
Alternate drug → Rifabutin → Causes Pseudo jaundice.

Pyrazinamide :
- Act by inhibiting myeolic acid synthesis.

S/E - Hepatotoxicity
Hyperurecimia

No drug interaction bcoz Neither microsomal enzyme inducer or inhibitor.

Undergoes renal route of excretion so need dosage adjustment in RF pt.

Ethambutol :
Bacteriostatic
MOA : Inhibiting Arabinoglactan synthesis.

S/E → • Optic neuritis
↳ loss of ability to differentiate red from green.
↳ Supplement c Hydroxycobalamine (Vit B12)
• Hyper urecemia.
Excretion → Undergo renal route of Excretion
- Need dose adjustment in RF pt.

Streptomycin :
C/I in pregnancy bcoz cause permanent deafness.
in Children.

TB in liver ds pt:
Avoid — Isoniazid, Rifampicin, Pyrizinamide.

Safe — Streptomycin, Ethambutol.

TB in a Renal ds pt:
Avoid — E, P, S

Safe — R > H

Newer drug for MDR-TB:
Bedaquiline:
Inhibit mycobacterial ATP synthase.
Food ↑ Absorption.
Cross resistance c clofazimine
May cause QT prolongation.
↳ Cardiotoxicity.

Delamanid
Pretomanid — Inhibit Mycolic acid synthesis.

Sutezolid — Derivative of linezolid.

Anti TB drug causing:

① Hypothyroidism — Ethionamide (also used for leprosy)
PAS

② Psychosis — INH, cycloserine.

Antibiotic useful in MAC = Azithromycin,
Clarithromycin

REC Regimen (R = Rifabutin, E = Ethambutol, C = Clarithromycin)

③ Cross BBB – INH, Pyrizinamide, Rifampicine, Cycloserine.

④ Uveitis – Rifabutin

Anti-leprosy drug.

– ATT drugs → Rifampicin
Ethionamide.

Other drug → Clofazimine
Dapsone.

Antibiotic useful for leprosy – Ofloxacin
Minocycline
Clarithromycin

Dapsone – Sulphonamide

Uses of Dapsone –
DOC for dermatitis herpatiformis.

Inj. Acedapsone (i.m) one dose acting for 3 months.

S/E – Allergy (M/C)
Hemolytic Anemia.

Clofazimine –
Bacteriostatic
Anti inflammatory property.
↓
also useful for lepra reac^{n}.

S/E – Reddish black skin discolouration
Dermatological.

Lepra Reacⁿ:

Type I – Cell mediated immunity to M. leprae.

Type IV hypersensitivity.

TOC – Prednisolone (Steroid).

Type 2 – Immune complex deposition.

Type III Hypersensitivity.

T/t – Steroids
Clofazimine
Chloroquine.

Virology.

Drugs useful for HIV:

Fusion inhibitors:

Enfuvirtide
– Given S/C

S/E → Injection site reacⁿ
Pneumonia (Rare)

CCR-5 inhibitor:

Maraviroc – FDA approved
Aplaviroc } undertrail.
Vicriviroc }

NRTI's (Nucleoside Reverse Transcriptase inhibitor):

Zidovudine (M/C)
- ↳ Myelosuppressant (Macrocytic Anemia)
- ↳ Lipodystrophy → due to mitochondrial DNA polymerase

Didanosine
- ↳ Pancreatitis

Stavudine – Worst drug.
- ↳ S/E – Severe Neuropathy
  - Lactic acidosis
  - Lipodystrophy

Abacavir (Rule out HLA-B5701 allele, MI, Safe in RF)

Zalcitabine

also useful for HBV:
- Lamivudein – Best drug (No serious adverse effect)
- Emtricitabine
- Tenofovir – Causes GIT toxicity, Fanconi's Syndrome).
  - ↳ Really a nucleotide inhibitor.

NNRTI:

1st generation:
- Efavirenz
- Nevirapine, NVP
- Delavirdine.

2nd gen:
- Etravirine
- Rilpivirine.

Common S/E – Skin Rash
- Steven Jhonson Syndrome
- Toxic epidermal necrolysis.

Nevirapine
↳ S/E – Hepatitis (LFT)

Efavirenz
↳ S/E – Neuropsychosis

Integrase inhibitor:
Raltegravir
Elvitegravir } Best drug.
Dolutegravir

Protease inhibitor:
Saquinavir – Best tolerated
Indinavir – Nephrolithiasis
Nelfinavir
Ritonavir – Powerful microsomal enzyme inhibitor (CYP3A4)
↓
Called Booster.
Amprenavir
Fosamprenavir
Atazanavir → Not cause lipodystrophy.
Lopinavir.
Tipranavir → may cause intracranial hemorrhage.
Darunavir } Sulfonamide

Common S/E – Hyperglycemia
Fat redistribution
Hyperlipidemia.

TESAMORELIN – GHRF
↳ Reduce abdominal fat in HIV c lipodystrophy.

CROFELEMER – CFTR inhibitor
Use – HIV drug induced diarrhoea.

Maturation inhibitor.
- Bevirimat. (Under Trail)

HAART / CART (Highly active anti retroviral therapy):
2NRTI + 1 NNRTI
NRTI + NNRTI + PI
] Triple drug therapy
↓
To prevent drug resistance.

NACO 2011 → Zidovudine + Lamivudine + Nevirapine.

CMV (Cyto megalo Virus) → Cause Retinitis.
- Ganciclovir (DOC)
↳ M/c S/E – Myelosuppression.
Valganciclovir
Fomevirsin
Foscarnet
Cidofovir
Maribavir.

Foscarnet :–
Useful for HSV (resistant to Acyclovir)
CMV (Ganciclovir resistance)
ADR – ARF
Penile ulcer.

Cidofovir — Useful for Respr papillomatosis.

Drug for Herpes simplex Virus

Acyclovir — For HSV
ADR — Acute Renal Failure

Docosanol — Viral entry inhibitor
given topically

Famciclovir — Prodrug
Active form — 6-deoxy penciclovir.

Drug useful for Hep B:
Injection are { IFN-α
PEG-INF-α

Oral agents:
1st line — Entecavir
Tenofovir (Anti HIV drug)

2nd line — Lamivudine
Adefovir
Telbivudine.

Drugs for HCV:

Commonly we give PEG INF α plus ribavirin.

Sofosbuvir – Given orally
Renal excretion
Causes Bradycardia

Other drugs –
Telaprevir
Boceprevir
Simeprevir
Grazoprevir
~~Elbasvir~~ Elbasvir

Daclatasvir
Velpatasvir
Ombitasvir

Ledipasvir
Viramidine – (Under trial)

Antifungal drugs.

- Membrane Active Antifungal Agents:

Squalene → Lanosterol → Ergosterol → Fungal cell membr

Squalene epoxidase ⊖ ← Terbenafine

14α-demethylase cyto P450 ⊖ ← Azoles

Polyene antibiotics —

Amphotericin B + Ergosterol → Forms a pore in fungal cell

↓ Act on fungal cell wall.

↓ Destroy fungus

Amphoteracin B:

Usually given as a slow iv infusion.

Very well distributed all over body / poorly distributed in CNS.

ADR — Infusion related reacn (Fever, Chills)
Nephrotoxicity (Dose limiting toxicity).
Hypokalemia
Hypomagnesimia
Anemia
Seizure.

To avoid Nephrotoxicity — Give Hydration.

Newer formulation: ABCD (Colloid dispersion)
ABLC (Lipid complex)
Liposomal AMB (For Kalazar)

↓ less systemic toxicity.

Drug interaction – Be careful while using Amphotericin B with other Nephrotoxic agents like –
Aminoglycosides
Vancomycin
Cyclosporin.

Azoles + Amphoteracin B : Mutually antagonist
↓ ↓
Inhibit Ergosterol No action ē Ergosterol.

Terbinafine – Squalene epoxidase inhibitor.

5- Flucytosine – Antimetabolite acting on fungal nucleus.

5 Flucytosine + Amphotericin B ⇒ Synergism.

Grascofulvin –
– acting by inhibiting microtubule.
– Useful for Dermatophytosis
Onychomycosis.
– Given orally.
– Microsomal enzyme inducer
– Disulfiram like reac^{n}.

Newer Antifungal – Echinocandins
eg: Caspofungin
Micafungin
Anidulafungin
MOA – Acting on β-1,3 –glucan synthase inhibitor.
Uses – Candida & Aspergillosis.

Page No.
Date : / /

Nikkomycin – Inhibit chitin Synthesis
Useful for Candida & Aspergillosis.

Amoebiasis

Lumen Amoebiasis
- Diloxanide furoate (Flatulance)
- Nitazoxanide
  ↳ Use in Cryptosporidiosis
- Quinodochlor → Cause Subacute myelo optic neuropathy (SMO

Tissue
- Extraintestine
- Both intestine & Extra intestine

- Iodoquinol

- Paromomycin (oral) → i.v. for Kala-azar.
- Tetracyclines

Extraintestine :
Chloroquine.

Both :
Metronidazole
Tinidazole
Secnidazole (Single dose) – M/C C/E – Nause, Vomiting
Ornidazole (Metallic taste
Satranidazole (less ● neurological ADR)
Ementine
Dehydro ementine.

Page No.
Date : / /

Guinea worm : For complete removal of worm
DOC – Niridazole.

Helminthiasis

Trematodes	Cestodes	Nematodes.
DOC – Praziquantel	DOC – Praziquantal	DOC – Albendazole
Except – Fasiola hepatica	Except – Echinococcus granulosa	Except – Ochocerca Volvulus
↓	Neurocysticercosis	(Ivermectin)
Triclobendazole	↓	↓
Bithional	Albendazole (hepatotoxic)	Strongyloidosis
		Scabies
		W. bancrofti
		↳ DEC.

Leishmaniasis

Kala-azar	Cutaneous	Mucocutaneous
↳ For all forms Sodium Stibogluconate		↓
(DOC) Amphotericin B (In India)	↓	
Hyperkalemia → Pentamidine (ENaC blocker)		
Paromomycin	Fluconazole	Amphotericin B.
oral [Miltefosine	Metronidazole	
oral [Sitamaquine		

Page No.
Date : / /

Trypnosomiasis.

African	South American.
- Sleeping sickness.	- Chagas de
T. gambience	• T. cruzi
& T. rhodesiense.	DOC – Benznidazole
	Nifurtimox.

Early heamolymphatic stage
Suramin (DOC)
Pentamidine

Late - CNS stage
Malarsoprol (DOC)
Eflornithine.

Anti-Malarial drug

Chloroquine (M/c)
↳ Very large apparant Vd of 100-1000 L/kg.

Uses:
R – Rheumatoid Arthritis
E – Extra-intestinal Amebiasis
D – DLE (Discoid lupus erythmatosus)
L – Lepra reac^{n}
I – Infectious mononucleosis
P – Photogenic reac^{n}
M – Malaria
G – Giardiasis.

– Safe in Pregnancy.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

S/E → GI toxicity (Nausea & Vomitting)
CVS (Bradycardia, HTN)
Chronic therapy cause Bull's eye maculopathy.
Lives damage.

Mefloquine:
For t/t & prophylaxis of Malaria.
Long half life.
Single oral dose
S/E - Neuropsychosis.

If combine c̄ Halofen, Quinine - Risk of QT prolongation.

HALOFANTRINE, LUMEFANTRINE:
Absorption ↑ c̄ food.
Halofantrine - more cardiotoxic.

Lumefantrine + Artemether ⇒ ACT

Primaquine
- Vivax curative
In G6PD deficiency → Cause hemolytic anemia.
C/I in pregnancy.

Artemisinin:
Artesunate, Artemether, Arteether → Fast acting drug
Short acting - Recurrentence more
↓
For extending duration of action combine c̄ Mefloquine.

Page No.
Date : / /

Indication :

Multidrug resistance Malaria
Cerebral Malaria.
Not indicated for chemoprophylaxis of Malaria

S/E – GI toxicity (M/C)
CVS → QT prolongation, 1st degree AV block.
Hematology → Reversible Leucopenia.

WHO approved Combine therapies :

FDC = Artemether / lumefantrine
Artesunate + amodioquine
Artesunate + SP
Artesunate + Mefloquine
} ACT's

Unsafe Antimalarial drug in Pregnancy :

Halofantrine
Tetracycline / Doxycycline.
Primaquine

ENT

Handwritten Note

MBBS Help

http://mbbshelp.com

http://www.youtube.com/mbbshelp

http://www.facebook.com/mbbshelp.com

Name: _____

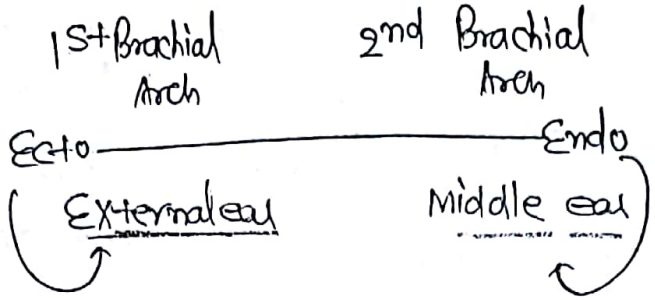
Subject: ENT

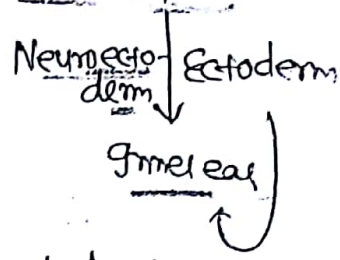
MBBSHELP.COM

27/3/18

ENT

EAR ⇒ Middle ear is Sandwitch b/w the ectoderm.





* Otic capsule gives Rise to ectoderm which gives Rise to inner ear

→ Middle ear cavity - Six sided box of Middle ear cavity

Ant. TEA (Tensor tympani ; Eustachian tube ; carotid wall)

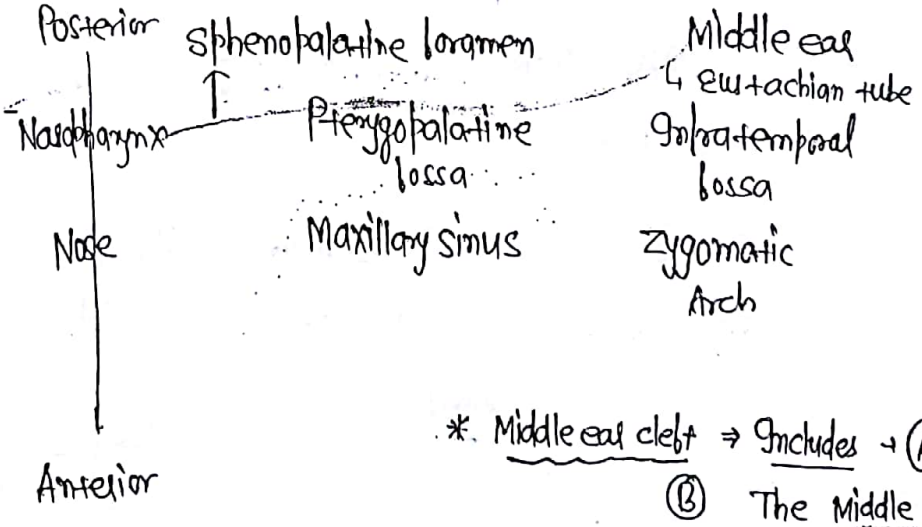
Post. ⟶ Mastoid

Medial → Promontry ⟶ Inner ear

Lateral → Tympanic Membrane ⟶ External ear

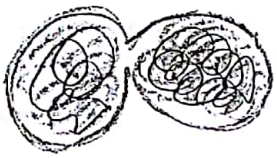
Roof → Tegmen tympani ⟶ Middle cranial fossa

Floor → Jugular bulb



* Middle ear cleft ⇒ Includes → (A) Eustachian tube;
(B) The Middle ear ;
(C) Aditus; which leads posteriorly to the Mastoid Antrum & Air cells.

- Eustachian tube - Starts from Anterior wall of Middle ear; going to Lateral wall of Nasopharynx (1.25 cm behind Inferior Meatus),
  - ↳ Length = 36 mm (Reached by the age of 7 years)
  - 1° Toynbee test ⇒ Eustachian tube Patency ***
- Sphenopalatine Foramen ⇒ Angiofibroma (Juvenile Nasopharyngeal Angiofibroma)
  - ⇓
  - Biopsy is C/I; b/c it is tumor of blood vessels
  - → tumor is Removed in total; Debulking Sx is C/I.
  - (14-15 yr) old boy.
  - -Mc benign Neoplasm of Nasopharynx.



⇒ Dumbell-Shaped tumor
- ↳ b/c one portion of tumor filling the Nasopharynx & the other portion extending to the Pterygo-palatine fossa.

- "Hollman Miller sign" OR "ANTRAL sign" ⇒ Hallmark Sign of Angiofibroma
  - ↳ compress the posterior wall of Maxillary Sinus
    - ↳ Result in bending down,
- Maxillary Artery Ligation in Pterygopalatine fossa is done in epistaxis.
- Vidian Nerve cut in Pterygopalatine fossa is done in Vasomotor Rhinitis.

* Small Angiofibroma ⇒ Transpalatine approach.

* Large Angiofibroma ⇒ Transpalatine + Sublabial approach.

* Fisch Staging of Juvenile Angiofibroma ⇒

Stage I → Tumor is Limited to Nasopharynx / sphenopalatine;

Stage II → Tumor is Limited to pteropalatine fossa / mastoid;

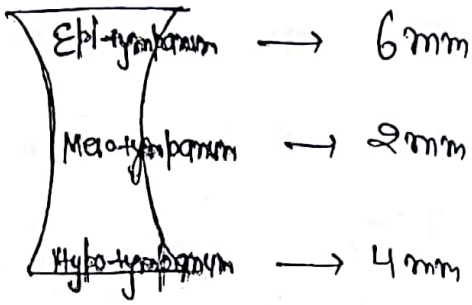
Stage III → Tumor is Limited to Intratemporal fossa

Stage IV → Tumor is Limited to Intracranial fossa

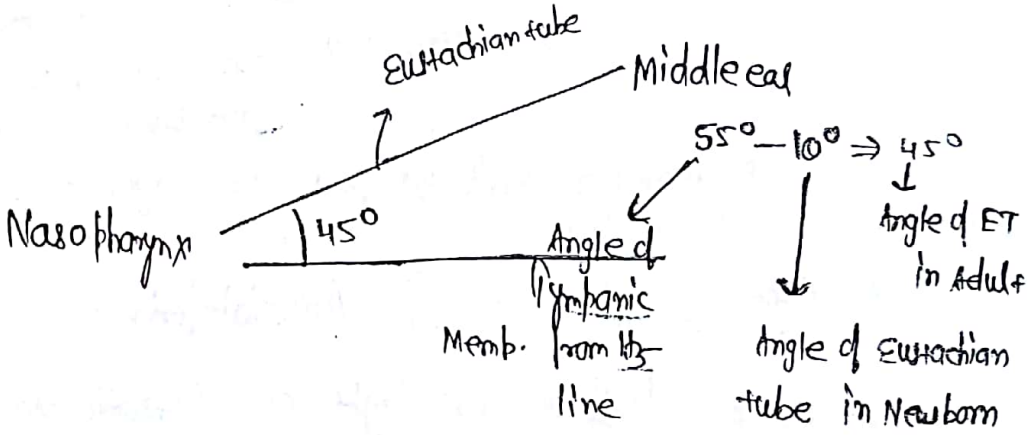
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* When we take section of Middle ear; It is "Biconcave" In shape

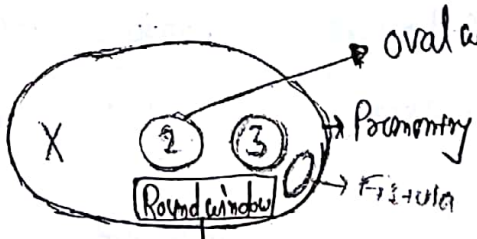
* Middle ear → Epi-tympanum ⇒ Widest (6mm)
  → Meso-tympanum ⇒ Narrowest (2mm)
  → Hypo-tympanum



*



* Protympanum ⇒ Part of Middle ear surrounding the Eustachian tube



Pressure Release of Inner ear

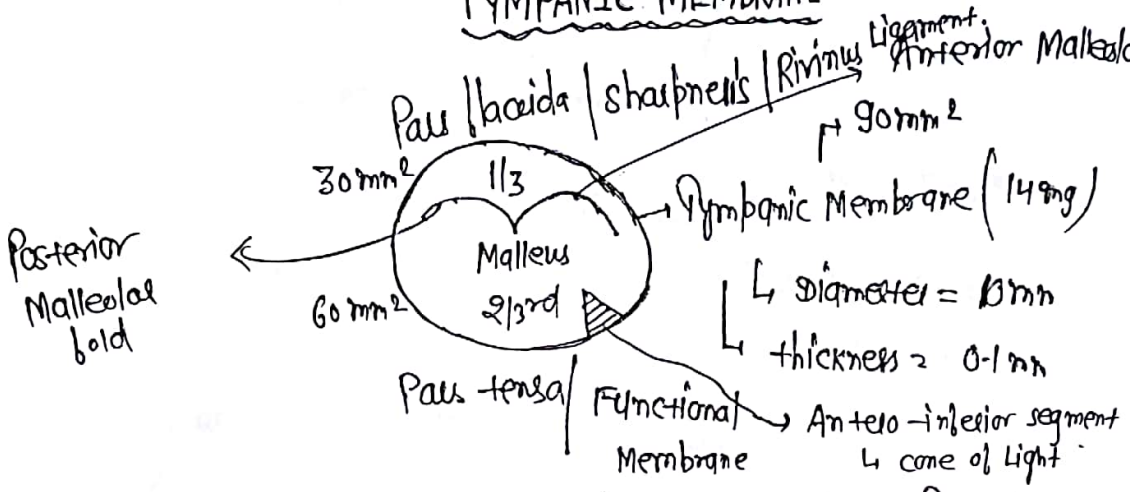
* Eustachian tube is pressure Release of Middle ear

Lateral 1/3rd bony → Medial 2/3rd cartilaginous

Order of Infection ⇒ Mucus → Pus → Osteomyelitis
↓
Fistula

3rd window effect ⇒ Loss of Sound energy from a Artificial fistula
↳ b/c of damage (opening) in Semi circular canal.

TYMPANIC MEMBRANE



* Anterior Malleolar fold is longer than Posterior Malleolar fold.

* Cone of Light ⇒ @ Anterioinferior
↳ if we put Light on Tympanic Membrane; cone of Light seen,
↳ if we Remove Mucus in glue ear than do Myringotomy.
↳ Grommet Insertion (to prevent accumulation of Fluid in the Middle ear).
↳ Small Plastic tubes

* Tympanic Membrane contains all the three germ layer; but
(✗) Pars flaccida; (✓) Healed TM contains 2 layers (Mesoderm absent)

* Pearly Grey > Pearly white - Colour of Tympanic Membrane

* Curved Membrane effect ⇒ Tympanic Membrane is More mobile @ Periphery than at the centre

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Most Concave part of Tympanic Membrane ⇒ Umbo.

• Order of Reliable Marker of Middle ear ⇒

Umbo > Handle of Malleus > Cone of Light.

* Only Malleus seen on Tympanic Membrane = Normal
Nothing seen on Tympanic Membrane = Buldging
More than Malleus on TM = Retraction

M/c cause/ earliest cause = Eustachian tube dysfunction/ Retracted Pouch formation

* TOSS Classification :- "FMT" → Flaccida, Toss, Malleus

Grade I :⇒ Pars flaccida Retracted but Not touching Malleus

Grade II :⇒ Pars flaccida touching Malleus

Grade III :⇒ Grade II + Mild touching Epi-tympanum/Scutum

Grade IV :⇒ Grade III + Severe damage to Attic/scutum of Attic

* SADE classification → "SIMT" → Sade, Grey, Tensa

Grade I → Pars tensa Retracted but Not touch incus

Grade II → Pars tensa Retracted but touching incus.

Grade III → Pars tensa touching promontory but mobile

Grade IV → Pars tensa touching Promontory and adherent (Adherent to (atalectasis of ear)

* Multiple Reflection point ⇒ Intact Tympanic Membrane
  ↳ Light Rays are Reflected from Tympanic Membrane

* Nerve supply; Venous supply; Arterial supply of Tympanic Membrane

∴ ⇒

* Arterial supply
  - Outer surface → Deep Auricular branch of Maxillary A.
  - Inner surface → Ant. tympanic br. of Maxillary A.
  - Inner surface → Post. tympanic br. of Posterior auricular A.

* Venous drainge
  - Outer surface → External jugular vein
  - Inner surface → Transverse Sinus

*Nerve supply
- Outer surface → Auriculotemporal Nerve (Anterior 1/2)
- Outer surface → Auricular br. of vagus Nerve (Posterior 1/2)
- Inner surface → Tympanic br. of Glossopharyngeal N.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Infection of CNS from Middle ear ⇒ via Fissure of Hustle ④

Middle Ear → cavity of Middle ear ⇒ Tympanic cavity

- Sensory Supply ⇒ 9th & 10th Nerve

↓

Tympanic plexus ⇒ ⊕nt on Promontory

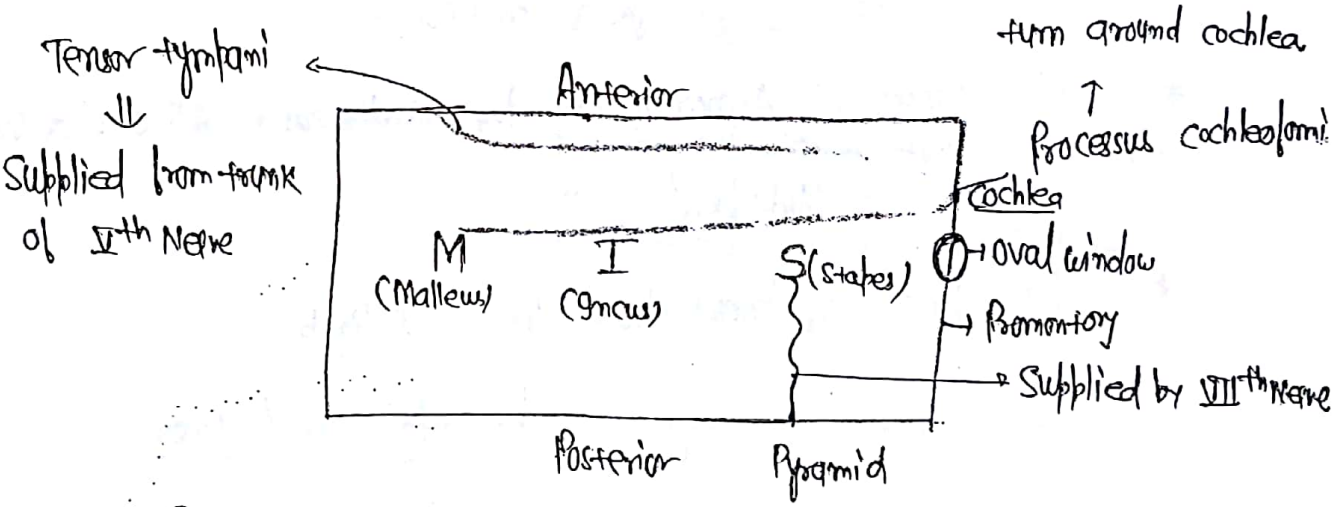
fibres of 9th Nerve ⇒ Jacobson fibre

fibres of 10th Nerve ⇒ Arnold fibre

↳ Parasymphathetic ; but Arnold fibers are sympathetic so Mixed Nerve

* Arnold fibres coming from Carotid plexus at Anterior wall.

- Motor Supply ⇒ 5th & 7th Nerve



Processus cochleoformis ⇒ Hook-like projection Located Anterior to oval window for tendon of tensor tympani.

↳ It Marks the Level of the Genu of the Facial Nerve

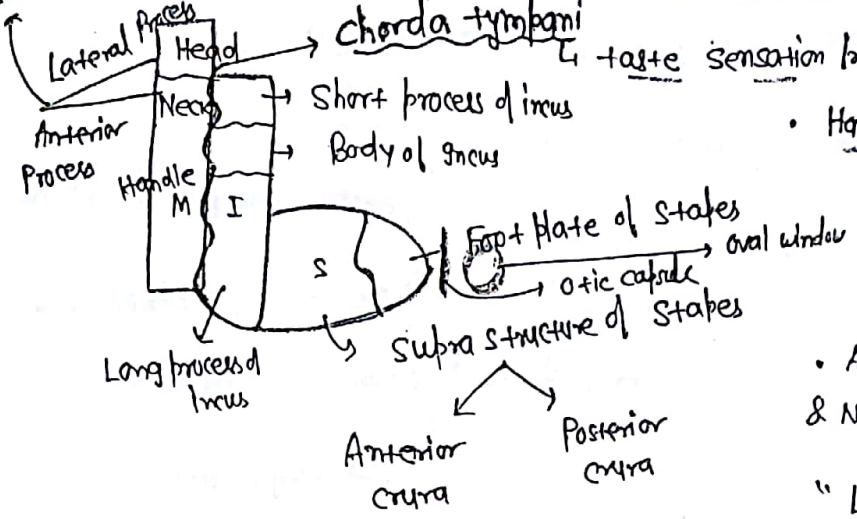
⇓

Important Landmark for Surgery of Facial Nerve

Auditory ossicles

originate from Malleus

→ Moving b/w Malleus & Incus



↳ taste sensation from Ant. part of tongue

- Handle of Malleus ⇓ Manubrium
- At the junction of head & Neck of Malleus ⇓ "Lateral Process of Malleus"

Malleus ; Incus ⇒ 1st branchial arch

Stapes ⇒ 2nd " "

↳ Saddle type of synovial joint.

* Incudomalleolar joint
  Incudostapedial joint
  ⇒ Synovial joint
  ↳ @ High Risk ; b/c Less surface area
  ↳ Ball & Socket type of synovial joint

* M/c congenital Abnormality in Middle ear ⇒ All ossicles subluxation
  ↳ Multifocal

* Long process of incus have lenticular limb
  ↳ M/c site of Necrosis
  ↳ due to tortous Artery

* Vestibular surface = Medial surface of Foot plate
  ↳ otic capsule

* M/c site of otosclerosis ⇒ Foot plate.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

***

Tomy = Puncture
ECTOMY = Removal
PLASTY = Repair

Q: In Stapedectomy all of the following Remove except ⇒

1. Ant. crura of stapes
2. Post. crura of stapes
3. Lenticular Process
4. Foot plate

* Length of Stapedial process Mapped from = Oval window to Lenticular process

* Cholesteatoma
  - No tumor
  - No cholesterol.

Mucous → Pus → Osteomyelitis → Fistula
↓
Erode columnal epithelium of Middle ear & Make it squamous epithelium (via metaplasia)

* Complicated Pus → Squamous debris In the Middle ear.

* Pediateric Population comes ⇒ Congenital Cholestetoma
  - No H/o ear Symptom ⇒ 1° cholesteatoma
  - H/o ear symptom ⇒ 2° cholesteatoma
  - H/o Trauma ⇒ 3° cholesteatoma

Primary Acquired

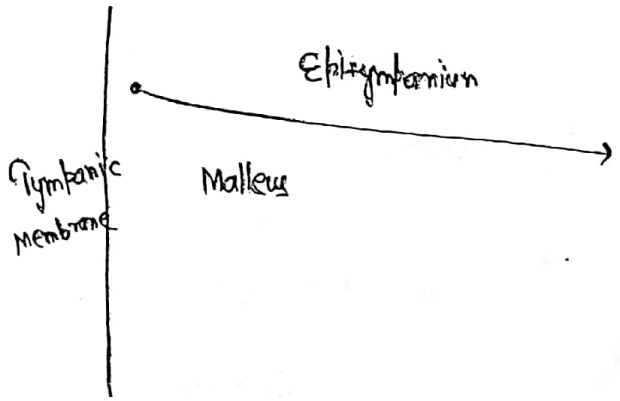
1. Retraction pocket (Wittmaack)
2. Basal cell hyperplasia (Ruedi)
3. Squamous Metaplasia (Sade)

Secondary Acquired

1. Squamous Metaplasia
2. Epithelial Migration (HaberMann)

Tertiary acquired

1. Post - traumatic
2. Post - tympanoplasty.



Above mellus and below tympanic membrane

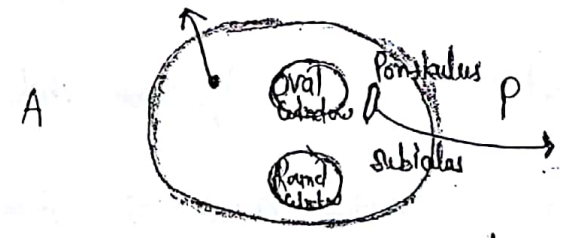
↑

Prussack space

⇓

M/c site of cholesteatoma

(Maxim cholesteatoma formed)



Bounded by Ponticulus ↑ & below by subiculus

Sinus tympani / Tympani sinus

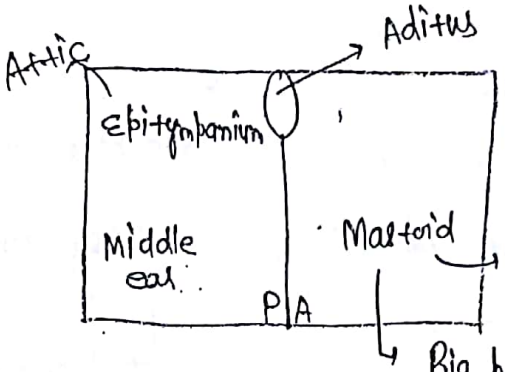
⇓

M/c site of Residual disease,

M/c site of Reoccurrence.

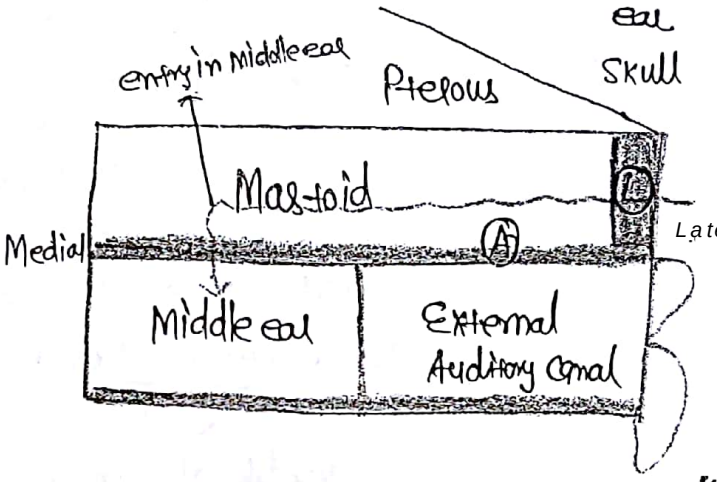
bc it is very small space & tough to clean it.

Posterior (Mastoid) wall



Also "Antrum"

Big hole; which is posterior to Middle ear & also behind the external ear



Width of lateral wall

↓

15 cm

Width of lateral wall in new born -> 1-2mm

* Rate of growth of Lateral wall = 1mm/year
* @ which year Adult size = Newborn size = 15 year

* Approaches to the Middle ear :⇒

Annulus ⇒ Bony canal; on which tympanic Membrane lies;

Via Tympanic Membrane

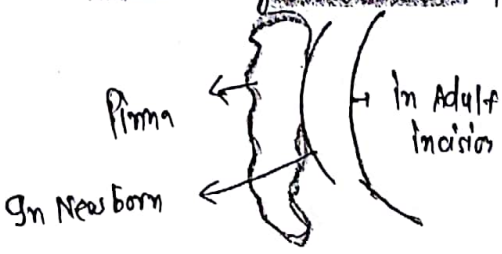
Trans-tympanic approach
(Rosen Endomeatal incision)

via Mastoid

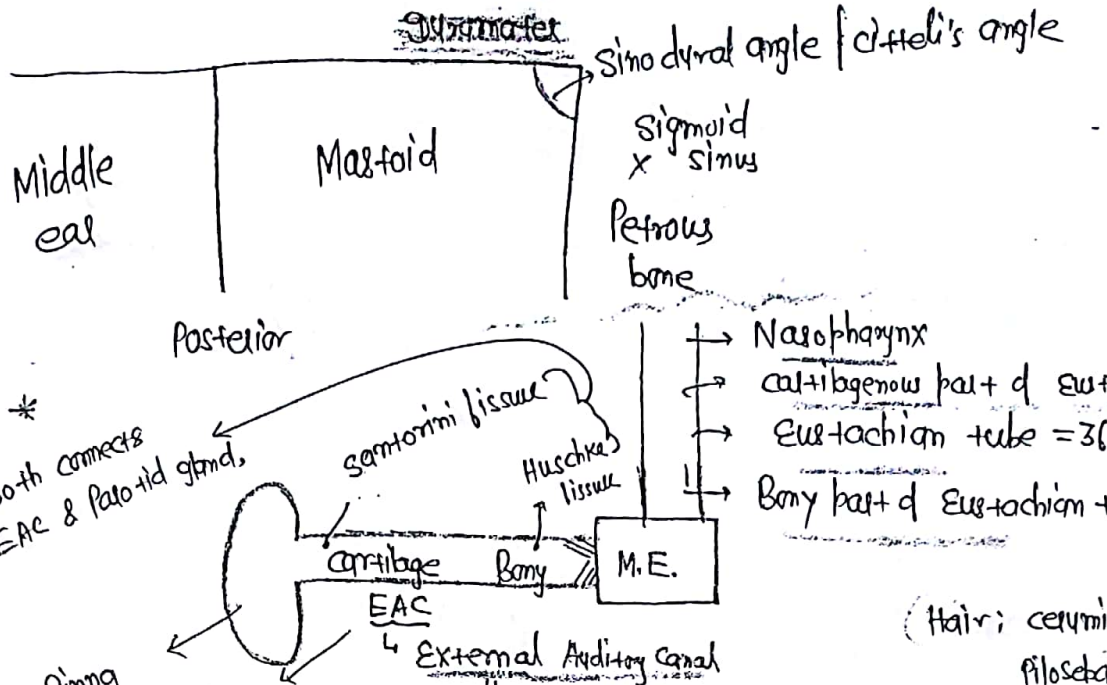
Post auricular approach
(Wilde's Incision)
↳ Behind pinna

- When we give 5mm incision then we face "KORNER SEPTUM"
  ↳ Ptero squamous suture

- Lower edge of the Mastoid (tip of Mastoid) is absent in New born.
  ⇓
  develop of the age of 2 years
  ⇓
  Facial Nerve is Running beneath tip of Mastoid; so; in New born Facial Nerve is exposed
  ⇓
  So; in New born the incision Never extended upto the edge of Mastoid



http://mbbshelp.com WhatsApp: +1 (402) 235-1397



Narrowest part
↳ isthmus (M/c site for foreign body)
5mm Away Tympanic Membrane

24mm Long → Bony = 16mm
→ Cartilagenous = 8mm.

organic More dangerous
↳ swells up

Button battery
↳ c/ln ↓ in Necrosis
↳ Lead to Facial Palsy.

Hair; ceruminous gland & Pilosebaceous gland
⇓
⊕ in cartilagenous part of EAC; Not in bony part

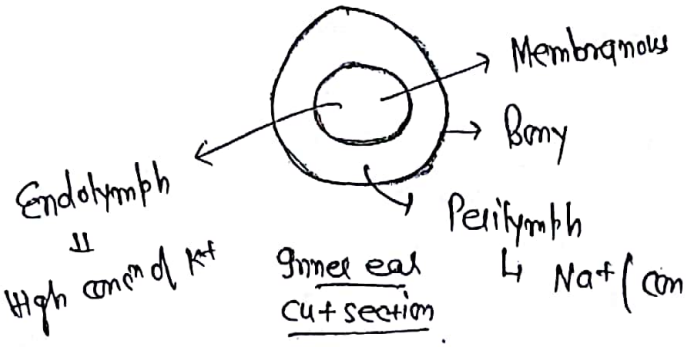
INNEAR EAR

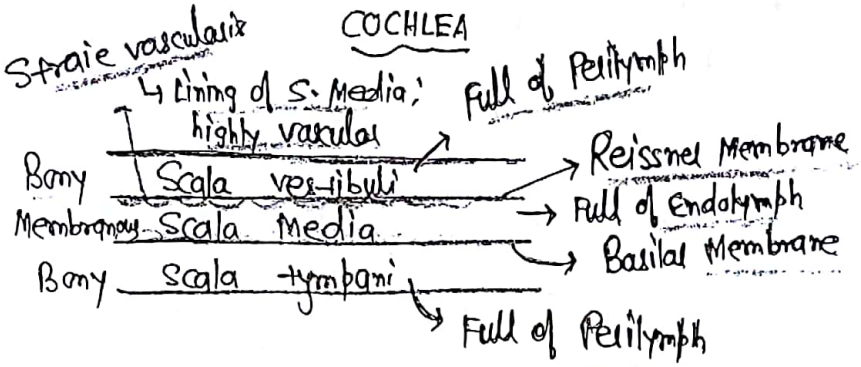
from Anterior to Posterior; it is divided into ⇒

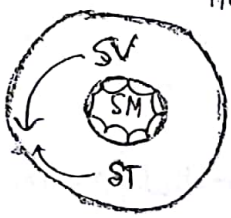
organ	its sensory organ	Functional defect / cause
– Cochlea	organ of corti	→ Headache / Deafness
– Central vestibule	otolith — Utricle, Saccule ↳ Maculae	→ Lineal balance / Ataxia
– Posterior part	Superior, Posterior (SCC), Lateral — Cupulae — Semi-circular canal.	→ Angular balance / Nystagmus, vertigo

* ceruminous gland ⇒ Modified Apocrine Sweat glands.

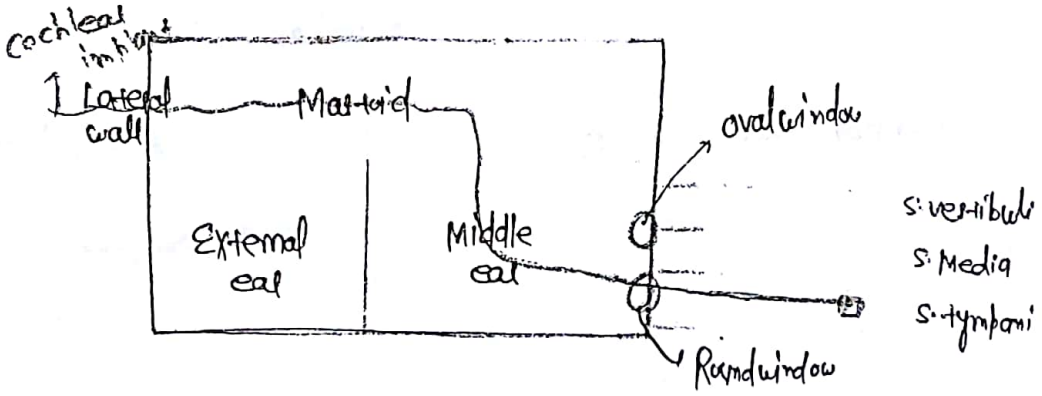
* Cross-section of inner ear :⇒







Helicotrema
⇓
attachment of the Scala vestibulae & scala tympani.



* endolymph is an internal concept ; secreted inside & absorb inside.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

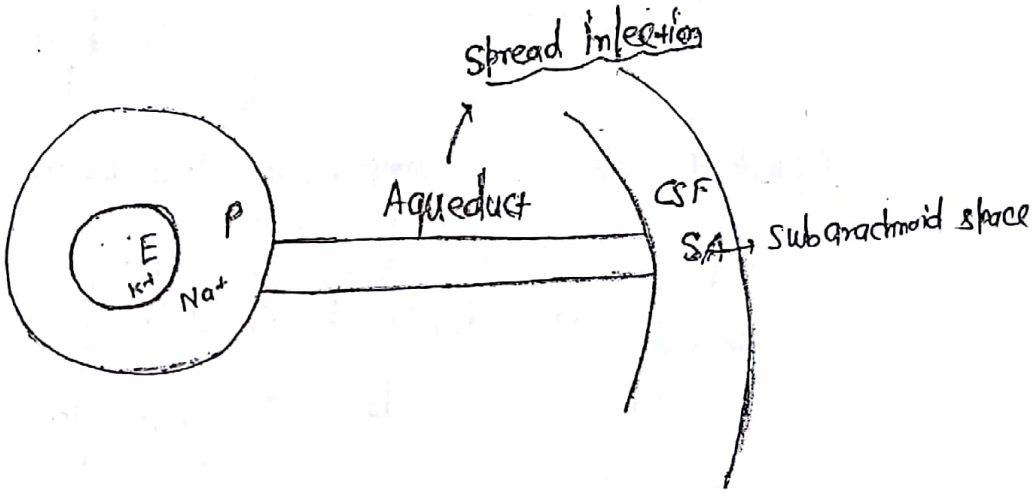
- Perilymph is ultra-filtrate of CSF!
- Endolymph secreting organ of inneal ear :⇒

Cochlea → Stria vascularis

Utricle/Saccule ⇒ Dark vestibular cell

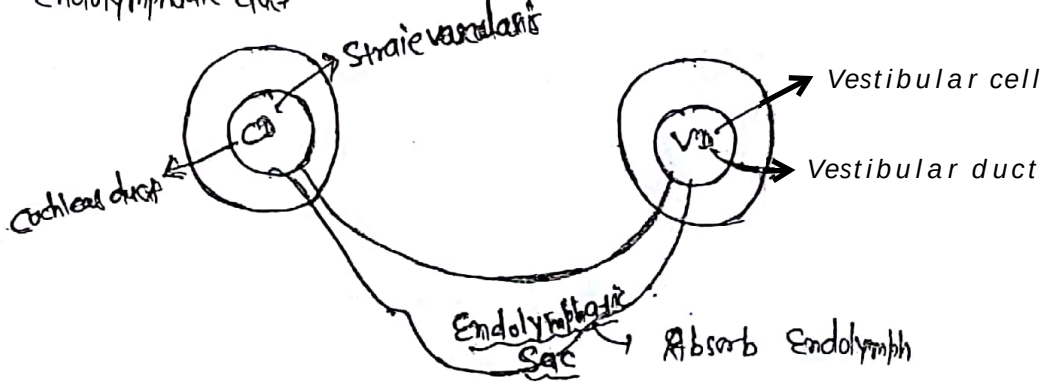
Semicircular canal ⇒ Planum Semilunatum

* Perilymph Secretion :⇒ by Aqueduct of Cochlea
  - drawback → Infection spread



Q. Infection of inneal ear goes to brain via :⇒

a) Cochlear duct (Membranous part of cochlea)
b) Vestibular duct — i.e Scala Media
c) Aqueduct
d) Endolymphatic duct



* Cochlear duct = Membranous part of cochlea = endolymph ⊕ in it.
= deafness on back pressure

Vestibular duct = Membranous part of vestibule
↳ endolymph ⊕
↓
Vestibular symptoms on Pressure

Endolymphatic Sac = absorption of endolymph
↓↓
Located in extradural space
↳ Meniere's dz
↳ if sac is defective
↳ endolymphatic hydrops.

Aqueduct ⇒ Communication b/w brain & inner ear
↓↓
Perilymph secretion
↳ Infection to the brain causes

	Pinna	Meatus/EAC	Middle ear	Vestibule	Cochlea
Development Starts (in week)	6	8	3	3	3
Complete (in week)	20	28	30	20 ↓ Inner ear.	20

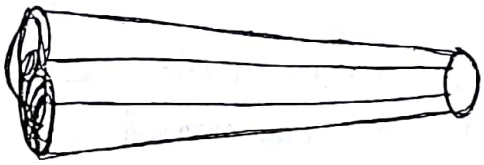
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Congenital Abnormality of Pinna ear

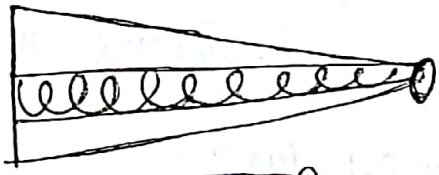
→ If cochlea takes 1.5 turns ⇒ Mondini dysplasia

– If cochlea is absent ⇒ Micheal Aplasia

– Cochlea & vestibule dysplasia ⇒ Scheibe Anomaly (M/c).



↳ Alexender dysplasia



Bing's dysplasia

↳ Membranous part gone; Not bony; So;

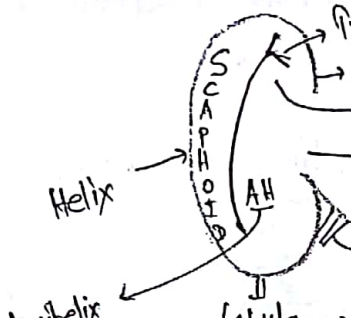
IOC = MRI ; Not CT

BAT Ear ⇒ Absent Antihelix

Mozaic Ear ⇒ Mix Antihelix & helix

Wild earth Ear ⇒ Absent helix

PINNA → Made of Yellow elastic Cartilage except :-
Lobule (No cartilage).



Cymba chancha → M/c site to check tenderness

Incisura terminalis ⇒ M/c site for giving incision

Tragus ⇒ from 1st branchial Arch ; Rest of Pinna from 2nd branchial Arch

Last 3 hillocks

1st + 3 hillocks

Lobule → Last Structure to develop in GUL.

If hillocks Not fused; Sinus formation

* Pinna achieve Adult size by the age 6yr; So; No surgery below 6yr

* Incision at Incisura terminalis is K/as → Intel-cartilagenous Incision
or
End-Aural incision
or
Lempert Incision.

⇓

Area b/w the Tragus & crus of helix

* Pinna attained configuration by 20 weeks of GL

AUDIOMETRY

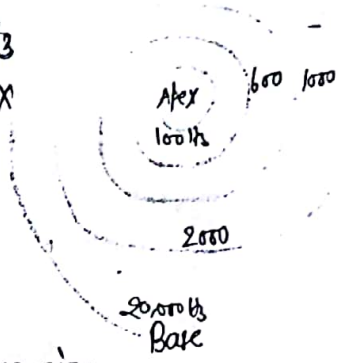
Frequency = type = Hz
Intensity = Loudness = dB
} both are independent properties of Sound

Cochlea Respond to 20 Hz – 20,000 Hz

Base → 20,000 Hz
Apex → 20 Hz

Base → High
Apex → Low

This concepts in a/c to "Travelling wave theory of Von Bekesy".



500/1000/2000 Hz = Speech frequencies

⇓

Frequencies to be assessed

25 dB = cut-off Marking
= Normal threshold
= Audiometric zero

It Means 30 dB threshold = 5 dB deafness

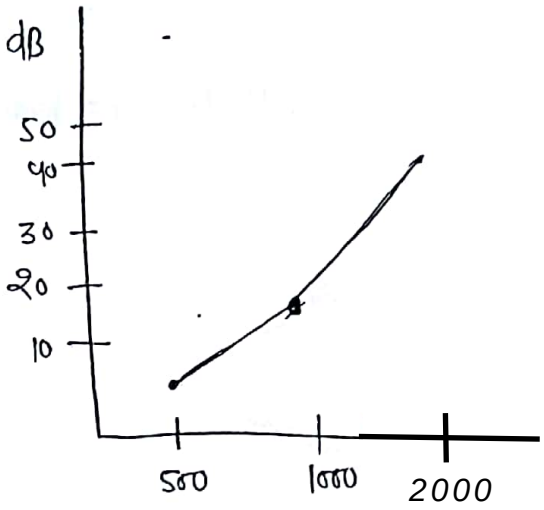
Subjective Audiometry (Asking to patient)
i) PTA;
ii) Speech audiometry;
iii) Beksey Audiometry;
iv) Threshold tone decay test;
v) Short Increment Sensitivity Index (SISI) test.
→ Detect Retrocochlear Lesion.

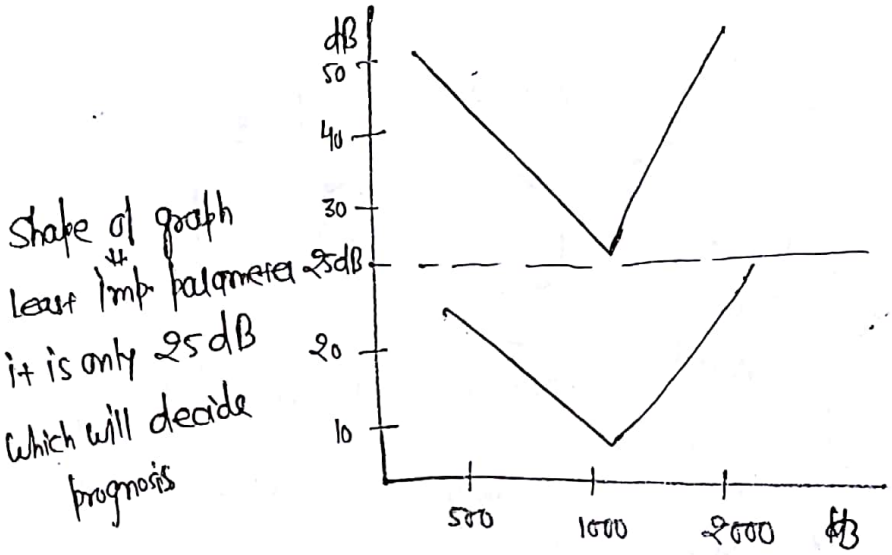
Objective Audiometry
⇓
Ixoc
disadvantage ⇒ Very costly.
b/c No chance of Malingering in this Audiometry.
i) Impedance Audiometry;
ii) Evoked - Response Audiometry;

http://mbbshelp.com .WhatsApp: +1 (402) 235-1397

Pull tone Audiometry (PTA)

eg:- 500 Hz → 5 dB
1000 Hz → 15 dB
2000 Hz → 40 dB
20 dB





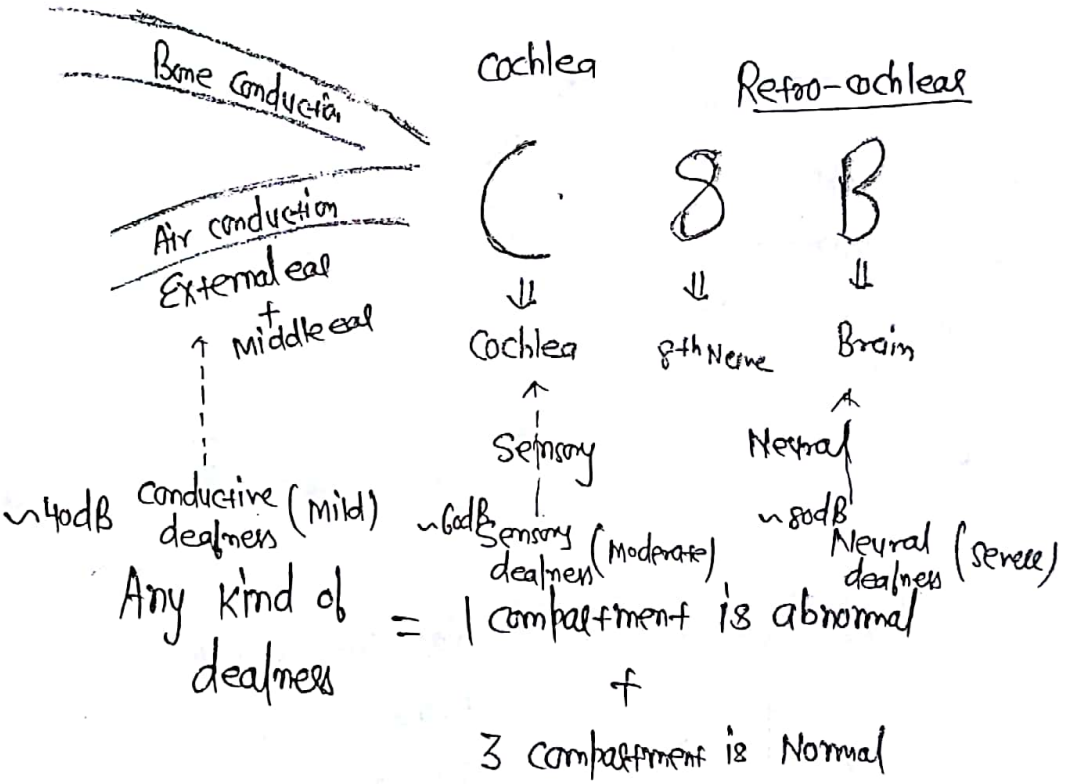
Shape of graph
Least Imp parameter
it is only 25 dB
which will decide
prognosis

* Barany Noise box ⇒ Non-specific sound
Unwanted Ear
Masking.

White Noise
Wide band Noise
Narrow band Noise

Deafness ⇒ Defined as patient Responding to the Sound beyond 25dB.

If Not Response to at all ⇒ Dead ear



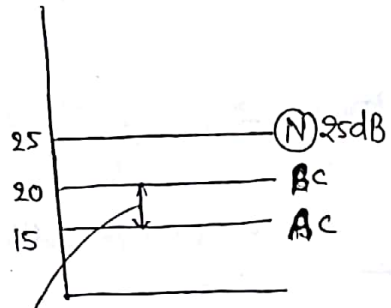
* At one time we plot a graph for separately Air conduction & Bone conduction

* Red colour graph = Rt. side
Blue colour graph = Lt. side

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

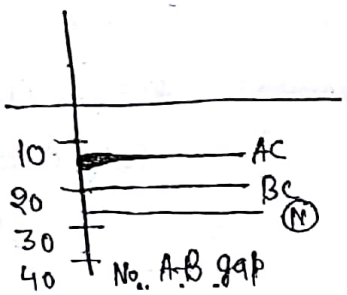
Audiogram key	Rt. Ear	Lt. Ear
AC (Unmasked)	O	X
AC (Masked)	Δ	□
BC (UnMasked)	<	>
BC (Masked)	[	]
No Response	↙	↘

- Right Normal

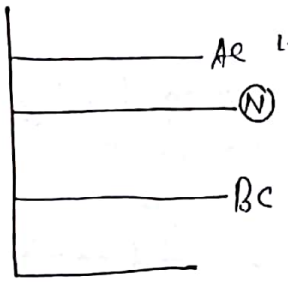


Amplification seen in it; b/c Airconduction prt.

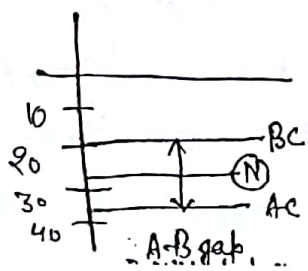
→ Air-bone gap.



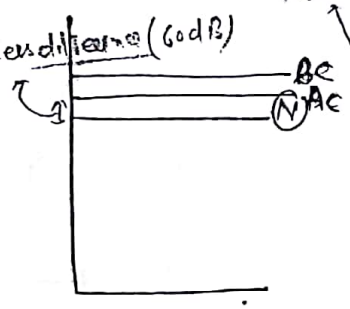
Right conductive deafness

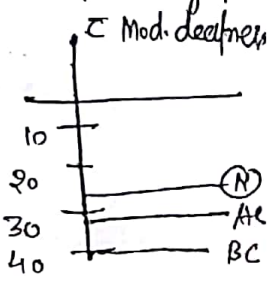


AC Not amplify here b/c; it is defective

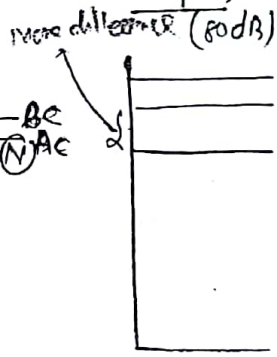


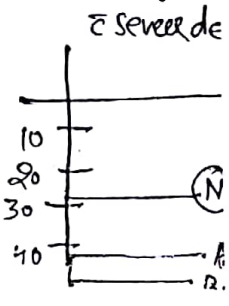
Right Sensori-deafness





Rt. Neuro deafness





http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Ratio of $\frac{\text{Tympanic Membrane}}{\text{Oval window}} = \frac{21}{1}$ = (Total Ratio)

$\frac{\text{Pass tensa}}{\text{oval window}} = \frac{14}{1}$ = (effective Ratio)

$\frac{\text{Malleus}}{\text{Stapes}} = \frac{1.3}{1}$ (Level action of Middle ear)

↓

it Means Handle of Malleu is 1.3 times Longer than Long process of the gncus.

Sound Amplification or Middle ear transformer Ratio. $= \frac{14}{1} \times \frac{1.3}{1} = \frac{18}{1}$

$dB = \frac{1}{\log} \Rightarrow$ Sound Amplification = 5dB

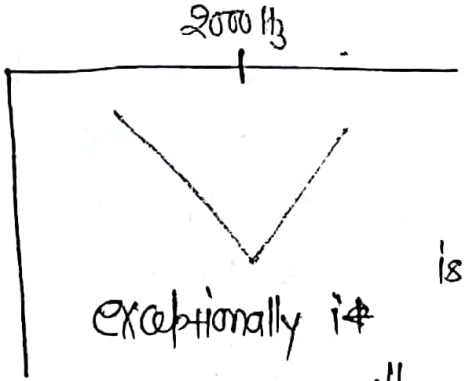
Q. Maxm hearing Loss @ 2000 Hz ⇒ Carhart Notch

↓

Feature of otosclerosis.

↓

Loss should be in Air-conduction



is exceptionally it

loss of bone-conduction.

↓

Ossides themselves are bony in nature; they have same Role in bone conduction; which is dominated in otosclerosis; hence this is a bone conduction.

* Resonance frequency of ossides ≃ 2000 Hz; that's why this Notch

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

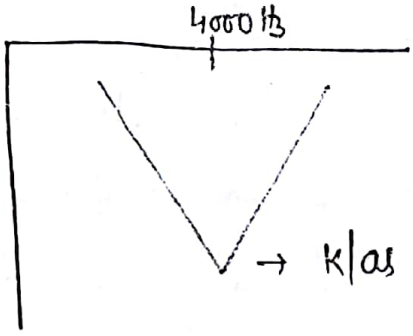
is @ 2000 Hz

Resistance frequency ⇒ It is the frequency; @ which ossicles give Minm Resistance
⇓
Any Structure

* Resonance frequency of Middle ear ⇒ 800 Hz
Resonance frequency of Pinna ⇒ 3000 Hz.
Resonance frequency of Tympanic Membrane ⇒ 800-1600 Hz

* In Noise induced trauma ⇒ b/c Noise injured the Outer hair cells of cochlea & 4000 Hz cochlear Reception

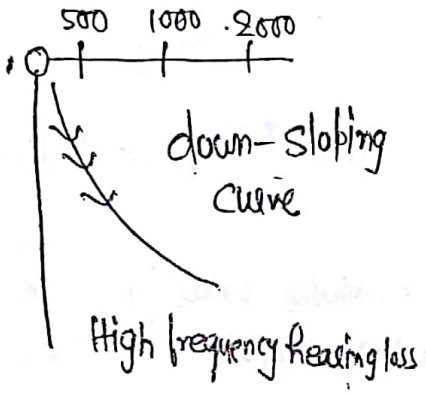
Both AC & BC Loss.



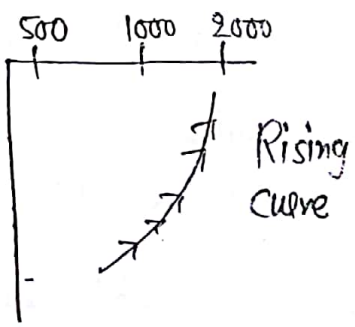
→ Known as "Acoustic Dip / Boiler Notch"

* WHO Maxm 85dB Intensity ⇒ to 8 hours in 5 days

Indian factory act Maxm 90dB Intensity ⇒ to 8 hours in 5 days excess



High frequency hearing loss
⇓
Presbycusis



Low frequency hearing loss
⇓
Meniere's d

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

- Capacity of PTA (Pure tone Audiometry) ⇒ 125–8000 Hz.

- High frequency Audiometer ⇒ 8000 – 20000 Hz
  - for Ototoxic drugs ⇒ Aminoglycosides
    Anticancer drugs
    Diuretics
    - Methotrexate is Not Ototoxic.

* U-shaped Audiogram ⇒ Congenital deafness

- Speech Audiometry ⇒ dB v/s % (Hz)

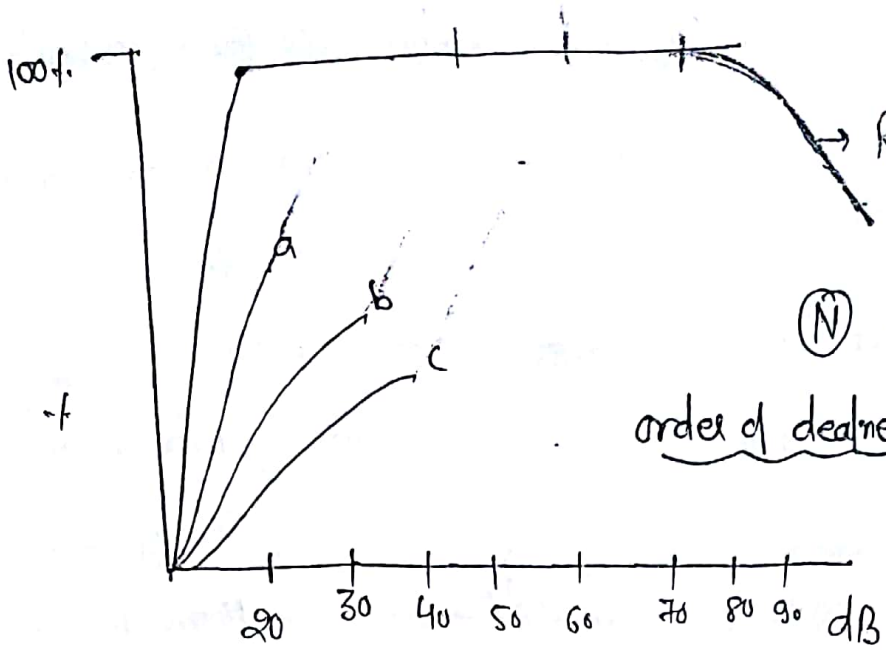
eg ⇒ 10 words ⟶ 1 dB ⟶ 10 %
10 words ⟶ 5 dB ⟶ 30 %
10 words ⟶ 10 dB ⟶ 80 %

- Subject is considered to be Normal ; if he Repeats 100% words upto 25 dB Sound.

- We use Monosyllable ; Bisyllable words (b/c these words all
  (Maa, Paa —) (MaMa, Papa — dependent on dB)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

eg !⇒



(N) Speech audiogram

order of deafness = c > b > a

Neural ↓ Sensori Conductive ↓

Any Rt. Shift ⇒ Deafness;

Higher the Shift ⇒ higher the deafness;

* In Neural patients; where 8th Nerve is already damaged on continous stimulation; it gets exhausted and so the phenomenon of Fatiguability.; get exhausted & Start Repeating less percentage of words ; hence; can't sustain the Pleatu graph and this fall-down is Kla "Roll-over phenomenon"

⇓

test ⇒ Tone Decay test;

Threshold Decay test.

⇒ Roll over phenomenon = Fatiguability = Decay test.

→ Decibel at which the patient Repeat 50% of the words; is Kla "Speech Reception Threshold"

eg ⇒ 10 words → 1 dB – 10%

10 words – 5 dB – 30%

toward — 10 dB — 50%

* Add 30 dB to SRT & check how Much % of words pt. Repeated
  ↳ Known as "SDS" (Speech discrimination Score)
  ↳ Unit ⇒ "%":

* Higher the Deafness ; Less should be increase
  50 % $\xrightarrow{+30dB}$ 90% (conductive deafness)
  60 % $\xrightarrow{+30dB}$ 70 % (Sensory deafness)
  50 % $\xrightarrow{+30dB}$ 55 % (Neural deafness)

* Neural deafness = Roll over phenomenon = very Poor SDS

* Connexin 26 Mutation is involved in Non-Syndromic SNHL.

TUNNING FORK TEST (Y) → 256, 512, 1040 } Hz

Hit Slow = Less intesity

Hit Hard = More intensity

* 512 Hz = Best head = therefore using in ENT

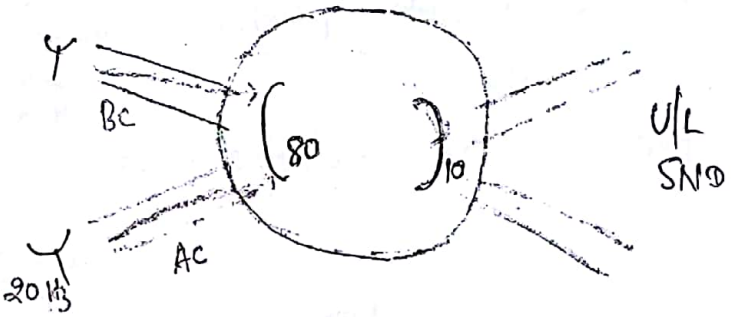
* 128 Hz > 256 Hz = Best bet = CNS (Medicine) = in Posterior column defect

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Amplification ⊕ ⇒ Rinne's ⊕ ⇒ AC > BC
⇓
(N) / (SD) / (ND)

* Amplification ⊖ ⇒ Rinne's ⊖ ⇒ BC > AC
⇓

* Negative Rinnes for 256, 512 & 1024 Conductive deafness
Hz Indicates a Minm A-B gap of 15, 30, 45 dB
eg Respectively.

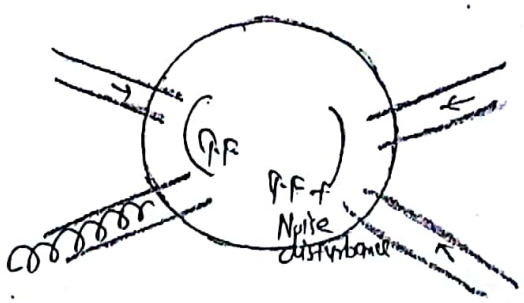


→ False ⊖ Rinnes ⇒ Severe U/L Sensory Neural deafness
⇓
d/t Lack of Masking
⇕
Trans cranial transmission of Sound

* Weber's test ⇒ centralised in (N) Human being.
Weber Lateralized to (N) ear ⇒ Sensori Neural deafness
Weber Lateralized to better ear ⇒ B/L Sensori Neural deafness

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Weber's Lateralize to disease ear in conductive deafness



* Weber's Lateralize to worse ear in B/L conductive deafness

* Way to crack ⇒
  - Schwabach's or ABC (Absolute bone conduction) test ⇒ Pt. bone conduction is compared ✓ the examiner.
    - In ABC testing Meatus of both patient & examiner is occluded; while in Schwabach test; Meatus is Not occluded
  - Gille's test & Ring test ⇒ done in otosclerosis
  - done for conductive deafness
  - if we block EAC & No change in hearing then it is conductive deafness.
  - Both are bone conduction test

Write the Possibility of weber

⇓

Rule out one ✓ the help of Rinnes

Q. Rt. Rinnes ⇒ ✓ ; Rinnes Lt. = ✓

Weber Lateralized to Rt.

↳ Rt. conductive deafness (Rt. ear > Lt. ear)

Lt. conductive deafness

Q. Rinnes Right ⇒ ✓ ; Rinnes Lt. = ✓

Weber Lateralized to Left

↳ Lt. conductive deafness

+

Rt. sensorj Neural deafness

Rt. Normal also

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Q: Rinnel's (+) ⇒ both ear & weber lateralised to Rt ear. (15)

⇓

Left sensorineural deafness

+

Right (N)/ sensorineural deafness.

AIIMS
Q: Right ⇒ (+); Lt → (−) ; weber Lateralised to right ear

Rt. (+) Lt (−) W → R

(X) Right, conductive deafness

(X) Left Sensorineural deafness

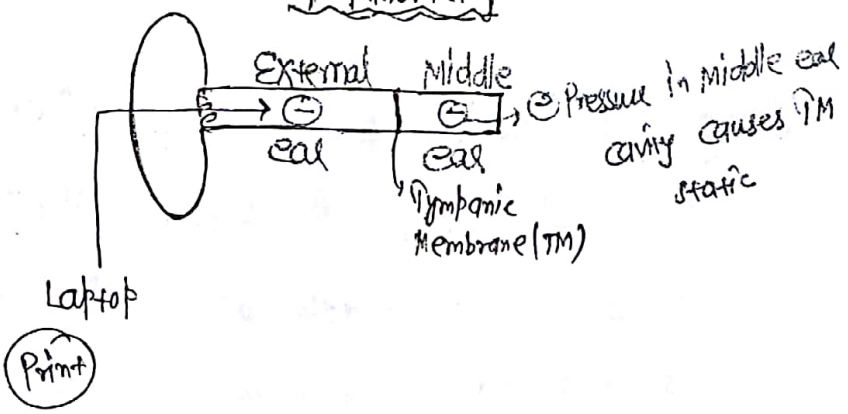
If weber & Rimel's are Mismatch ; either ⇒ Malingering ;
Forget Masking.

* Subjective test to Raise the possibility of Malingering

- Stienger test ; - Stapedial Reflex
- Lombald test ; - BERA
- Lee speech Delay test

*

Tympanometry

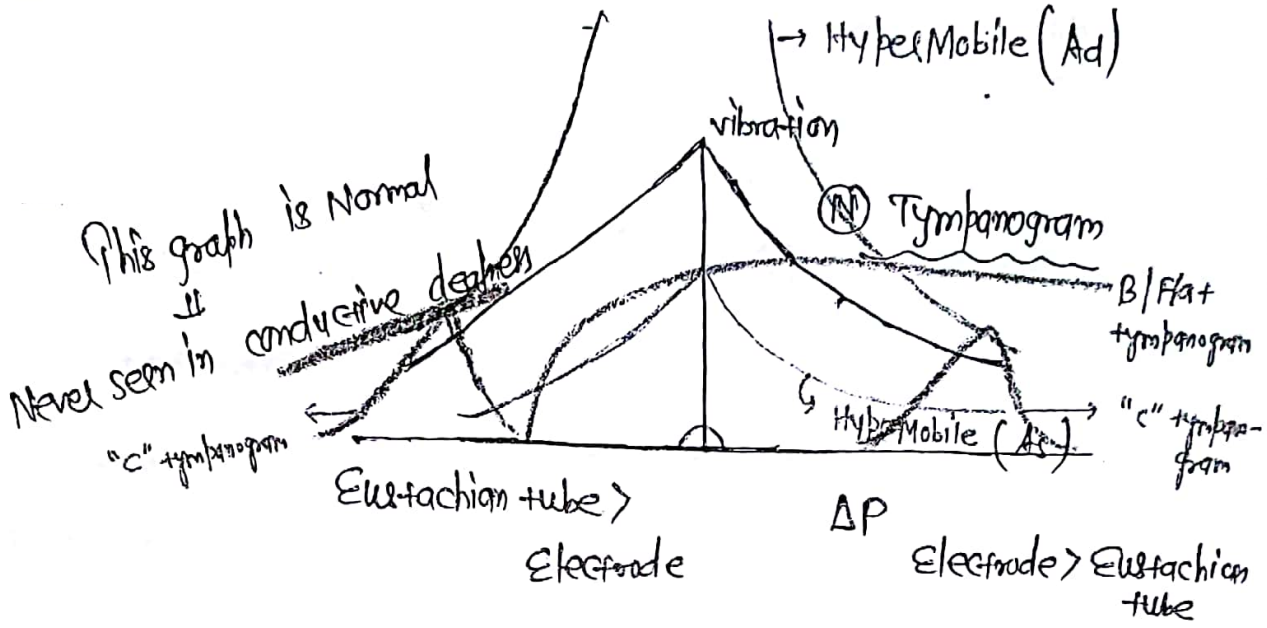


http://mbbshelp.com WhatsApp: +1 (402) 235-1397

$\Delta P = 0$

Eustachian tube − Electrode = ΔP

- We keep the electrode @ External auditory canal & Insert a electrode And Measures ΔP and vibration of Tympanic Membrane



⇒ HyperMobile Tympanic Membrane ⇒ Thin TM (congenital) & Ossicular damage

⇒ HypoMobile Tympanic Membrane ⇒ Seen in Otosclerosis, Otofibrosis, Tympanosclerosis, Tympano fibrosis. — all are D/d of conductive deafness.

* Some other graphs ⇒

Perforated Tympanic Membrane = "B" tympanogram

Fluid in the Middle ear = "FLAT" tympanogram

Eustachian tube dysfunction = "C" tympanogram

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

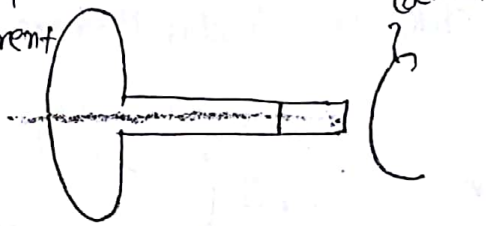
As per few books ; "B" & "FLAT" tympanogram all same (16)

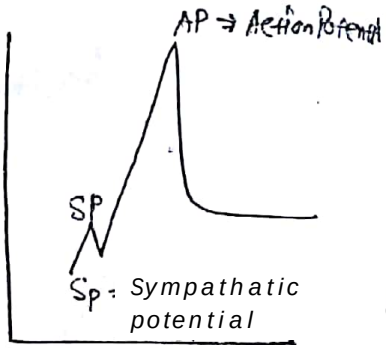
* Impedence Audiometry ⇒ Tympanometry + Stapedial Reflex
  ⇓
  Uses 220 Hz frequency
  ⇓
  IOC for Conductive deafness

Stapedial Reflex → Reaction time ⇒ 40-160 ms
⇓ → > 70 dB
Center ⇒ Superior olivary complex. (Afferent of Stapedial Reflex ⇒ 8th C.N. ; efferent of Stapedial Reflex ⇒ 7th C.N)

ELECTROCOCHLEOGRAPHY Electrocochleography

*
Endocochlear potential (+80 mv.)
is direct current (DC) Potential Recorded from Scala Media.





Invasive Route (trans-tympanic)

Laptop

electrical activity of cochlea ; ← Sp ⩽ 0.3 ⇒ (N)

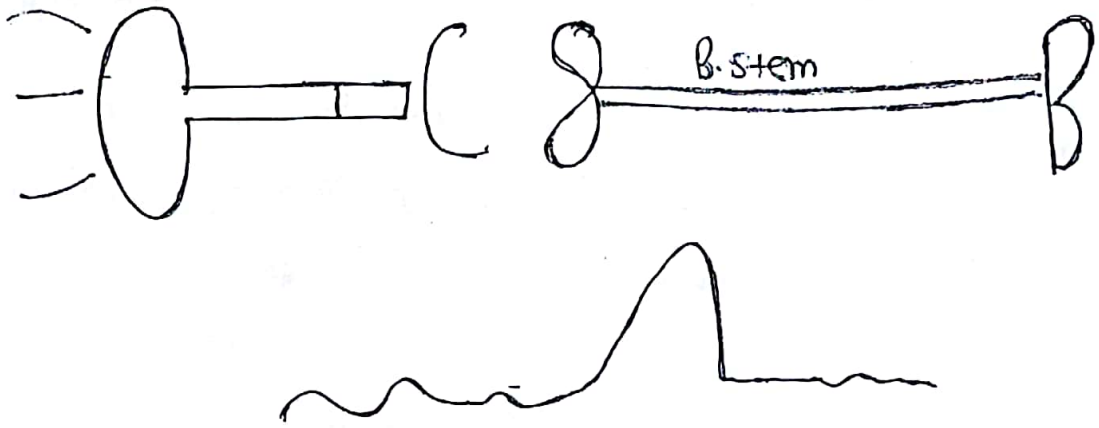
electrical activity in distal part of Auditory Nerve ← AP > 0.45 ⇒ (ABN)

in b/w 0.3 - 0.45 ⇒ equivocal Repeat the Investigation

3 Parameters Measured are ⇒ cochlear Microphonics; Summating potential; & Action Potential.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

BERA



BERA (Brainstem Evoke Response Audiometry) / ABR (Auditory brain-stem Response)

AABR (Automatic Auditory brain stem Response)

- Investigation of choice in Acoustic Neuroma = AABR > BERA

Nerve	Wave
Eight Nerve	I, II (I → distal part of cochlear N.; II → Proximal part of cochlear N.)
Cochlear Nucleus	III
Olivary Nucleus	IV
Lateral Leminiscus	V (Large wave) Latency difference ↳ 0.2–0.4 msec
Inferior colliculus	VI, VII

* BERA doesn't diagnose higher centre deafness
* CERA (Cortical Evoke Response Audiometry) for higher centre deafness.
  ↳ Not Suitable for children.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

BERA	CERA
– Recording is Made from brain stem potential	– Recording is Made from Cortical potentials
– Click Stimulus is used	– Tone Stimulus is used
– Responses are Not frequency specific	– Responses are frequency specific
– Can be performed in Awake & Restless patients.	– Pt. Must lie. still through out the process
– Suitable for even young children	– Unsuitable for children
– Response begins after 1-10 ms after giving stimuli	– Response begins after 50-300 ms after stimulation

Meniere's disease (Age ⇒ 30-40 years) (common in Males)

- endolymphatic hydrops ⇒ ↑secretion & less absorption
- Moderate deafness (60dB)
- Low frequency hearing Loss:
- Rising curve
- Speech audiometry graph ⇒ Right shift
- Plateau @ 60dB. (Sometime b/c of Recruitment phenomenon; patient can't touch the plateau)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

- Roll over phenomenon ; Decay test ⇒ ✗
- q|w Mutation in short Arm of chr. 6
- Poor SDS
- Rinne's ⊕ ; webel lateralized to better ear;
- goc ⇒ Electrocochleography (>0.45)
- U|L in Nature;

Otosclerosis ⇒ B|L; (common in Female)

- three hallmark feature of Meniere's ⇒ Tinnitus (T)

↓

vertigo (V)

↓

Sensory deafness. (S)

±

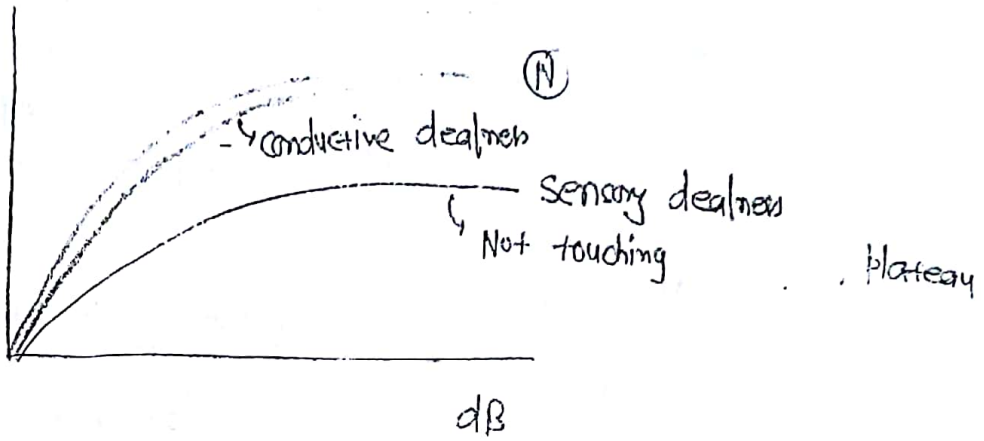
Fullness of ear.

* Fluctuating deafness
* Reverse symptom of Meniere's ⇒ Lermoyez syndrome (S → V → T)
* T + V + S + Drop Attack | Ataxia ⇒ Tumarkin crisis.
* ↑ vertigo in Loud sound ⇒ Tulio phenomenon

⇓

b|c of inner ear is More sensitive; or there is communication b|w middle ear

* Every sensory patient is oversensitive to 1 dB ↑es in intensity ; this oversensitivity is known as "Rerciment" phenomenon". (Pt. is discomfort on testing 1dB from 60dB;



* False perception of two frequency ; when the source is giving one ⇒ Klas " Diplacusis"
↳ b/c different Refractive index in both ear

* M — Meniere's
Malignant otitis externa
} both have Medical Rx.

Rx ⇒ · Low Salt diet
↓
Labyrinthine Sedatives (eg ⇒ Dimenhydrinate; Prochlorperazine; ProMethazine).

· Positive pressure therapy ⇒ to compensate the internal Pressure ; we give external Pressure via grommet insertion from " Meniere device".

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Intra-tympanic injection of gentamicin Near the Round window. ↳ ☜ the help of Microwick device

↳ It affects (Melano Receptors)
Na+ – K+ ATPase

- Direct injury to outer hair cells

* Nicotonic Acid is (50mg) Vasodilator of Inner ear.

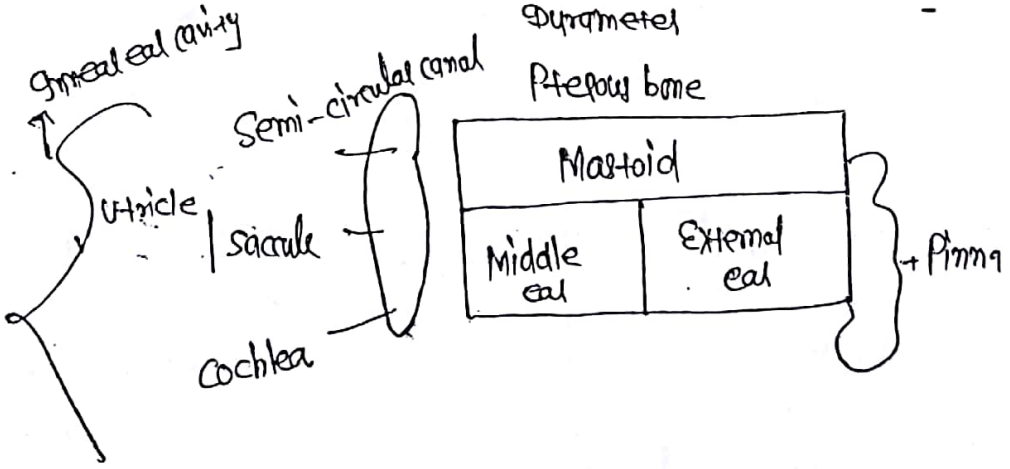
Very Rarely we operate the patient

↳ endolymphatic Sac decompression;
Shunt Surgery drain into G.J.V.
↓
Internal jugular vein.
Fick's Sx
Cody Sx.

AI-15
Glycerol test
↓
Glycerol is dehydrating Agent; When given orally; it Reduces endolymph pressure & cause improvement in hearing in Meniere's ds.

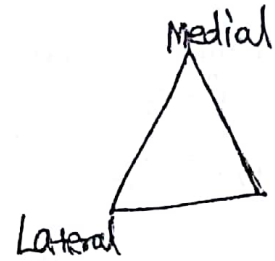
*

- Mastoid ⇒ McEwan Δ | Lateral wall Sx
- Endolymphatic Sac decompression ⇒ Donaldson Line
- To enter Posterior cranial fossa ⇒ Trautman's Δ



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Facial Recess is used for Posterior Tympanotomy.



* Paracusis willisii ⇒ Improvement in the ability to hear conversation in the presence of Loud background Noise
  ⇓
  Seen in Otosclerosis

↳ Common in Females (In India ⇒ Common in Males)

Otosclerosis (Foot plate of stapes involve ⇓ Conductive deafness)

= Mild deafness (40 dB) → Air-bone gap ⊕
⇓
Carhart Notch
⇓
Seen in Bone conduction

= Right Shift on Speech Audiometry

= Plateau @ 40 dB

= Good SDS

= · Roll-over phenomenon
· Decay test
· Recruitment phenomenon
· SISI (Short Increment sensitivity index)
↳ test for Recruitment phenomenon

} XX

* Recruitment phenomenon test,
  - Short Increment Sensitivity Index (SISI)
    - 70-80% Sensitivity

* Rinnes ⊖; Weber Lateralized to worse ear;

* IOC ⇒ Impedance Audiometry
  - As graph.

* Rx ⇒ Stapedectomy
  ⇓
  New Rx oc ⇒ Stapedotomy

* Changages after surgery ⇒ ① Tympanogram becomes Ad;
  ② Carhart Notch disappear.

* Autosomal dominant | Hereditary causes ⇐ Most imp. cause.
* H/O Pregnancy pointed towards otosclerosis.
* Otosclerosis + Blue sclera + Osteogenesis Imperfecta
  ⇓
  Vander hoeve Syndrome

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* HPE findings are same in otosclerosis & osteogenesis imperfecta.

Middle ear cavity

* Malleus Incus Stapes (Rw) → groove / dip inside oval window → Area enter the oval window
  ⇊
  M/c site of otosclerosis
  ↳ actual disease starts from here

* Otosclerosis is klas " Fistulae Anterior Fenestrum"
  ↳ klas " otospongiosis".

* Early stage of otosclerosis ⇒ Inflammed Reddish foot plate Tympanic Membrane = Schwartz / Flammingo Pink sign
  ⇊ if it is (+)
  No Surgery; b/c of Acute inflammation; bleeding More; to Reduce it; 1st ly give NaF
  ⇊
  Replace Sclerotic focus from Normal bone by Tes Osteoblast & Tes Osteoclasti.

* It is a/w Measles (otosclerosis)
  Sensorineural deafness is a/w Mumps
  Conductive deafness is a/w CMV

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

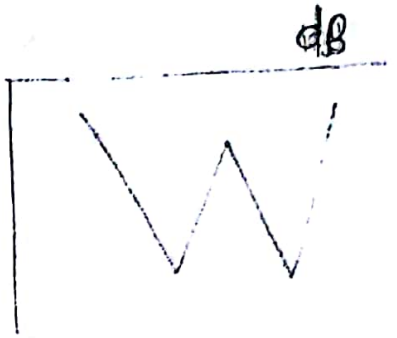
* In 99% cases Otosclerosis it affects Foot plate; In 1% affect Cochlea.

⇓

No A-B gap

No Cahart Notch

- See "W" shape graph on PTA



⇓

Also " Cookie bite Audiogram"

* Robinson's Prosthesis is Related to Otosclerosis (Buckle-handle phenomenon)

* Gelle's test ⇒ No change in hearing through bone conduction; when Air pressure of ear canal is tes by Siegle's speculum. (+) in osteosclerosis.

* Gelle's pheromenon ⇒ (-) in Otosclerosis.

* ACOUSTIC NEUROMA

Trick ⇒ Feeble voice = Conductive deafness

Loud voice of Patient = Sensory Neural deafness

⇒ Most Common CP Angle tumor

⇓

Result in Neural deafness

Ixoc = BERA

↳ I & II wave impaired. (Initially)

Later on all the waves will impaired.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* changages of VIIIth wave is easily appreciated
  └ Inf. vestibular Nerve

* Soft tissue tumor
  └ IOC ⇒ Gd-enhanced MRI
  (▽)
  └ Ice-cone appearance of CP angle

* Ice-cone appearance of Middle ear is (N) finding.

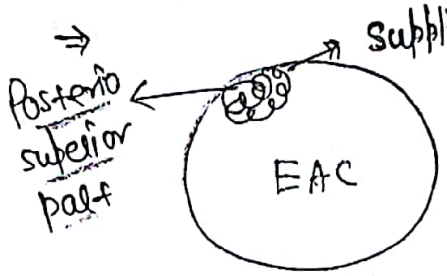
* TxOC ⇒ Surgery
  └ If pt denies → γ-knife Radiotherapy.

* Antoni classification → Antoni type-A cells, Antoni type-B cells } Schw.

* It causes pressure Symptom on all Nerves except → I & II nd

* earliest Nerve to be involved ⇒ Vth Nerve
  ⇓
  Facial N. is Resistant to pressure ; Involve very late
  ⇓
  Whenever Involved ; sensory fibres are involved first.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397



⇒ supplied by Facial N. / N. of Wrisberg

⇓

Loss of sensation in Acoustic Neuroma

⇓

"Heistelbergel sign"

QQ. ∴ Which is earliest involve in Acoustic Neuroma?

a) Vth N.. b) VIth N. ; c) VIIth CN. ; d) VIIIth CN

* ear discharge ∈ (N) Tympanic Membrane

↳ Otitis externa

* ear discharge ∈ Any change in Tympanic Membrane

↳ Otitis Media

Malignant otitis externa

- Osteomyelitis of Skull base

- Ear discharge ∈ Normal TM ∈ granulation in the EAC
∈ facial Nerve Paralysis ≅ Malignant otitis externa

IOC ⇒ Tc99 Scan = Diagnosis

Gallium Scan = Prognosis

↳ costly ; so; use ESR for prognosis

↓

Clin 2 weeks ESR comes down

↳ means Pt. is Responding.

- Stage I ⇒ Symptoms ⊕ ; Tc99 ⊖
- Stage II ⇒ Symptoms ⊕ ; Tc99 ⊕
- Stage III ⇒ Stage II + Cranial N. Palalysis
  - IIIa ⇒ single N. Involved
  - IIIb ⇒ Multiple N. Involved

  M/C Nerve = 7th Nerve
- Stage IV ⇒ Stage III + Intracranial complication

* Mx ⇒ Mainly Pseudomonas Involved

↓

give 3rd gen. Cephalosporin > Penicillin > ciprofloxin

↓

if Pt. is Resistant to cephalosporin then go for ciprofloxin; Not Penicillin

* Sx ⇒ Debridment of granulation tissue.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Pseudomonas causes ⇒ Malignant otitis externa
  - ↓ the wax ⊕ → diabetics
  - ↓ the wax ⊕ → Generalized otitis externa
  - → Perichondritis (Inflammation of Pinna c (N) EAC)
  - → CSOM.
  - → itching / Pruritis

* All E.N.T. infection caused by "Streptococcus" except ⇒ Furuncle in canal by "Staphylococcus" & above condn by Pseudomonas.

* Pinna inflammed c granulation in the canal c Black discolouration of the skin
  - ↳ Osteomyelitis of skull base
    - ↳ Malignant otitis externa

* Pinna inflammed c (N) External Auditory canal
  - ↳ Perichondritis

* Helix is M/c involved in "Apple Jelly Nodule".
  - of Pinna

Osteoma of the Canal

Benign tumor of skull base

Frontal sinus > Ethmoidal sinus > Maxillary sinus > Mandible ⇒ Temporal bone

M/c site ⇒ External Audi...

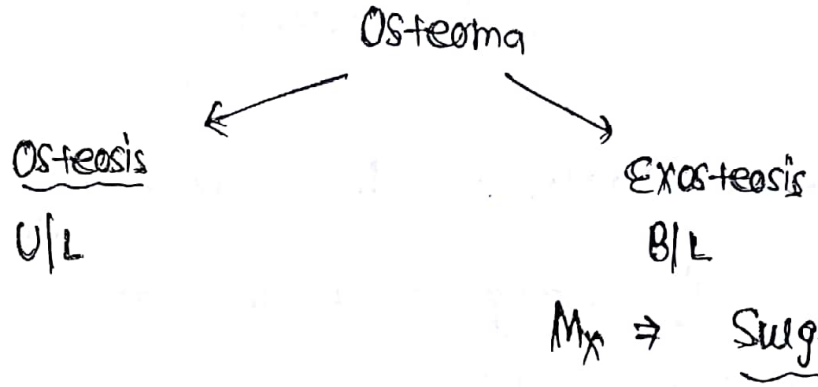
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Cycler and Swimmer Involved in External Auditory canal osteoma b/c water & Air hits.

* Swimmer ear ⇒ diffuse Otitis externa

* Sufer's ear ⇒ Osteoma in EAC

*



Mx ⇒ Surgery

*

Keratosis obturans

- Growth Abnormality
- Squamous cells in external Auditory canal,
- Young – age (5-20 years) affected; always B/L;

- Direction of growth of squamous cells changes from centrifugal to centripetal.
- Symptom ⇒ Obstructed canal

↓

clean C | % acetic acid

* if Not Responsive ; after I.T. Acetic acid
  ↳ do canaloplasty

* Boxer's ear | cauliflower ear
  ↳ Multiple hematoma

* Tx ⇒ Conservative Management.
  - if coming in Acute stage
    ↳ do Incision & Pressure bandage

* If Osteo Necrosis (+) ⇒ cholesteatoma
  if Osteo Necrosis (−) ⇒ Keratosis obturans

	Keratosis obturans	Cholesteatoma
Age →	Young, Adult	Elderly
Systemic association →	Sinusitis; Bronchiectasis	None
Pain →	Acute; Severe	chronic; dull
Hearing Loss →	Moderate; conductive	Little or None
Otorrhoea →	Rare	Frequent
Lateralization →	Usually B/L	Usually U/L
Bony erosion →	circumferential	Localized
Meatal Skin →	Intact	Focal ulceration
Osteo Necrosis →	Absent	Usually (+)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Infection to Middle ear

QQ 1 week old child; cry; O/E Allergic Rxn on Tympanic Membrane

⇓

Allergic otitis Media (from Milk).

↳ via Eustachian tube (Angle 10°)

↳ b/c it is shorter (Half) wider Horizontal 18mm

Baby have Recurrent attack of Allergic Rxn occur if Mother Not follow Advice

⇓

Txoc ⇒ Advice to feeding in Upright position.

Resulted into the "otitis Media"

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Otitis Media

Serous Otitis Media

⇓

Klau" Secretory Otitis Media | Glue ear"

Excessive Fluid in Middle ear

- Bulging Tympanic Membrane
- No Reliable Marker seen
- No Fever
- No congestion
- Age ⇒ 6month - 6years
- give → A → Antibiotics
  A - Analgesic
  A - Anti-allergic
- Least Important to-give Antibiotics; b/c It is only for prophylaxis.

* if pt Not Response

Myringotomy

(Small Radical incision @ Antero-Inferior)

If pt. doesn't Respond for 3 Months → Grommet's Insertion (It expells itself; after ⓜ epithelization)

Acute Suppurative otitis Media

⇓

Mucus + Pus in Middle ear

- Age ⇒ 6month - 6year
- Bacteria ⇒ Streptococcus (M/C)
- Severe Bulging
- No Reliable Marker seen
- High grade fever
- congested tympanic Membrane (Cart-wheel Appearance)

- Stages of ASOM :-
- Stage of Tubal occlusion;
- Stage of Pre-suppuration; (Cart-wheel Appearance)
- Stage of suppuration; → Light-house sign ⇓ b/c bulging TM Reflect the Light very Much.
- Stage of Resolution;
- Stage of complication

- Rx ⇒ Antibiotics
  Analgesics
  Anti-allergic
  ↓ if pt doesn't Response
  Myringotomy (Circumferential Incision) ↳ Grommet C/I (No Foreign body Inserted) b/c Pus ⊕

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Chronic Suppurative Otitis Media (CSOM)

- Ear discharge + Perforation
- ib ASOM Not Resolve after Myringotomy; Overbulging of Tympanic Membrane; Perforate Result in Ear discharge

CSOM → This classification is No More

Safe / Tubo-tympanic

- Operate to improve healing status.
- clean cut perforation on Tympanic Membrane;
- Some damage to Ossicle May be (+)
- But; basic Anatomy is preserve
- Mx ⇒ Tympanoplasty

Unsafe / Attico-Antral

- Cholesteoma
- Scaty discharge
- Polyp
- granulation
- Foul smelling discharge
- Blood staining

- Attic
- Aditus
- Antrum
- Pars flaccida

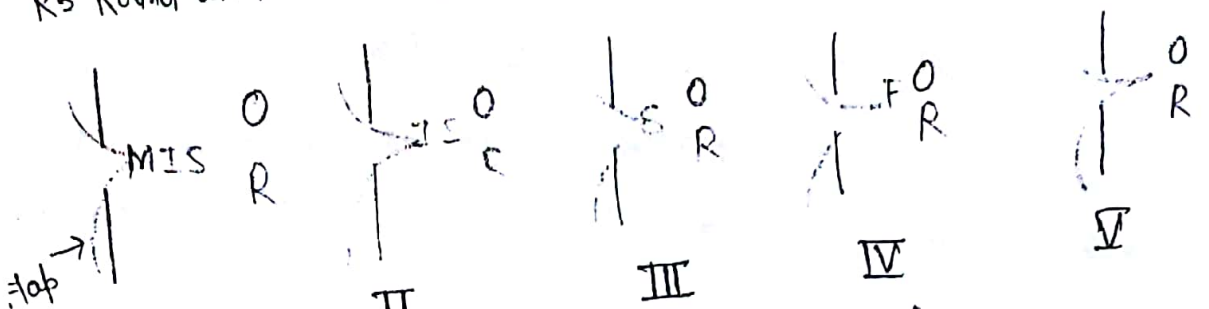
- It is Obstructed ear; hence; we release the obstruction to Reduce complication.
- Tympanic Membrane & ossicles eroded
- Basic Anatomy distorted;
- Remove Air-cells
  - ↳ Mastoidectomy (Mx).

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

O = oval window
R = Round window

M = Malleus S = stapes
I = Incus F = Foot plate

Tympanoplasty



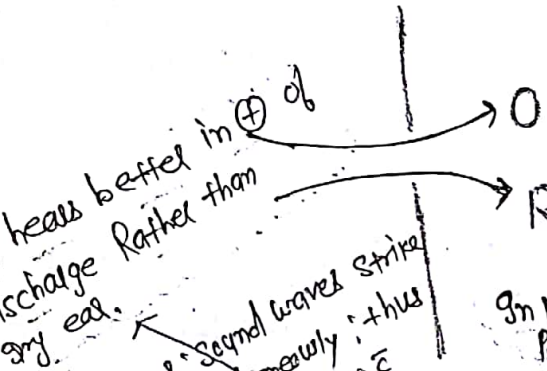
I Myringoplasty

II Myringo Incudo pexy

III Myringo-Stepedopexy (Bird like Middle ear) → columellar effect,

IV Minor Cavum effect.

No hearing Improvement after tympanoplasty; but it is cost effective & do the ear dry.



∴ hears better in ⊕ of discharge Rather than dry ear.

↓

b/c in dry ear, Sound waves strike both windows simultaneously, thus cancelling each other's effect & thus, No Movement of Perilymph & thus, No hearing. ***

Type IV

In Normal Person

No Phase difference b/t Air hitted both on oval & Round window

↓

When oval window Receives a wave of Compression; Round window Receives a wave of Rarefaction. Thus there is difference in phase when sound Reaches both window.

Round window shielding effect (Fenestration Sx).

If pt afford →

* Tympanoplasty + ossicular change Reconstruction (OCR)

Partial ossicular Replacement Prosthesis

↓

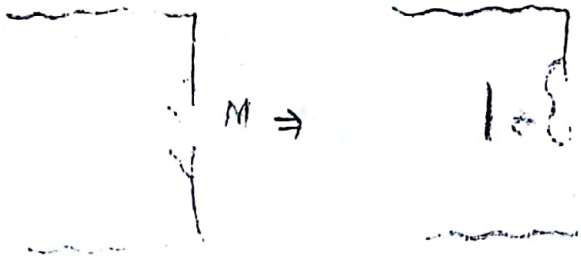
In type III tympanoplasty

Total ossicular Replacement Prosthesis

In type IV tympanoplasty

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* M/c complication of Tympanoplasty ⇒ Residual Perforation (26)



↓ Sleeping down of graft

Blunting of graft.

* Austine Kartush classification ⇒
Group A ⇒ Malleus & stapes ⊕
Group B ⇒ Malleus & Foot plate of stapes ⊕
Group C ⇒ Malleus ⊖ & stapes ⊕
Group D ⇒ Malleus & stapes superstructure Absent.

Group O – Intact ossicular chain (all three ossicles ⊕)
Group E – ossicular head fixation
Group F – stapes Fixation.

Mastoidectomy (Mx of Unsafe ear)

* Open Lateral wall of Mastoid
↓
Cleaning the Mastoid cavity
↓
entering the Middle ear from Aditus
↓
Clean epi; Meso; Hypo-tympanum
↓
avoid Keeping the graft (to Release out pus).

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Disease		T/t
* • Serous Otitis Media & ASOM	⇒	Myringotomy ;
• Safe ear	⇒	Tympanoplasty ;
• Unsafe ear	⇒	Canal wall up Mastoidectomy
• Unsafe ear c̄ complication	⇒	Canal wall down Mastoidectomy

Mastoidectomy

Canal wall up

Unsafe ear

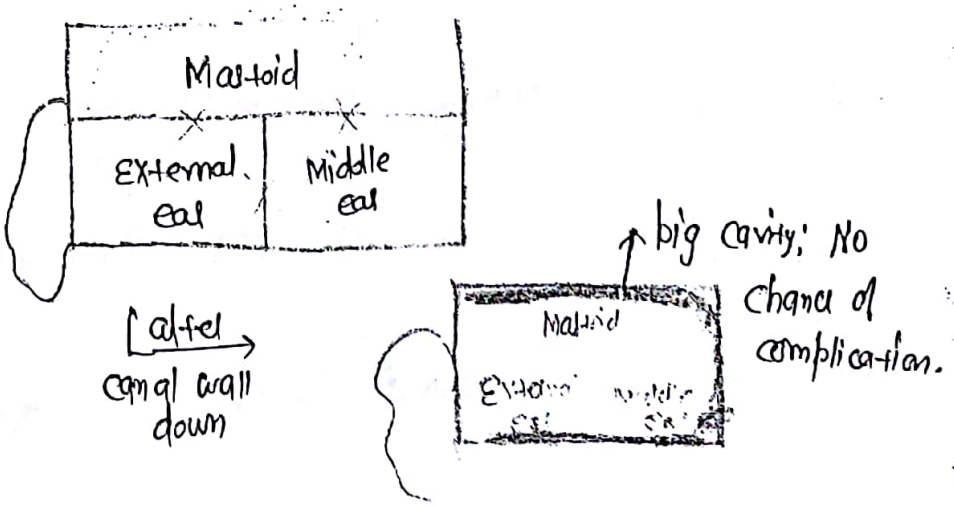
- Cortical Mastoidectomy ; (Schwartz operation)

CAT Surgery
- ↳ is a Misnomer
- ↳ Combined Approach tympanoplasty.

Canal wall down

Unsafe ear c̄ complication

- Radical Mastoidectomy
- Modified Radical Mastoidectomy
- Atticotomy.



* Complication of Unsafe ear ⇒ ① Intracranial complication ⇒
  - Meningitis (M/c)
  - Brain Abscess
    - Temporal Lobe
  - Extradural abscess
    - No New symptom is added
    - ⇓
    - "Silent" complication
  - Subdural abscess
  - Otic hydrocephalus (Rare)
    - ⇓ Ear ⇓ ↑ICT
    - ↓ drastically Reduces after i.v. administration.
  - Lateral Sinus thrombosis

② Extracranial complication
- Mastoiditis (M/c; also overall)
  - M/c symptom = ear discharge.
  - M/c sign = tenderness
  - * Grooving of the Mastoid = earliest sign.
  - * Sagging of the canal = Hallmark sign.
    - Posterior wall of EAC hanging down (after inserting otoscope)
  - * Bezold Abscess ⇒ Pus Along SCM Muscle
    - Citteli's Abscess ⇒ Pus Along Digastric Muscle
    - Luc's Abscess ⇒ Pus Along canal (EAC)
    - Post-auricular Abscess ⇒ Abscess behind Pinna

Empty delta sign.

on CT scan

veins (Multiple vein Joint to form sinus)

- Oedema over Mastoid
  - Griesinger sign
- Retinal vein full of blood
  - Crowe beck sign
- No ↑ in ICT on pressing jugular vein
  - Tobey Ayer sign
- Spiky fever = Picket = Hectic fence fever fever
  - ⇓ also seen in Malaria.

③ Facial Nerve Palsy
- Tympanic part Involved

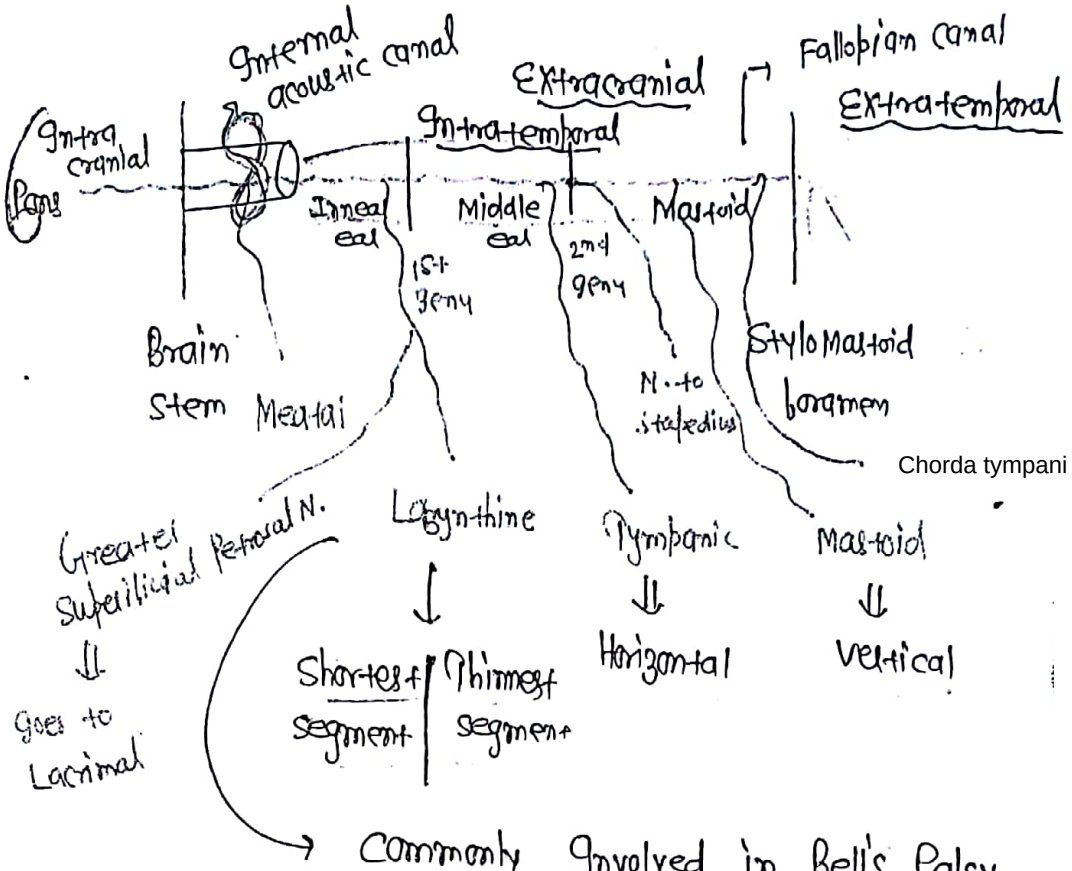
④ Labyrinthinitis
- Lateral scc Involved
  - CSOM (M/c)
  - Stimulated in caloric test.
  - Medial to Mastoid

* Grommets Insertion ⇒ Inserted after 3 Month
Traumatic Perforation ⇒ healed after 3 Month
Laryngeal development ⇒ completed by 3 Months
Chronic Sinusitis ⇒ defined as > 3 Months
Deaf Newborn ⇒ Should be Diagnosed by 3 Months.

⑤ Petrous apex Involvement
↳ Gradenigo Δ (Ixoc ⇒ HRCT temporal bone)
⇓
Ear discharge + 5th Nerve Palsy ⇓ Pain + 6th Nerve Palsy ⇓ Diplopia

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Facial Nerve Injury



→ Commonly involved in Bell's Palsy.

* 7th C.N. Makes a Loop around 6th C.N.

Trauma

Immediate facial N. Palsy
(< in hours)
- do Sx decompression

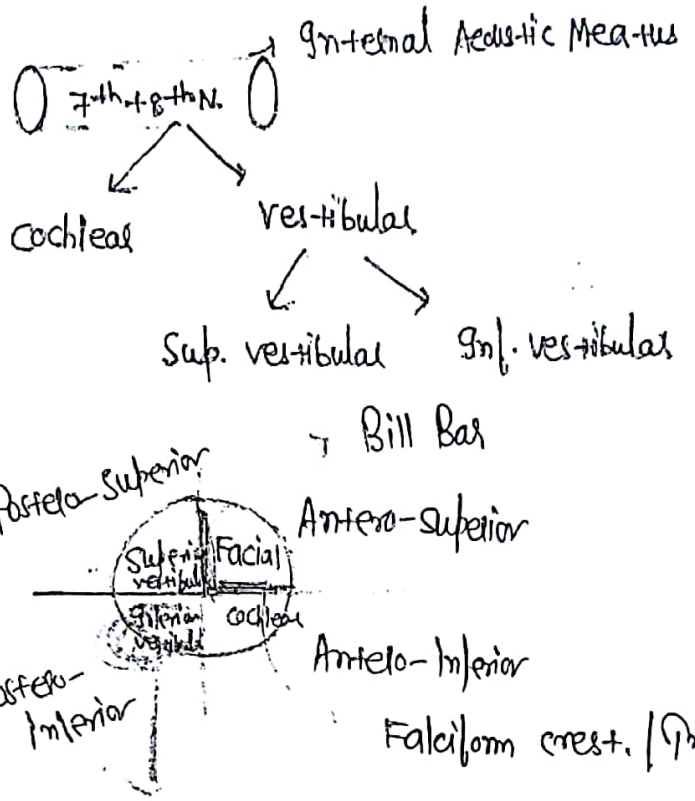
Delays facial N Palsy
(< in day
— go for Steloids

* Fallopian Canal / Facial canal = Covers Labyrinthine ; Tympanic & Mastoid branch of Facial N.

* 1st Genu ⇒ at Processus cochleformis
* 2nd Genu ⇒ at semi-circular canal.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* In Intracranial Facial Injury ⇒ Diplopia seen b/c 6th Nerve damage

* 

Falciform crest. / Transverse crest.

Acoustic Neuroma

↳ Facial N. protected from it by Bill's Bar & Falciform crest

↱ Labyrinthine part is involved.

Bell's Palsy

In order of Preference

1st preference ⇒ Steroids

Should be prescribed within 3 days (Maxm benefit) ← Acyclovir (Herpes virus / EB virus)

B-complex

Physiotherapy (Least Preference Modality)

C/in 3 days we never prescribe physiotherapy b/c it leads to dyskinesia.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

→ If patient is Not improved ; after 3 weeks

⇓

go for electrophysiological test

⇓

If there is evidence of Nerve degeneration

⇓

do Sx decompression.

* REHABILITATION OF DEAF PATIENT

Conductive deafness ⇒ Hearing Aids

Sensory deafness ⇒ Cochleal Implants

Neural deafness ⇒ Brain stem Implants

Conductive deafness ⇒

Receiver
Amplifier
Microphone
⇒ Part of Hearing Aids

Trick ⇒ RAM

" Completly in the Canal (CIC)" Hearing Aids
↳ For Cosmetically Conscious P+.

" BTE (Behind the ear) " Hearing Aids
↳ For old Person

* "In the ear" (ITE)

* BAHA (Bone Anchored Hearing Aids) → Indication

→ Canal Atresia
Canal stenosis
Pus in the canal.

* Cochlear Implant

External device
⇓
Kept in Mastoid
- Made up of →
Processor
Microphone
Transmitter
(Trick ↳ PMT)

Internal device
⇓
Kept in Scala tympani via Round window
⇓
Multichannel electrode are the best electrodes
– Also "Receiver Stimulator"

– Stimulates the 8th Nerve.
– Post Lingual candidates are the best candidate for cochlear implant.
– M/c Indication ⇒ Mondini dysplasia
Contraindicated in ⇒ Micheal Aplasia

http://mbbshelp.com · WhatsApp: +1 (402) 235-1397

Brain stem Implant

- In Neural deafness
- Structure wise similar to cochlear Implant (only wire is Long)
- Kept on Lateral Recess on IVth ventricle

* All congenital deafness are Sensori Neural except
  - Treacher Collin Sx.
  - Crouzon Sx
  - ↓
  - both are conductive deafness.

* As per National deafness programme :⇒
  - OAE (Otoacoustic emission) should be done on 1st day,
  - OAE should be definitely done by 1st Month,
  - Diagnosis should be confirmed by BERA by 3rd Month,
  - IIt should be done by 6th month; to avoid Any Maldevelopment in Language

* If Newborn is suffering from Intracranial Infection
  - → BERA should be used for Screening procedure.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* OAE May be absent in (N) New born;

OAE → Arises from outer hair cells

- Spontaneous OAE
- Evoked OAE
  - Transient Evoke OAE ⇓ Commonly used
  - Distorted product OAE

* Fistula test ⇒ Press the tragus & Look for vertigo;

Absent in (N) human

(+) in Unsafe ear.

False (−) fistula test ⇒ No vertigo in the presense of Fistula

eg ⇒ extensive cholestoma;

Dead Inner ear.

False (+) ve fistula test ⇒ vertigo in the absense of Fistula

⇓

Hennebert sign (+)

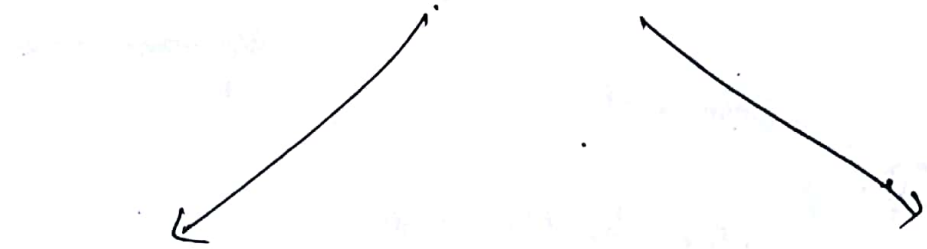
eg ⇒ congenital syphilis

Meniere's disease

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

TINNITUS (Ringing sensation in the ear)

- Any pathology of the ear can lead to tinnitus.



All causes all Subjective except ⇒ A-V Malformation; Myoclonus.

Caloric test

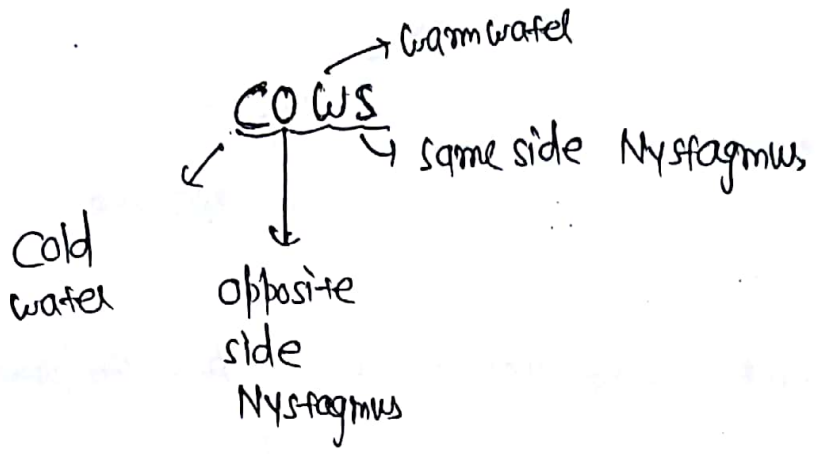
- Look for Nystagmus. after sensitization of vestibule

- Kobrak caloric test ⇒ 37°C (Body temp.)
  - ↳ stimulate Lateral canal.
  - * Position of Patient ⇒ 60° back in sitting Position
    - ↳ b/c in this position Lateral canal sensitize maxm (comes in vertical position)

- Modified Kobrak caloric test ⇒ Used cold water; Rest same as Kobrak caloric te

- Hallpike Bithermic caloric test :⇒

↳ 37°c ± 7°c (cold water ⇒ 37°, warm water ⇒ 44°)



Patient position ⇒ Supine ± 30° up.

Vestibular Evoke Myogenic potential

- Inferior vestibular Nerve Stimulated

↓

See the Response of Sterno-cleido Mastoid Muscle

* Benign Paroxysmal Positional vertigo

- Displaced otoconia from Macula ⇒ Aetiology
- M/c cause of Peripheral vertigo (for few seconds)
- Dix hallpike's test
- Rx ⇒ Epley's Maneuver

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* How to calculate % of Hearing Loss ⇒

Given in question ⇒ (Rt. side status) (Lt. side status)

take the Average

⇓

Substract by 25

⇓

Multiply by 1.5

⇓

$$\left(\frac{[\text{Better ear} \times 5] + \text{worse ear}}{6} \right)$$

eg:-

60, 60, 90

$\frac{210}{3} = 70$

$-25 = 45$

$\times 1.5 = 67.5$

30, 40, 50

$\frac{120}{3} = 40$

$-25 = 15$

$\times 1.5 = 22.5$

$$\frac{22.5 \times 5 + 67.5}{6} = \frac{112.5 + 67.5}{6} = \frac{180}{6} = 30\%$$

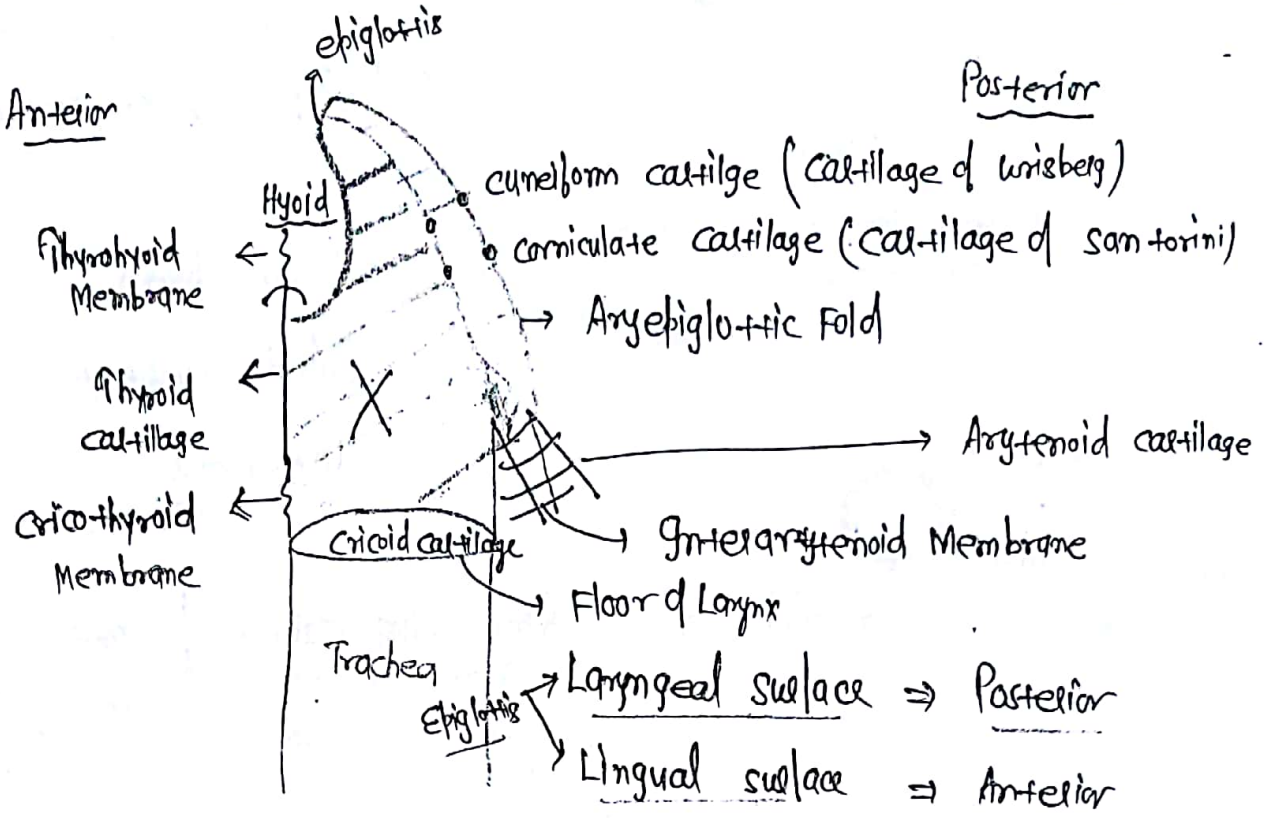
* At 70% Deafness get handicapped certificate

* if both eal all same; only Multiple by 1.5; No Need to go further two steps.

* if Anyone eal is Normal then No need to give Disability certificate.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

LARYNX (C_3-C_6)



Unpaired cartilage ⇒ Thyroid; cricoid; epiglottis;

Paired cartilage ⇒ Arytenoid; corniculate; cuneiform.

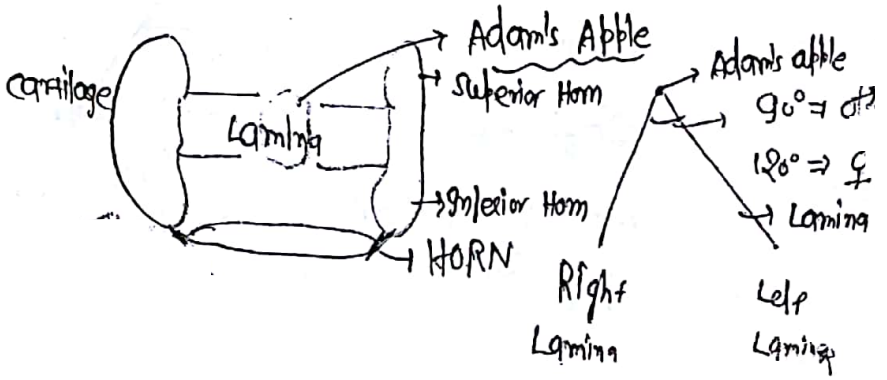
* Laryngeal development starts by 4th week & completed by 3rd Month of GL

* All cartilage can ossify except ⇒ epiglottis; cuneiform; corniculate

* All cartilage are hyaline except ⇒ epiglottis; cuneiform; corniculate

*

Shape of thyroid cartilage ⇓ "H" Shaped.



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* All joints of Larynx are synovial ⇒ Cricothyroid; cricoarytenoid.. (Two joints are possible)

* Thyrohyoid Membrane pierced by Superior Laryngeal Nerve

* 3 Neck Muscle sitting on Thyroid cartilage ⇒ Sterno thyroid
Inferior constrictor
Thyrohyoid

* Cricoid ⇒ Ring Like cartilage / signet shaped cartilage / complete cartilage

* Dimension of Larynx

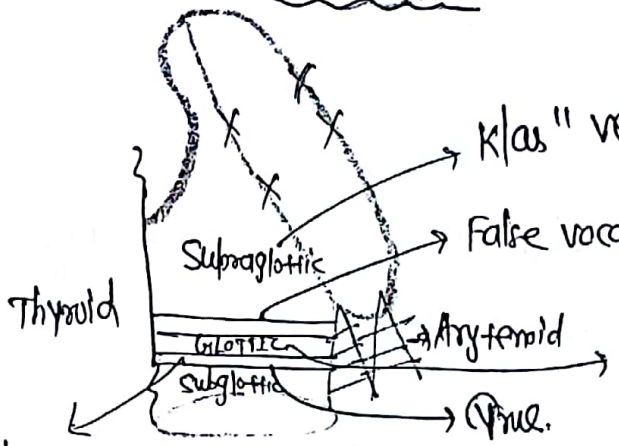
Sexes	Length	Transverse diameter	A-P diameter
Male →	44 mm	43 mm	36 mm
Female →	36 mm	41 mm	26 mm.

* Development of Laryngeal cartilage

Name of cartilage	developed from
• Thyroid cartilage →	Ventral ends of 4th Arch cartilage
• Arytenoids →	6th arch
• Corniculates →	6th Arch
• Epiglottis →	Hypobranchial eminence
• Cricoid & Tracheal Cartilages →	6th branchial arch

VOCAL CORDS

Anterior



Posterior

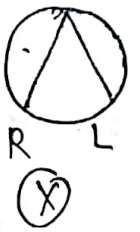
K/as "vestibule".

False vocal cord ⇒ vestibular fold

Ventricle

True.

True vocal cord
⇓
Functional vocal cord



(X)

(✓)

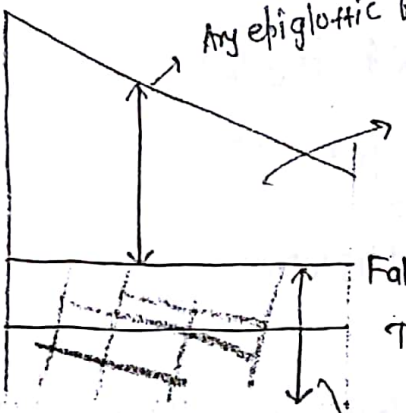
Vocal cord
⇓
are thickening
of Lateral wall

* Vocal cords Anteriorly attached
c̄ thyroid & Posteriorly c̄ Arytenoid

Right

*
Lateral wall of Larynx
*
⇓
Memb. from AEF to SG cricoid.

* Upper part of Membrane (upto False vocal cord)
⇓
Quadrangular Glottis + Subglottis
memb.



Ary epiglottic fold (AEF)

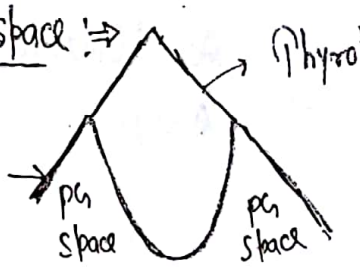
Quadrangular Membrane

False vocal cord

True vocal cord

Cricovocal Membrane / Conus elasticus.
⇓
Lower part of Membrane (from False vocal cord to cricoid).

* Paraglottic space ⇒ (Pg space)



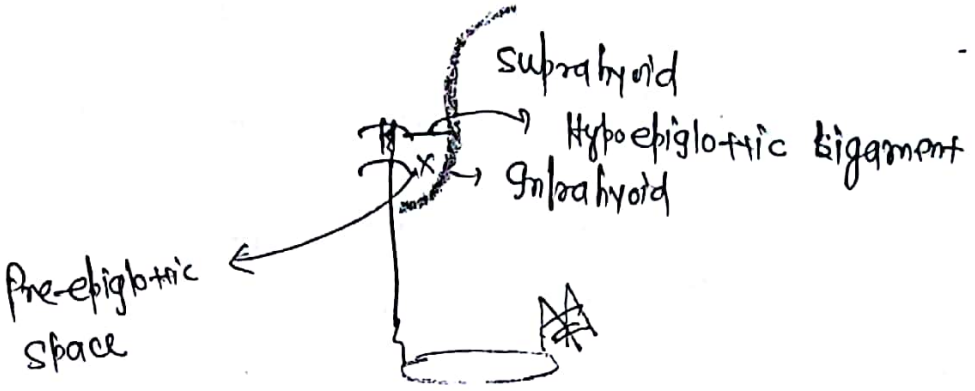
Thyroid cartilage (Anterior part).

Posterior part of Thyroid cartilage

Medial boundry ⇒ Lateral wall of Larynx

Lateral boundry ⇒ Posterior part of Thyroid cartilage

* Pre-epiglottic space :⇒



Anterior boundry ⇒ Thyroid; Thyrohyoid; Hyoid.

Posterior boundary ⇒ Inferior part of epiglottis.

Superior boundary ⇒ Hyo-epiglottic Membrane

* Crico-arytenoid Muscle

Lateral Posterior

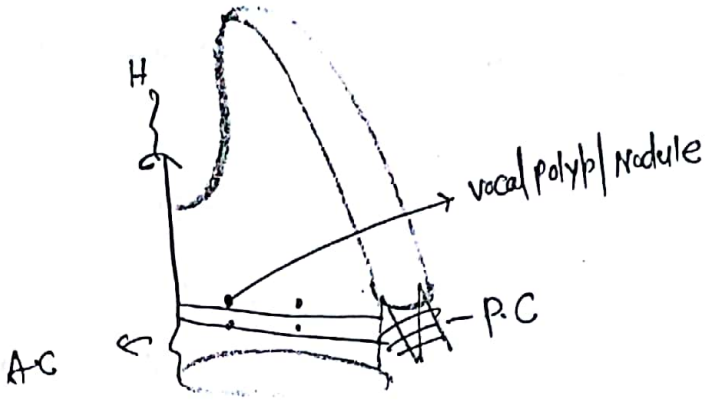
* Any Pathology of Larynx three factors all always prt :-

A → Abuse → Voice Rest (1st Line Rx)

A → Acid (Gastric) → Antacid

A → Allergy → Antiallergic

Commissure of Laryngx



Posterior commissure is highly exposed; so; M/commonly affected; except ⇒

① syphillis
② Leprosy
③ Lupus
④ Congenital webs
⑤ Papillomatosis

} these are at Ant. commissure

* Vocal polyp
vocal Nodule
Glottic carcinoma

} M/c site ⇒ Junction of Ant. 1/3rd & Post. 2/3rd of Vocal cords.

VOICE ABNORMALITY

i) Dysphonia plica ventricularis ⇒ Faulty use of False vocal cord

⇓

Seen in "Mimicry"

↳ give "speech theraphy" to patient.

ii) Mogiphonia ⇒ Abnormal voice in front of Public

↳ Mx = Speech theraphy

iii) Androphonia ⇒ Low pitched voice in female

↳ Male Like voice

iv) Phonasthenia ⇒ weakness of voice d/t Muscle weakness

⇓

- Thyroarytenoid weakness
- Interarytenoid weakness

→ Both May weak ..

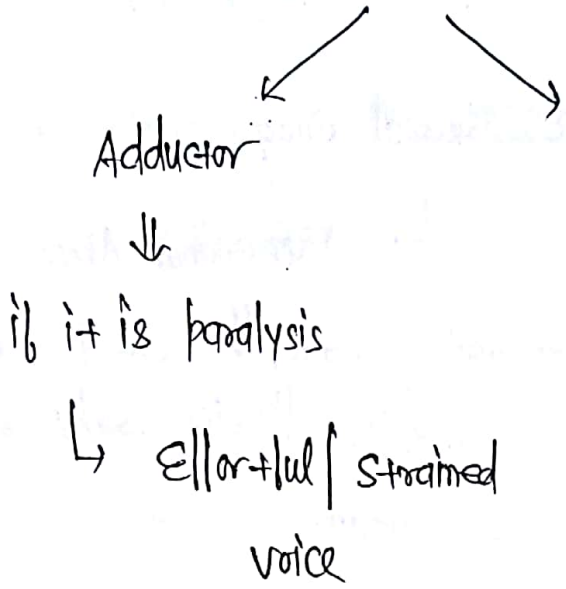
On Indirect Laryngoscopy:

- Thyroarytenoid weakness ⇒ R (L → Elliptical appearance
- Interarytenoid weakness ⇒ R △ L → Triangular appearance
- If both all weak ⇒ R (Key hole) L → Key hole appearance

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Δx ⇒ Wait & watch (conservative Mx).

v) Spasmodic dysphonia ⇒



Mx ⇒ Multiple injection of botulusim toxin

vi) Pubelphonia ⇒ High pitched voice in Puberty

Pitch ⇒ old = child > Adult

- only seen in emotionally dependent boys.
- Non-organic (Functional) causes
- Gutzmann's test ⇒ Push thyroid inside towards Arytenoid → voice become Normal (b/c tension of vocal cord ↓) So; Pubelphonic;.

Mx ⇒ Psycho therapy.

if voice Not (N) ⇒ organic cause

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

vii) Functional Aphonia ⇒ Loss of speech d/t Psychogenic causes.

- seen in Young females.
- all Investigation (N) (i.e Larynx ⇒ (N))

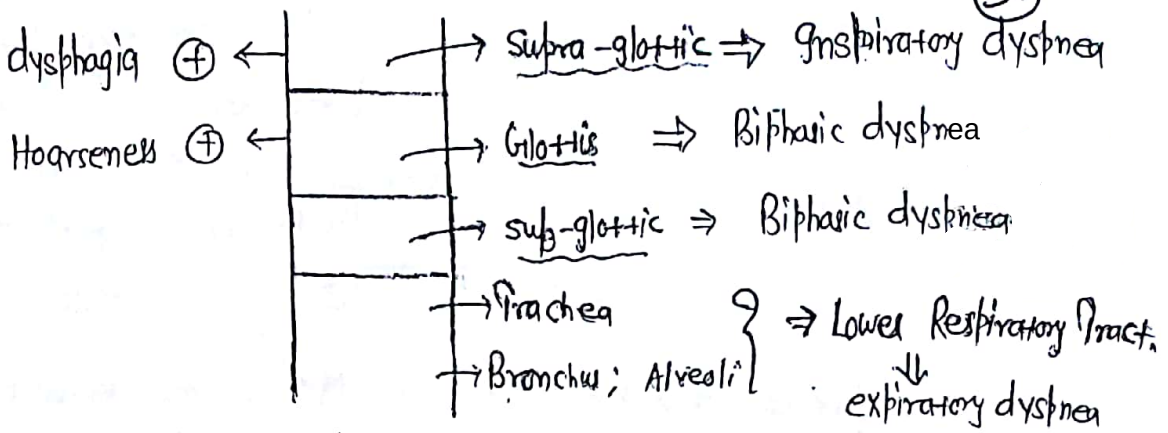
No voice = c Normal cough

↳ Functional Aphonia

⇓

Mx = Psycho-therapy.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397



* Dyspnea is More pronounced during expiration; b/c of chest contractic

* Supraglottic = Inspiratory dysnea = Dysphagia

* Biphasic dysnea ∈ Hoarseness ∴ Glottic segment.
  (∴ = involvement of)
* only biphasic dysnea ∴ Subglottic segment.
  (∴ = involvement of)
* expiratory dysnea ∴ Lower Respiratory tract.
  (∴ = involvement of)

QQ Hot Potato voice ⇒ Supraglottic Ca**

Investigation of the Larynx

Indirect Laryngoscopy

- OPD procedure
- Sitting position
- Non-invasive procedure
- Subglottic best seen
- Dominant hand
- No Anesthesia Required
- Warm-up for Antifogging on Mirrorside

Direct Laryngoscopy

- OT procedure
- Supine position
- Invasive procedure
- Whole Larynx best seen
- Non-dominant hand
- Under General anesthesia

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Indirect Laryngoscope

- only upper half is visible

Direct Laryngoscope

- also can give Local Anesthesia; if we want to see vocal cord Mobility.
  OR
  Biopsy from supraglottic part; if it has tumor or Mass.
- Full Larynx is visible

* Paraglottic space & Pre-epiglottic space
  - are Prognostic Markers (if tumor pr. @ here ⇓ Bad Prognosis)
  - Seen in MRI Larynx

* **Video**-Stroboscopy ⇒
  - Flickering Light (Intermittent Light to see vocal cord Mobility)
    - to visualize fine Movement of Vocal cords / Glottic Movement.
    - ⇒ dt Slow Motion around wall of Larynx; we see clearly.

* Contrast Endoscopy ⇒
  Applying a Chemical on Mass and appreciate the Colour change..
  ⇓
  Methylene blue / Methylline blue

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Carcinoma of Larynx

* M/c type ⇒ SCC (Squamous cell carcinoma)
* M/c site ⇒ Glottis > Supraglottis > Subglottis
* M/c Predisposing factor ⇒ Smoking
* Glottic → Rt by → RT

  Supraglottic / Subglottic → Rt by → Surgery.

* order of Metastasis ⇒ Lungs > Liver > Thoracic vertebra

Protocol :⇒ i) Symptom;

ii) Duration of symptom (tells about ∨ site of origin)

iii) I/L examination

iv) D/L examination (Biopsy)

v) MRI Larynx

vi) MRI Chest

vii) MRI Abdomen

viii) LN examn → No. of Lymph Node
→ Size of Lymph Node (M/imp. parameter) ⇓ "Largest" is the Main deciding factor.
→ Level of Lymph Node

Levels of Lymph Node in Neck ⇒

Ia = Sub Mental

Ib = Sub Mandible

II = Upper Jugular
III = Middle Jugular
IV = Lower Jugular
→ drains the Larynx

V = Post. Δ of Neck

VI = Upper pre-tracheal
VII = Lower pre-tracheal
→ Delphian Lymph Nodes

TNM classification ⇒

N_1 → <3cm

N_2 → 3-6 cm

N_3 → >6cm

M_0 → No Metastasis

M_1 → Metastasis

M_x → pt. Not Investigation yet

Krause Lymph Node ⇒ Jugular foramen

Rouviere Lymph Node ⇒ Retropharyngeal space

Delphian Lymph Node ⇒ pre-tracheal space

Tumor of Larynx ←
- T_1 = Only one Subunit involved (among Supraglottic; Subglottic; glottic)
- T_2 = 2 or 3 Subunit involved

Outside the Larynx ← T_3 = SP = Paraglottic; pre-epiglottic; Pharynx; Paralysis of vocal cord; Perichondritis

Away from the Larynx ←
- T_{4a} = ST = Tongue; Trachea, Thyroid Muscle
- T_{4b} = Mediastinum; pre-vertebral space; Carotid Artery.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Fixed vocal cord is "Paralysis of vocal cord"
  ↳ Also "Immobile vocal cord".

* "sluggish vocal cord movement / Impaired Mobility / Partially Immobile"
  ↳ Comes under T_2.
  ↳ It Means Not completly Paralysed ; Some Muscle fibres still good.

* If in question Carcinoma-in-situ given ⇒ $\frac{T_x}{CO_2}$ Laser.
  In T_1 or T_2 ⇒ Radiotherapy OR Partial Laryngectomy
  T_3 or T_4 ⇒ Total Laryngectomy f/b Radiotherapy.

If patient Deny for Surgery
↳ Concurrent chemo-Radiation
⇓
"Cis-platin" used /
"5-FU" used !

* Terminal Stage ⇒ Go for Palliative Mx
  ↳ chemo-Radiation

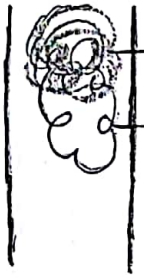
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Types of Partial Laryngectomy :⇒

(1)

→ Supraglottic tumor (T_1)

↳ Horizontal Partial Laryngectomy.



→ Supraglottic tumor

→ glottic tumor

↳ HB - partial Laryngectomy

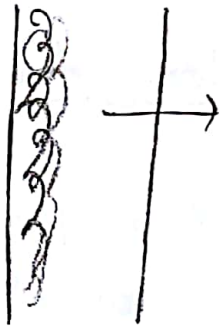
Indication

↳ In case of T_1 · Supra-glottic ca ;

· early case of T_2 - Supraglottic ca;

Minm invasion of Pre-epiglottic space;

(2)



→ Vertical - Partial Laryngectomy

↳ T_2 - hemilarynx glottic ca

⇓

b/c tumor starts from heel; goes upwards & downwards ; Not touching the base of tongue ; while starts from supraglottic goes to base of tongue also.

(3) * Laryngotomy c cordectomy ⇒ Indicated for Radio-Resistant T1 glottic Ca. (40)

↓↓ Klas

Laryngofissure c cordectomy

* Pulmonary function test (PFT) is Mandatory before HPL.

↳ to check the cough Reflex. *** ↓↓

both vocal cord should be (N); Both Lungs should be (N).

* In all cases of T1 or T2 ⇒ 1st Line of Tx

↓↓

Radio-therapy. ***

QQ: O/E Mass (+) in Rt. Aryepiglottic fold; Rt. false vocal cord but both true vocal cord - (N); Rt. arytenoid - (N).

Rx OC - ??

(a) RT,
(b) HPL
(c) VPL
(d) TL

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

TRACHEOSTOMY

Trachea contains 16–20 Rings

1st & 2nd Ring ⇒ High Risk of Necrosis.

⇓

Best site for giving Incision → b/w 2nd & 3rd Ring

* "Vertical Incision" takes Minm time; Leave Long Scar; give in emergency.

* "Horizontal Incision" takes More time Leave Minm Scar

|| In the case of elective procedure

Indication

Head & Neck tumors

* Any obstruction above trachea

↳ do Tracheostomy.

* M/c Physiological complication → central Apnea (b/c of CO_2 washout)

* M/c complication ⇒ Hemorrhage (venous > Artery)

↳ Thyroid vessels bleed.

* Most dangerous complication ⇒ Surgical emphysema leading to Pneumothorax.

* Advantage of Cuff tube ⇒ Keep tube in Position
Reduce the chances of Aspiration

* Disadvantage of cuff tube ⇒ Pressure Necrosis of Trachea (High volume; Low pressure).

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Uncuff tube ⇒ Used where No chance of aspiration (+)

* Fenestrated tube ↱ A valve like opening in the Tracheostomy tube.

→ Pt. will speak out ☆ the help of this tube

⇓

Yes airflow to Larynx / vocalization of voice.

* Low-level tracheostomy ⇒ Indicated for infection having high Risk of dissemination. eg:→ Diphtheria

* High-Level tracheostomy ⇒ done for Malignancy; to preserve the actual site for permanent Tracheostomy

* Site of Permanent tracheostomy can be decided only after Total Laryngectomy.

Tube blockage

- Partial blockage ⇓ do Suction
- complete blockage ⇓ Remove the tube.

* Every 2 hours for 5 minutes; deflates the cuff tube

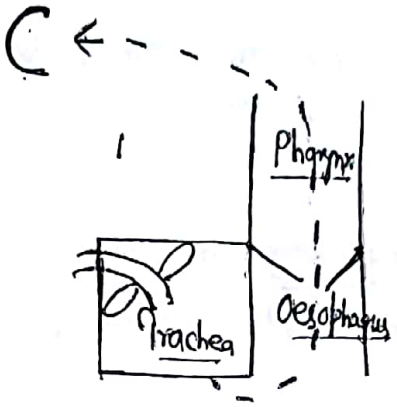
⇓

Never change the tube by attendent in 1st 7–10 days; b/c Proper tract is Not there.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* BJORK FLAP :⇒ Inferior base Flap below tube :
↳ It lessens the chances of dislodgement *

REHABILITATION OF PATIENT AFTER TOTAL LARENGECTOMY :⇒



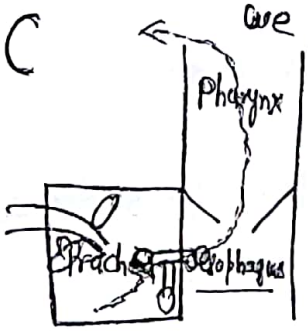
- esophageal speech ⇒ esophageal Air in form of voice
  - ↳ Big failure
  - ↳ Succes Rate = 50%.
  - ↳ 6-8 words we can speech out.

• Pt. taught to swallow Air & hold it in the upper esophagus & slowly eject it from the esophagus into the pharynx.

- Electrolarynx ⇒ Neck vibration in form of speech.
  - external device
  - Hand-held device

- Blom-Singer tracheo-esophageal prosthesis :⇒ b/w Trachea & esophagus we place the prosthesis;

Post. wall of Trachea OR Ant. wall of esophagus



- Best Method till date
- Never aspirate ; b/c there is Microvalve inside it.

Whenever air passes through this prosthesis Sound is produced.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Epiglottitis

- Emergency cond^{n}
- Acute cond^{n}
- high grade fever
- Inspiratory dysnea
- Dysphagia
- No Hoarseness
- Thumb sign
  - ↳ on Lateral view of X-Ray
- H-influenza (if No Hlo vaccination tick it)
  Streptococcus (≡)
- Rx ⇒ i/v Antibiotic ***
  - ⇒ Never give any painful Stimulus to the Patient
  - ⇒ Never treat the patient @ Primary level; gcu is Mandatory.

Laryngeo-Tracheo-bronchitis (croup)

- Not an emergency
- Chronic Cond^{n}
- Low grade fever
- Biphasic / expiratory dysnea
- No dysphagia
- Hoarness May be (+) se
- Steeple sign ( )
  - ↳ on X-Ray (AP view)
  - Subglottic Narrowing → seen only in steel sign
  - Church-top sign (on Lower part)
  - Pencil-tip sign (on upper part)
- Parainfluenza Virus
  type- 1, 2, 3

Rx ⇒ Symptomatic Rx
- Bronchodilators
- Analgesics
- Nebullization

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Condⁿ (Abnormality) ⇒	Site
Trauma ⇒	Supraglottis
Sarcoidosis ⇒	Supraglottis
Amyloidosis ⇒	Subglottic
Wegner granulomatosis ⇒	Subglottic
Chondroma of the Larynx ⇒	cricoid cartilage
Perichondritis ⇒	cricoid cartilage.

- Hemangioma of the Larynx ⇒ M/c vascular tumor of Larynx.
  - M/c site ⇒ Left Posterior Sub-glottic Area.

Rx ⇒ Steroids || or Laser | Sx | Interferon..

Radiotherapy ⇒ Not given
- ↳ also avoid in "Malignant Melanoma"
- ↳ b/c it Reduces the immune status of the body.

- Radiotherapy always preferred in — Glottic Ca
  - Nasopharyngeal Ca.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Papillomatosis

- M/c site ⇒ Anterior commissure
- Agent ⇒ HPV 11 > 6
- Intubation contra-indicated.

Juvenile	Senile
• Multiple	• Single
• Resolve Spontaneously	• Never Resolve
• Recccur spontaneously	• Never Recccur.
• Vocal Ligament Absent (So; thin vocal cord)	• Thick vocal cord

℞ ⇒ CO_2 Lasers

"Cidofovir drugs used"

AI→09

* Most children c Recurrent Laryngeal Papillomatosis are born to Mothers c condylomata accuminatum during ♀ & Parturition.

TB (Tuberculosis)

- M/c E.N.T. Manifestation of T.B ⇒ cervical Lymphadenopathy
- M/c site in Nose ⇒ Anterior end of Inferior turbinate
- Multiple perforation ⇒ T.B. Ear

⇓

always painless
May colourless / blood stain
May odourless / Foul smell.

- M/c site of TB Larynx ⇒ Posterior commissure
  - ↳ Painfull condⁿ ⇒ Weakness of voice
- M/c symptom
- M/c sign ⇒ Loss of Adduction
- Earliest sign ⇒ Hyperemia of Posterior commissure

"Mouse-bitten appearance" of Vocal cord

- Pseudoedema of the epiglottis present
  - ↳ b/c of cellular infiltration.
  - "TURBAN Epiglottis"
- Mx ⇒ ATT**

* TB-Larynx ⇒ affects Posterior 1/3rd of Larynx More commonly than Anterior part.

VOCAL CORD PARALYSIS

5 Muscles ⊕ ⇒ Cricoid C → T → Thyroid; A = A Arytenoid

E, F } b/c it can't possibly

CT TA IA

CA

LCA PCA

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Nerve vagus (X Nerve) → Recurrent L.N.
  → Superior L.N. → external L.N.
  → internal L.N.

* All Muscle of Larynx supplied by Recurrent LN except ⇒ cricothyroid ⇒ external br. of Superior L.N.

* All are Adductor Muscle except ⇒ PCA
  ↳ Abductor Muscle

* Recurrent L.N. Supplies 3 Adductor & 1 Abductor.

* Superior L.N. supplies only adductor (CT)
  ⇓
  Strongest Adductor.

* Sensory Supply:
  Area below the vocal cord ⇒ Recurrent L.N.
  Area above the vocal cord ⇒ internal br. of superior L.N.

* Recurrent L.N. ⇒ Mixed N.
  Internal br of Superior L.N. ⇒ Sensory N.
  External br of Superior L.N ⇒ Motor N.

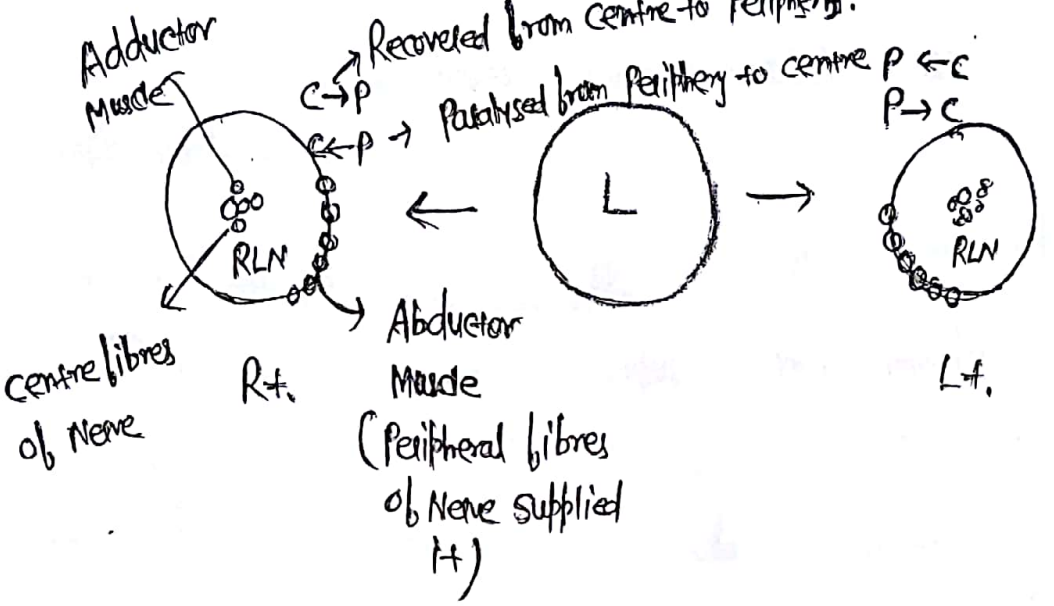
* In Any organic Pathology;
  * Posterior cricoArytenoid ⇒ 1st to be paralysed & Last to be Recovered;
  While all adductors are Last to be Paralysed & 1st to be Recovered.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

SEMON'S HYPOTHESIS

Adductor Muscle ⇒ Embryologically old ⇒ Strong

Abductor Muscle ⇒ Embryologically New ⇒ Weak



SEMON's Three stage ⇒ 1st stage ⇒ Paralysis of Abductor

2nd stage ⇒ Contracture of Adductor

3rd stage ⇒ Paralysis of Adductor

Distance from Midline	Position of vocal cord	Healthy Condn	Disease
0 mm	Median	Phonation	RLN Paralysis
1 mm	Paramedian	Whispering	RLN Paralysis
3 mm	Intermediate	XXX	Both Paralysis
7 mm	Gentle Abduction	Quite Respiration	SLN Paralysis
9 mm	Full Abduction	Deep Respiration	SLN Paralysis

→ also klas "cadaveric Position".

* In case of Recurrent Laryngeal N. Palsy vocal cord assumes Median & Paramedian Position; b/c of (N) cricothyroid Muscle (45)

↓

Kla "Wegner Grossman Law"

* M/c Injured Nerve ⇒ Recurrent Laryngeal Nerve**

V

Superior Laryngeal Nerve

Left > Right (b/c of Long course)

but; In thyroid Sx ⇒ *SLN > RLN (Injury)*

* M/c cause of Unilateral vocal cord Palsy ⇒ Malignancy.**

M/c cause of B/L vocal cord Palsy ⇒ Thyroid Sx.**

*If only Vocal cord Palsy ⇒ Malignancy > Surgery > Idiopathic

Mention in question

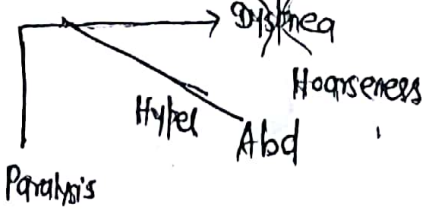
* EQ Incomplete Paralysis Kla⇒ Partial Paralysis Kla⇒ RLN Paralysis

Complete Paralysis Kla⇒ Total Paralysis Kla⇒ RLN + SLN Paralysis

* If patient have dysnea ; Aspiration ⇒ Surgical Intervention

Hoarseness ⇒ Wait & watch (w/w)

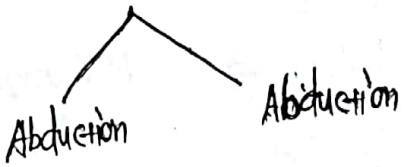
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Nerve Palsy	Position of vocal cord	Symptom	T/t
• U/L RLN Palsy ⇒		Compensated hoarseness	C/C
• B/L RLN Palsy ⇒	| |	dyspnea	Tracheostomy
• U/L SLN Palsy ⇒		Paralysis (Hoarsness)	C/C

↓

aspiration Not comes in Picture ; b/c epiglottis has Both sided supply of SLN

Abduction

• B/L SLN Palsy ⇒		Aphonia +++ Aspiration	Epiglottoplasty + Tracheostomy.

Thyroplasty ⇒ Repair of the thyroid to Manipulate

↳ Isshiki classification

Type -I ⇒ Medialisation → Gn SLNP

Type -II ⇒ Lateralisation → Gn RLNP

Type -III ⇒ Shortening (Relaxing) → Gn Relapsing cases of Tuberculosis

Type -IV ⇒ Lengthning (Tensioning) → Gn Anesthesia cases

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* **Method of Medialization**
  - Tit for SLNP
  - by Type-I thyroplasty
    - Injection of Teflon
    - Injection of gelfoam.

* **Method of Lateralization**
  - Tit for RLNP
  - ii) by type-II thyroplasty.

iii) **Cordectomy** ← Removing Some Layer of vocal cord

- by open approach
- via Endoscopy
- CO_2 Laser assisted ↓ Klas "Kasima operation"*

type-I ⇒ Sub epithelial
type-II ⇒ Sub-Ligamental
type-III ⇒ Trans-Muscular
type-IV ⇒ Total Cordectomy
type-V ⇒ Extended cordectomy.

iii) **Arytenoidectomy** ← Remove Inner half of Arytenoid to create Some space.

- via open approach ↓ Woodman procedure
- Endoscopy.

* Safety Nerve ⇒ Internal br of superior L.N.

Safety Muscle ⇒ PCA

↳ help in Respiration.

CONTACT ULCER ⇒ dip

↳ concave surface

In excessive vocal abuse

@ Posterior commissure.

⇒ Rx ⇒ Voice Rest

Anti-acid

Anti-allergic

INTUBATION GRANULOMA ⇒ H/o Intubation present.

⇒ Faulty Anaesthesia technique ↳ bulge

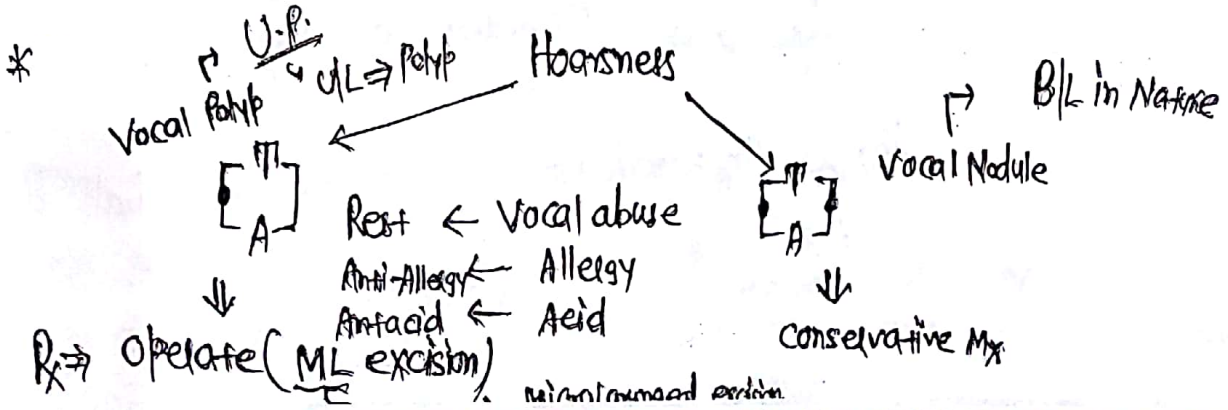
@ Posterior commissure convex surface

⇒ Rx ⇒ Voice Rest

Anti-acid

Anti-allergic

*

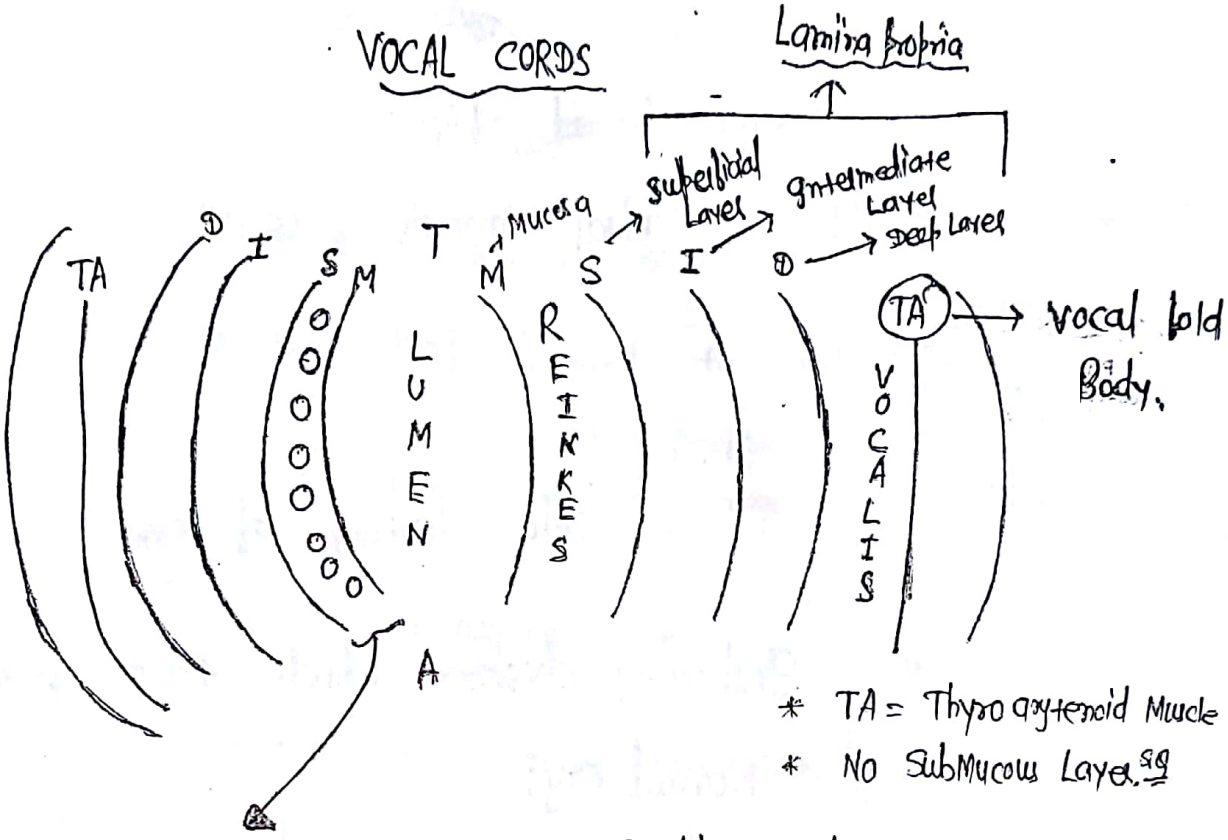


http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Vocal Nodule ⇒ Benign Neoplastic growth on free edge of both the vocal cords @ the junction of Anterior 1/3rd & Posterior 2/3rd. (47)

↳ Major cause ⇒ Vocal Abuse (AI→13)

VOCAL CORDS



* TA = Thyro arytenoid Muscle
* No SubMucous Layer.

Combine to form ⇒ Vocal Ligament ⇓ in Newborn

( ) Reinke space (b/w Mucosa & Superficial Layer).

Reinke's edema ⇓ Polypoid degeneration

Immature vocal Ligament is formed ⇒ 1-4yrs.

Mature vocal Ligament is formed ⇒ 14yrs.

↳ 1st Line of Rx ⇒ Voice Rest
Anti-acid
Anti-allergic

↓ if Not Respond

Microlaryngeal Stripping .** Indication ① Reinke's edema ② Ca in situ.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Congenital Abnormality of Larynx

• LARYNGOMALACIA

* Soft / weak / Floppy supraglottis ⇒ on A-P view

Omega-shaped epiglottis

- M/c congenital Anomaly of Larynx.

- M/c Pathology of Laynx.

⇒ Inspiratory dyspnea which ↑es on feeding;

⇒ Normal cry;

⇒ Short Relax Aryepiglottic fold.

⇒ New born comfortable in Prone position.

⇒ Max^m cases are asymptomatic

↳ so wait & watch

↓ got improve

c/in 2 weeks

↓ all improve

in 2 years

(So; Never Make diagnosis beyond 2 years)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

if severe dysnea (+) ⇒

* Congenital webs

M/c site ⇒ Ant. commissure **

* Biphasic dysnea c AL(N) cry.

Rx ⇒ CO_2 Laser

* "COHN'S" classification is used.

- Silastic keel is used to avoid Adhesion.

Excision via Laryngofissure b/b Placement of silicon keel (McNaughter keel) & Subsequent dilation

* Congenital stenosis

M/c site ⇒ Sub-glottic Area

* Biphasic dysnea c (M) cry.

* Maxm pt's are asymptomatic

↳ Wait & watch

* if acute dysnea (+) ⇒ use dilators (Metallic)

* if chronic dysnea (+) ⇒ excision Reanastomosis

Mccaffrey classification

<3mm – 9n preterm baby

<4mm – Full term baby.

Cotton Mayel classification

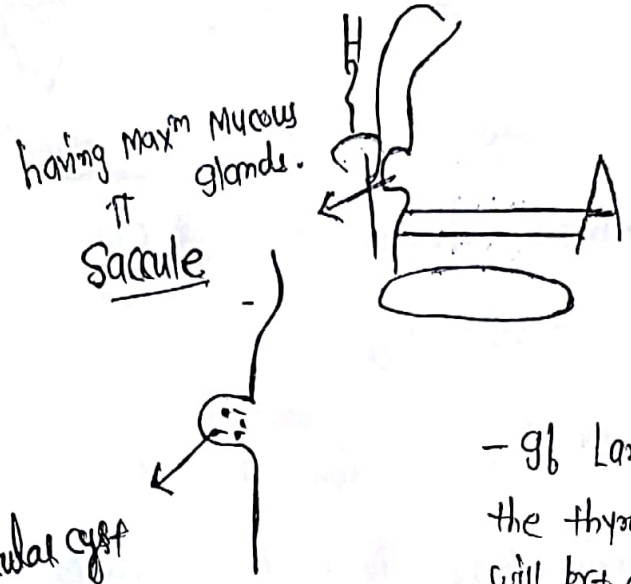
Grade-I ⇒ <50% obstruction

Grade-II ⇒ 51-70% obstruction

Grade-III = 71-99% obstruction

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Oil tank of Larynx ⇒ Saccule; which helps in Lubrication.



- If Laryngocele progress & Rupture the thyrohyoid Membrane; it will present as "

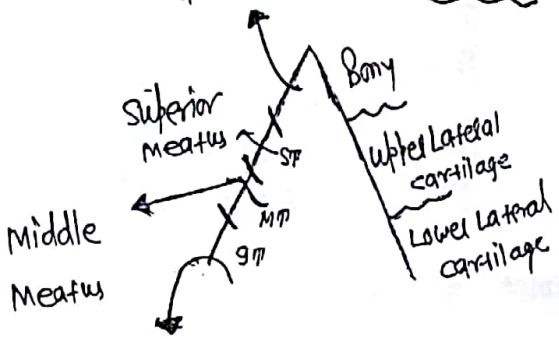
Large Saccular cyst
↓
Laryngocele (Air-filled cavity)

↳ Thyrohyoid Membrane Rupture is due for Laryngocele.

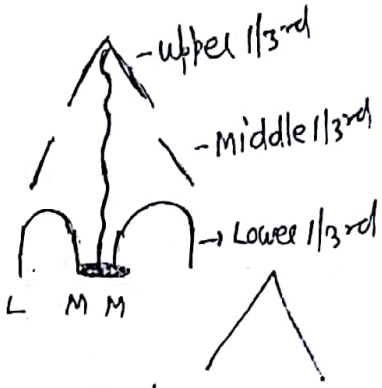
* PPP Rule (Posterior commissure Points to Paralyzed side in U/L Superior Laryngeal Nerve Palsy).

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

NOSE



Largest Meatus



Medial Lateral

⇓

Form columella

* ET opens 1.25 cm behind the Inferior turbinate.

* All turbinates are part of ethmoidal bone ∴ except ⇓ Inferior turbinate (separate bone) ↳ It articulates ē ethmoid.
* Total 3 turbinates on ↳ Superior; Middle; Inferior.
* pH of Nasal cavity = 7 (Neutral)
* Amount of water secreted from cavity = 1 Litre / day.
* Inferior turbinate ossification = 5th Month of IUL.
* Alternate congestion, decongestion in Nose (one side congestion then other side Decongestion).
  ⇓
  1 Nasal cycle
  ↳ duration ⇒ 2.5–4 hours
* Olfactory area ⇒ Upper 1/3rd (2–5 cm²)
  Respiratory area ⇒ Lower 2/3rd
* Anterior – Posterior Length of the Nose ⇒ 8 cm
  (Nib) (Choana)

* Upper 1/3rd Bony part consist of :⇒ a) Two Nasal bone;
b) Frontal process of Maxilla
↳ Lateral to Nasal bones on each side;
c) Nasal process of Frontal bone
d) Nasion ⇒ junction of Nasal bone & Nasal process of frontal bone

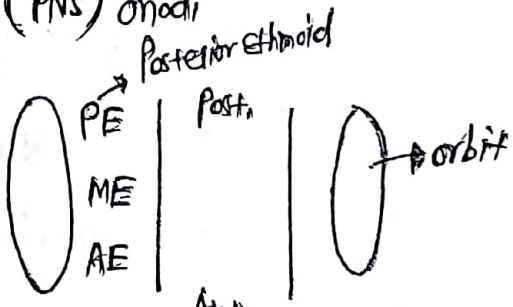
* Lower 2/3rd cartilagenous part consist of :⇒

- 2 Upper Lateral cartilage
- 2 Lower Lateral cartilage
- 2 or More Alar (sesamoid) cartilage
- 1 Septal cartilage
  ↳ Quadrangular / Quadrilateral space. NEET PG

* Nose ⇒ Midline structure
↳ Any cavity surrounding Nose
↳ Para Nasal sinus

Para Nasal Sinus (PNS) onodi

Supero-Inferior Section



Antero-Posterior section

- Sphenoid sinus is Postero-Superior to the Nasal cavity
- Largest PNS = Maxillary sinus = 15ml.
  Most functional sinus = Ethmoidal sinus (Maxm air cells)
  ⇓
  15 air cells (5A, 5M, 5P)
- Length of Pharynx ⇒ 15cm

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Foramen of Breschet :⇒ Venous drainage of Mucosa (So)
↓
Site of potential Intracranial spread of infection.

* V.V.G

	Status @ birth	Adult size	1st Radiological evidence
Maxillary Sinus →	present	15 yrs	4-5 Months.
Ethmoidal Sinus →	present	12 yrs	1 yr.
Frontal Sinus →	Not present	Until teens	6 yr.
Sphenoid Sinus →	Not present	15 – Adult	4 yr.

* Naso-chin view ← Water's view ⇒ Best view to see Maxillary Sinus.
Caldwell's view ⇒ For ethmoid & frontal Sinus.
Naso-lateral view. Lateral view ⇒ For sphenoid sinus
↳ 2nd best ⇒ Water's view c open Mouth.

GQ: on water's view all Sinuses Seen except ??
a) Maxillary; b) Frontal; c) sphenoidal; d) Posterior ethmoid

* Frontal sinus :⇒ Shows Maxm Variation in development.
↳ development of Frontal Sinus ⇒ Physiological upto 4 yrs.
drooling of saliva In Newborn ⇒ Physiological upto 4 yrs

ANATOMY

* Most prominent part of Forehead ⇒ Glabella

Upper edge of Nasal bone ⇒ RADIX / Root of Nose

Angle b/w Glabella & Radix / Nasofrontal Angle ⇒ Nasion (115-135°)

Bony cartilagenous junction ⇒ Rhinion

Nasolabial angle ⇒ 105°

* Most prominent point on the Nasal tip ⇒ Pronasale

WhatsApp: +1 (402) 235-1397

- Anterior Air cells = Agger Nasi
  ↳ of Anterior Ethmoid, ↳ elevation Anterior to Middle turbinate.

- Bulla Ethmoidalis ⇒ prt. in Anterior Ethmoidal Sinus
  ⇓
  Largest Air cells

- Floor of orbit combine ε floor of Anterior ethmoid
  ⇓ ⇓
  Roof of Maxillary. formed by Haller cells

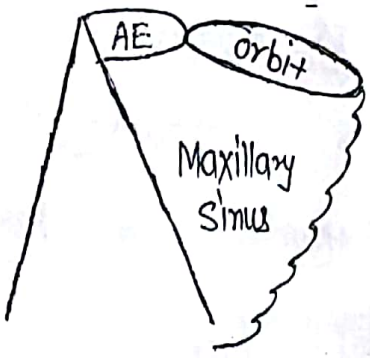
- Pneumatization of the orbital floor
  ↳ False impression of Heller cells.

- Most posterior cells ⇒ Onodi cells
  ⇓
  Part of Posterior ethmoid; close-to optic Nerve

for Any topic * of Nose ⇒ Ixoc = Rxoc = Endoscopy
Ixoc ⇓ diagnostic Endoscopy
Rxoc ⇓ FESS

* CONCHA BULLOSA :⇒ Largest turbinate
  ↳ Pathological structure.
  Bic of Any trauma; if Some air get trapped in turbinate, size tej klay "concha bullosa", also klay "Pneumatization of turbinate

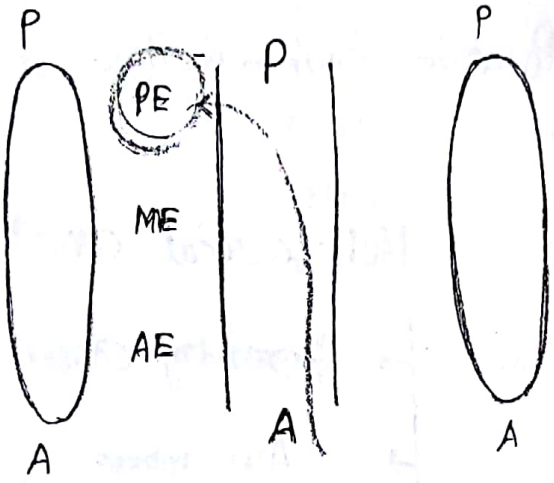
http://mbbshelp.com WhatsApp: +1 (402) 235-1397



Floor of orbit Combine ⊂ floor of Anterior ethmoid

⇓

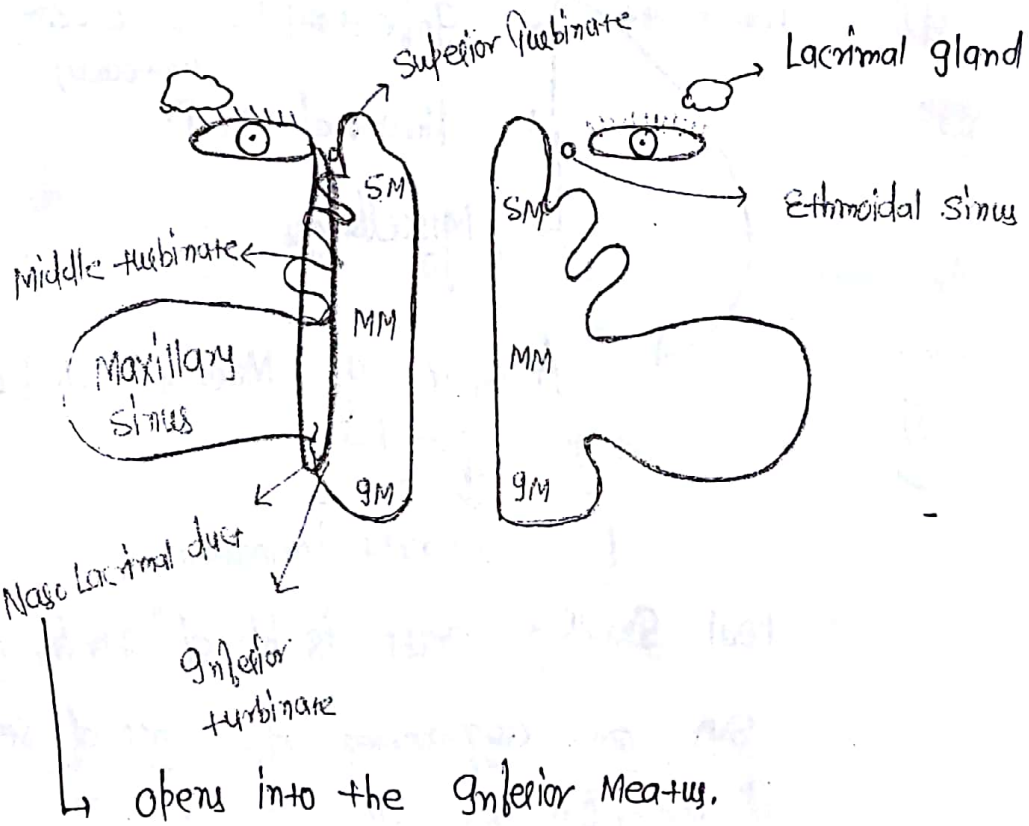
Roof of Maxillary Sinus



concha bullosa

⇓

B/c of Any trauma



↳ opens into the Inferior Meatus.

RHINITIS → Mostly in ♀ during puberty. (watery discharge)

1. Hypertrophic Rhinitis ⇒
   - Commonly involved ⇒ Inferior turbinate
   - "Mulberry like Nasal Mucosa" ⇒ Hallmark feature
   - Rx of ⇒ KTP Laser
     ⇓
     Potassium titanium phosphate

2. Atrophic Rhinitis ⇒ Multifactorial cond^n
   (OZAENA)
   - B/L in Nature
   - IgE Mediated immunologic Response.
   - → Hereditary causes
   - → Autoimmune
   - → Infection (Klebsiella ozane; Staphylococci, Streptococci)
   - → Hormonal cond^n
   - → Miscellanous

   → Atrophy of Mucosa & N. fibre
   ⇓
   Leads to crust formation
   - Foul Smelling crust is b/c of "atrophy of bone"
   - Symptom aggravates d/t loss of sensation
   - "Merci full anosmia"
     ↳ Full of foul smelling crust; but pt. didn't feel the smell.
   - M/c symptom = Nasal obstruction.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

⇒ Klebsiella ∧ Infection is associated ε/it. (S2)

↓ ozaena

Doc ⇒ Streptomycin

Tetracycline

Used to dissolve crust & clean the Nose. } Sodium bicarbonate 1

bi borate 1

Chloride 2

(B : B : C / 1 : 1 : 2) } ↳ It is → dissolve in 280 ml of H_2O & used to irrigate the Nasal cavities

- Complete obliteration of the Nose ⇒ Young's operation.
- Partial closure of the Nose ⇒ Modified young's operation

↓

Leave 3mm opening ⇒ Sx. of/t.

Injection of Teflon In the Lateral wall

↓

"Lautenslager Sx."

Following Removal of crust the Nose is painted ε 25% Glucose in Glycerine.

↓ Glucose Inhibits proteolytic organisms

↓ Glycerine is hygroscopic Agent.

Kemicetine Antiozaena Solution ⇒ contains chloromycetin, estradiol & vit D_2.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

3. DRUG INDUCED RHINITIS

- d/t Vasodilators
  - Antihypertensives
  - Anticholinesterase
  - OCPs

⇒ Causes Rhinitis

4. Rhinitis Medicamentosa

↳ Withdrawl of Any Vasoconstrictor

⇓

Rebound phenomenon

↳ Topical steroids — Tx

5. VASOMOTOR RHINITIS (Nonallergic condition)

Yes Sympathetic & Yes Palasympathetic (Palasympathetic overactivity)

dissect the vidian Nerve (vidian Neurectomy)

↳ Palasympathetic Secretomotor fibres to Nose

DNB IS Symptom – Paroxysmal Sneezing on getting up early in Morning.

ARIA ⇒ Allergic Rhinitis & its Impact on Asthma.

6. Allergic Rhinitis – TypeI HSN Rxn

O/E → Nasal Mucosa ⇒ Pale, boggy, Hypertrophic.

Allergic Salute ⇒ Transverse crease ⊕ on Nose d/t upward Rubbing of Nose

Granular Pharyngitis ⇒ d/t hyperplasia of Submucous Lymphoid tissue;

Tx → · Avoidance of allergen
· Medical Tx
· Specific Immunotherapy

Allergic Shiners ⇒ Dark circles under the eyes.

· Turbinates all Swollen.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

SINUSITIS ** (M > E > F)

↳ Least commonly involved.

⇒ Investigation of choice = Rx oc = Endoscopy

⇒ Viral > Bacterial > Fungi

↓ ↓ ↓

Rhinovirus Streptococci A. fumigatus > Niger > Flavus

⇒ Radiological Ix oc ⇒ CT Scan

↳ except ⇒ Gm fungal sinusitis

↳ M/C site ⇒ Maxillary Sinus.

CT Scan findings in allergic Fungal Sinusitis : ⇒

Area of high attenuation surrounded by a thin zone of Low attenuation.

↓

Fungal ball formation; which is identical to soft tissue tumor

↓

Hence; "MRI of PNS"

↓

also " Bony destruction"

- Allergic fungal sinusitis ⇒ Hallmark Not Gm
  - ↳ Fungal ball formation & Bony destruction
- Non-allergic fungal sinusitis
- Gm invasive fungal sinusitis
- Non-invasive fungal sinusitis

⇒ M/C site of Fungal ball ⇒ Maxillary sinus

Criteria ⇒ 2 Major + 1 Minor

OR

1 Major + 2 Minor

Major

A ⇒ Anosmia

B ⇒ Blockage

C ⇒ Congestion

D ⇒ Discharge

F ⇒ Facial Pain

F ⇒ Fever (Acute sinusitis)

Minor

- Halitosis
- Fever (chronic sinusitis) ⇒ >3 Months
- Pain in body (Except ⇒ facial)

Hallmark Symptom ⇒ Discharge

* if Cheek | dental | Swelling of Lower eyelid ? words ⊕ in question

⇓

Maxillary

* if Root | Radix | Dorsum | swelling of the Lower & upper eyelid

words ⊕ in question

⇓

Ethmoid

* if vertex | occipital | Retroorbital ; words ⊕ in question

⇓

Sphenoid

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Maxm headache - Morning
  Minm headache - Evening
  } Frontal Sinusitis
  ↳ office headache
  ⇓
  Shows; Periodicity

* Complication :→ Mucocele
  Pyocele
  Osteomyelitis
  Fistula
  } all seen in frontal sinusitis

* Osteomyelitis of Frontal sinusitis ⇒ Pott Puffy Tumor

* Orbital cellulitis ; orbital Abscess ⇒ Ethmoidal sinusitis
  ⇓
  Chandler's classification
  - Group 1 :→ Preseptal cellulitis
  - Group 2 :→ orbital cellulitis
  - Group 3 :→ Subperiosteal Abscess
  - Group 4 :→ orbital Abscess
  - Group 5 :→ Cavernous Sinus thrombosis

Deviated Nasal septum

↳ displacement of Nasal septum,
C/F of DNS :⇒ ① Epistaxis;
② Recurrent Sinus infection;

- 2nd Mc Pathology of Nose
- 4of. DNS
- 4+ has Symptomatic DNS
- T/t ⇒ Septoplasty.

* Cottle test :⇒ Used to test Nasal obstruction d/t Abnormality of Nasal valve as in case of DNC.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

SMR ⇒ Sub Mucosal Resection

- SMR = B/L Incision
  - ↳ Remove whole septum
- Septoplasty = U/L Incision
  - ↳ Remove only deviated part.

* Crooked Nose / Ugly Nose ⇒ curving of septum as well as external Nose
  - ↳ Txoc ⇒ Septo Rhinoplasty
  - ↳ M/c cause ⇒ Con genital

* Saddle Nose ⇒ depression on dorsum of Nose
  - ↳ external Nose deformity
  - ↳ M/c cause ⇒ Surgical trauma
  - Syphillis; Leprosy; TB;] ⇒ damage cartilagenous part
  - Wegner granulomatosis] ⇒ damage both
  - ⇒ damage bony part.
  - Rxoc ⇒ Augmentation Rhinoplasty
    - ↳ Iliac crest is best graft.

- Hump Nose ⇒ T/t ⇒ Reduction Rhinoplasty

M/c cause ⇒ Congenital.

external Nasal deformity.

- if ONLY Septum Ab(N) ⇒ Sebtoplasty
- external Nose Ab(N) ⇒ Rhinoplasty
- if both are Ab(N) ⇒ Septo Rhinoplasty

TRAUMA

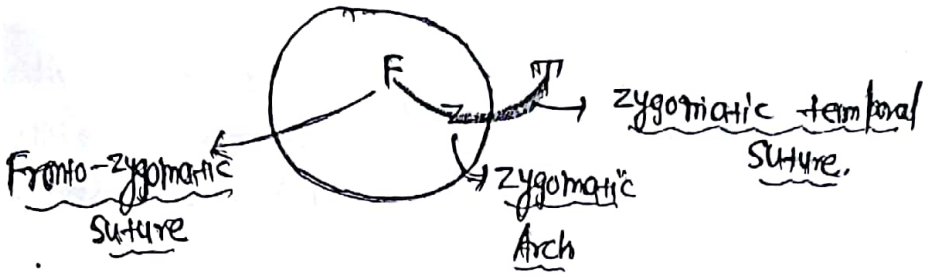
- Superior trauma & Posterior trauma Causes "Skull #".
- Anterior trauma, inferior trauma & Multidirectional trauma
  ⇓ causes
  "Facial #"
- Longitudnal # seen in Parietal Trauma
  ⇓
  It is More common; Result in
  bleeding & CSF otorrhea
  ⇓
  Result in conductive deafness
  ⇓
  Facial N. Palsy (20%)
  ⇓
  Less symptoms

More symptoms, more chance (80%) Facial N. Palsy

- Transverse # seen in occipital Trauma
  ⇓
  It is Less common ⇒ Result in SNHL

* M/c Facial bone # = Nasal bone #

2nd M/c Facial bone # = zygomatic bone # / Tripod #



* Real drop sign = Seen in orbital floor #

* Reduction should be done immediately ; if edema ⊕ ;; give Anti-Inflammatory & Reduces C/in 5 days..

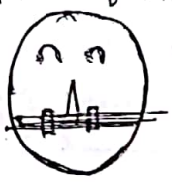
* Patient comes C/in 1st 21 days = Close

after 21 days = open

Le fort classification ⇒ based on direction of # Line.

I

@ Floor of Maxillary sinus



Low Maxillary #

OR

Guerin #

Hallmark feature ⇒ Floating palate

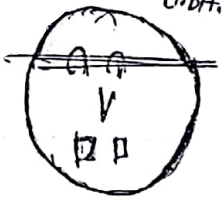
II

along Nasolabial fold

Pyramidal #

III

@ the Level of orbit.



Cranio-facial dysjunction

CSF Rhinorrhea ⇒ III > II

2nd classification :⇒ Based on direction of Trauma

Trauma coming from below

Class-I # ⇒ Below → Results in → Chevallet # (vertical #) (Select vertical #)

Class II # ⇒ Front → Results in → Jaljaway # (Horizontal #) ↳ slightly oblique

Class III # ⇒ Multidirectional

Trauma from Front

Malignancy

* M/c Benign tumor of Nose ⇒ Capillary hemangioma
* M/c site for capillary hemangioma ⇒ Litter's Area
* M/c site for cavernous hemangioma ⇒ Inferior turbinate
* M/c site for Maliagnant Melanoma ⇒ Nasal Septum
* M/c site for Papilloma ⇒ Vestibule / skin behind columella

Inverted Papilloma (Ringertz tumor / Schneiderian Papilloma)

- Pre-Malignant condn ↳ d/t HPV
- always U/L
- M>F (40-70yr)
- M/c site ⇒ Lateral wall of Nose" from Non-olfactory epithelium of Nose.
- 40-60yr is Age of distribution

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Dxoc ⇒ "Biopsy" is Must for diagnosis.

Rxoc ⇒ Medial Maxillectomy via Lateral Rhinotomy OR Midfacial degloving Approach. ("RT" is Not Advised)

* M/c Malignancy of Nose ⇒ Squamous cell ca

⇓

M/c site ⇒ Lateral wall of Nose

All tumor of Nose ⇒ Mx ⇒ Surgery.

PNS (Para-Nasal sinus)

M/c benign tumor ⇒ Osteoma

⇓

Seen in frontal sinus > Ethmoidal > Maxillary

Mx = Surgery ***

* M/c Malignancy = Sq. cell carcinoma ⇒ in Maxillary sinus **

↳ in Nickel Industry

* 2nd M/c Malignancy = Adenoca; seen in ethmoidal

↳ in Wood Industry workers

Mx ⇒ Sx + RT. *

For Maxillary sinus ⇒ Weber ferguson incision. **

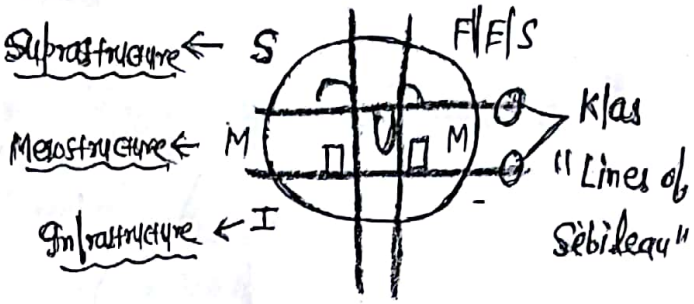
Ohngrens Line ⇒ extends from Medial canthus of eye to the Angle of Mandible

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Maxillary Ca

Ohngren's classification
- Use 1 Lines

Lederman classification
- Use 4 Lines



Tumor below Line ⇒ Good Prognosis
Above Line ⇒ Bad Prognosis

Epistaxis → Bleeding from Nose

Site	Location of site	Type of bleeding	Most Common in	Common caused bleed
Little's Area | Kisselbach's Area	Ant. part of Septum	Arterial	Child	Nose pick
Retro-columellar vein	Ant. part of Septum	Venous	Young Adult	X
Woodruff plexus	Post. part of Lateral wall	Venous	Old	HTN

→ Bleeding is from Source Anterior to the Piriform aperture & blood flows out from front of Nose.

Anterior epistaxis is More Common & less severe;

Posterior epistaxis is less common & More severe;

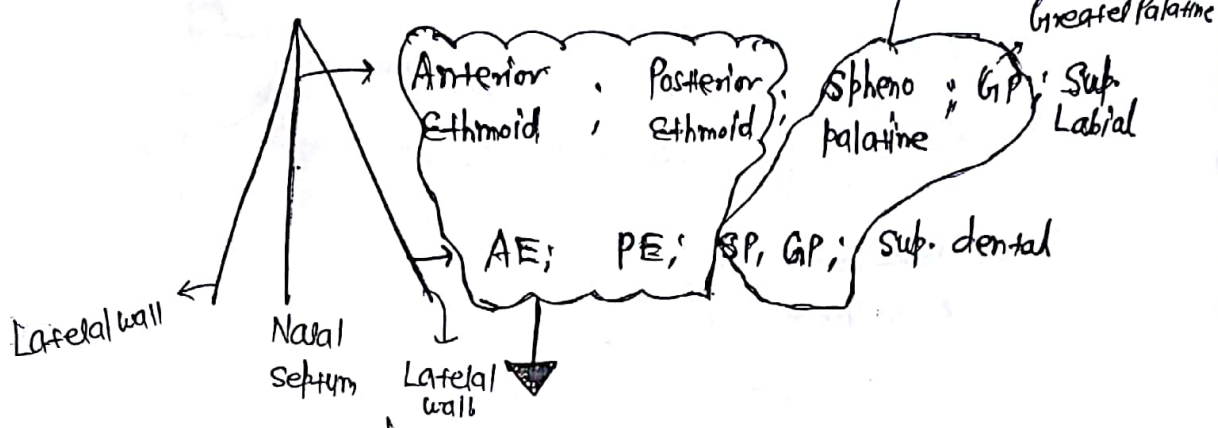
↳ Bleeding is from vessel situated Posterior to Piriform aperture & blood usually flows back into the throat. Bleeding is usually Spontaneous/due to Hypertension & Atherosclerosis

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Venous plexus of Post. Part of Septum = ** Brown's Area ⇩ 4th Area of epistaxis

branch of external Carotid A. ↑ branch of Maxillary A.

*



branch of ophthalmic A. ⇩ branch of Internal carotid Artery.

⇒ Artery of epistaxis ⇒ Sphenopalatine A.

℞ ⇒ Pinch out Nose | Spit the blood ⇒ Trotter Method ⇩ control 90% of bleeding.

if Not control ⇩ Anterior & Posterior Packing ⇩ Chemical cautery (1% $AgNO_3$) ⇐ endoscopic Ligation of Sphenopalatine A. (ESS)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

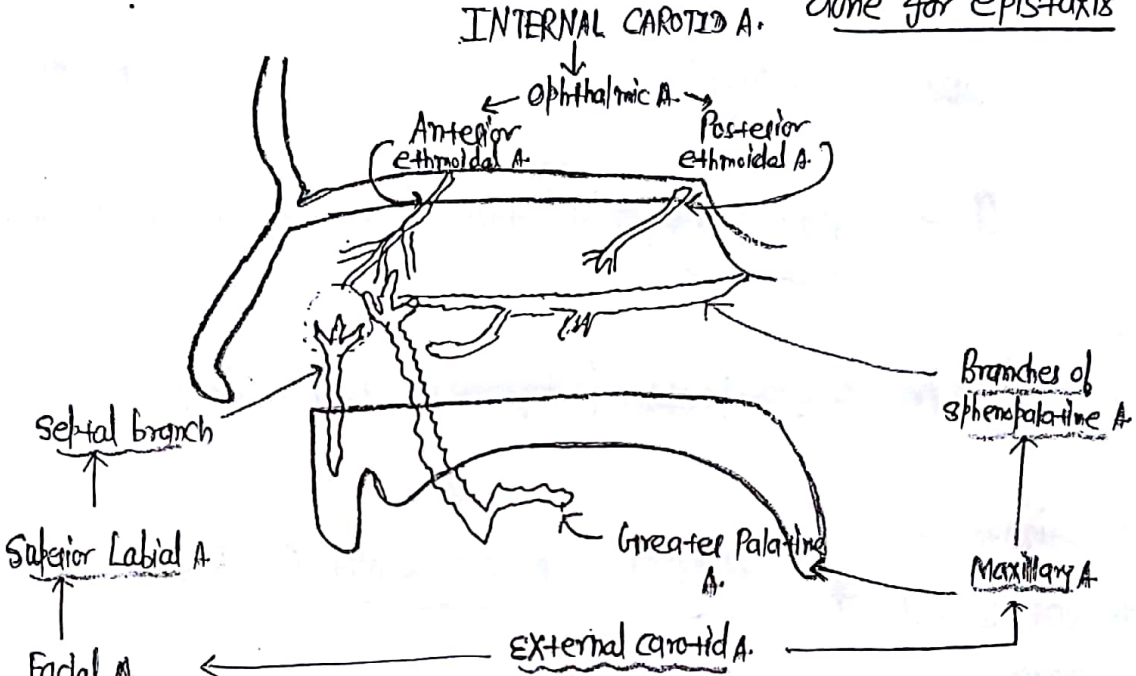
⇒ if bleeding above Middle turbinate (SB)

↳ Ligate Anterior Ethmoid A.

⇒ In old age / tumor / Chemotherapy / Excessive bleed

↳ Ligate External Carotid A.

⇒ TESPAL (Trans Nasal Endoscopic Sphenopalatine A. Ligation) ⇒ done for epistaxis



CSF Rhinorrhoea

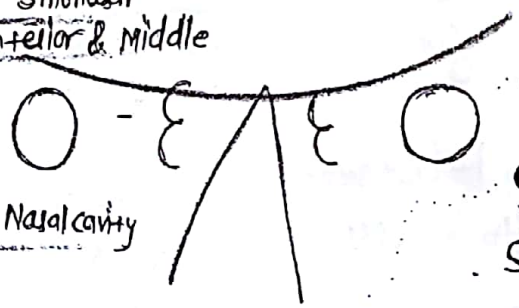
- Disruption of the barriers b/w the sinonasal cavity & the Anterior & Middle cranial fossa

↓

discharge of CSF in Nasal cavity

↓

CSF Rhinorrhoea



Fovea Ethmoidalis

↳ M/cly involved in CSF Rhinorrhoea

Cribiform plate ⇒ Max^m No. of Leaks

Surgical trauma

Traumatic

Head Trauma (90%) ←

Double Ring sign

Non-traumatic (Spontaneous)

↑ ICT

Single Ring Sign

- Tea-pot sign ⊕ in CSF – Rhinorrhoea.

CSF Rhinorrhoea	Sinusitis
• Traumatic	• Infective
• Non-sticky discharge	• Sticky discharge.
• Sniffing Not possible	• Sniffing possible
• Glucose > 30 mg/dl	< 10 mg/dl.

Confirmatory diagnosis ⇒ β_2-transferrin (Highly sensitive as well as specific) ***

⇓

in Electrophoresis (confirmatory investigation)

Investigation to detect site of Leakage ⇒ "HRCT" c or c/o+ Gadolinium

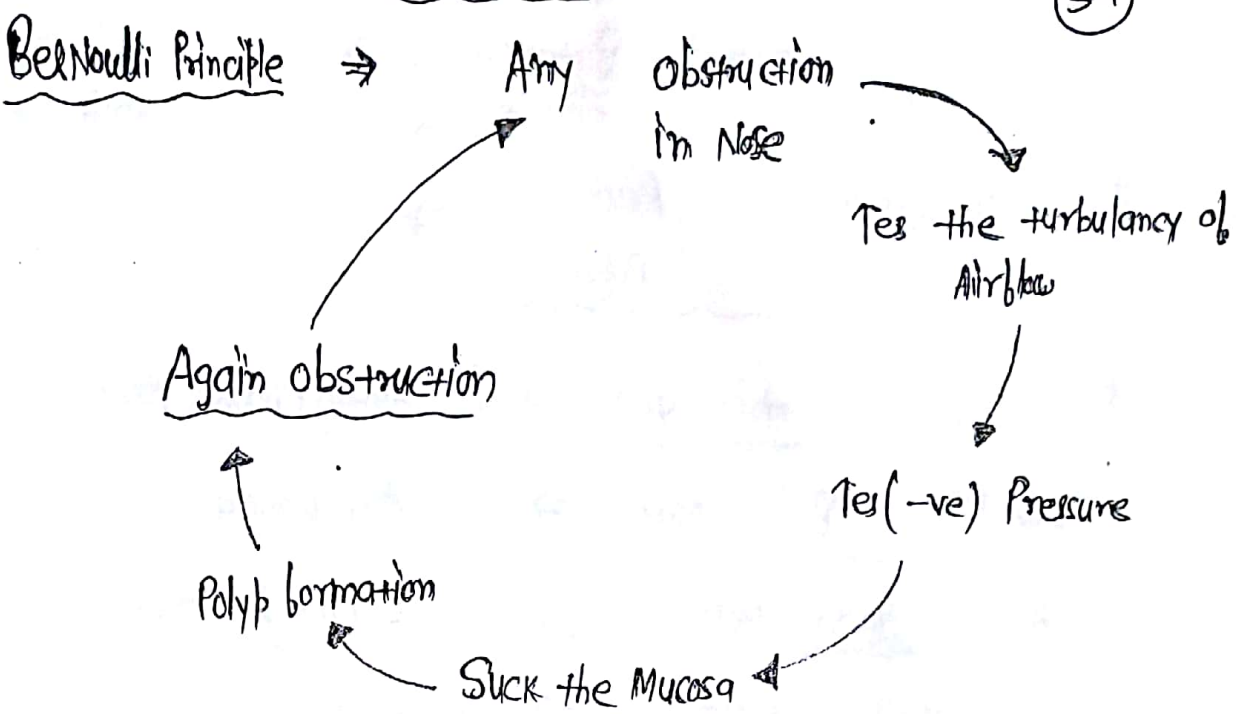
Rx of ⇒ Wait & watch c
i/v Antibiotics
↓ if No improvement c/in 2 weeks.
go for endoscopic Repair

Queckenstedt test ⇒ Compression of jugular vein leads to +ve CSF Leak: d/t +ve in ICP.

• Tissue test (Handkerchief test) ⇒ Unlike Nasal Mucosa, CSF doesn't cause a tissue to stiffen.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Nasal Polyp



- Nasal Polyp + Bronchiectasis + Dextrocardia

⇓

KARTAGENER SYNDROME **

- Nasal Polyp + Bronchiectasis + Azospermia

⇓

YOUNG SYNDROME *

Nasal Polyp + B. Asthma + Aspirin sensitivity

⇓

SAMTER's Triad *

* Age < 2yr; Mass In Nose
  ↳ Intracranial Mass
  ↳ Inv. ⇒ CT-Brain*

* Nasal discharge + Age < 2yr
  ↳ Foreign body

* Age (2-10yr) + Recurrent Polyp ⇒ Cystic fibrosis

* Age (10-14yr) + Polyp ⇒ Antro choanal Polyp
* Age (14yr) Boy + Mass ⇒ Angiofibroma
* Age 20-40 yr + Mass ⇒ Ethmoidal Polyp
* Age 40-60 yr + Mass ⇒ Inverted Papilloma
* Age > 60yr + Mass ⇒ Squamous cell Ca

ANTROCHOANAL POLYP / Killian's Polyp***
Choana
↳ 10-14 yr.

ETHMOIDAL POLYP
↳ 20-40 yr.

M
↓
Maxillary Sinus

Trilobed
U/L
Single
- Age ⇒ 10-14yr.
- Infection is the Main cause
*** Hyponasal voice ⊕

Grape like
B/L
Multiple
20-40 yr
Allergy is the Main cause
⇓
Anti-allergic Steroids

Ixoc = Rxoc = Endoscopy

* Frog face deformity / Angiofibroma
  ↳ Main vessels involved in the bleeding is Internal Maxillary A..

* High grade fever ∈ H/o Trauma ∈ B/L Pallipoldal Mass

⇓

Septal Abscess

↳ I & D done in 48 hours.
  ↳ to prevent *** Septal perforation

* Rhinophyma ⇒ Hypertrophy of Sebaceous gland
  ↳ Also " Potato Nose / Rum Nose / Whisky Nose "
    ↳ Seen in alcoholics **

  Rx ⇒ Surgery. **

* Rhinoscleroma ⇒ Bacterial Infection

⇓

Klebsiella Rhinoscleromatis

⇓

Doc ⇒ - Streptomycin
  Tetracycline

↳ Ulceration + crust formation + Woody Nose

* Mikulicz Cells ⇒ Large cell
  Russell's body ⇒ Small cell.

Microphage

Eosinophils

* Rhinosporidiosis (Rhino. seeberi) ⇒ ~~Fungal disease~~

↓

Seen in Tamil Nadu Protozoal disease

℞ ⇒ Dapsone

Sx (Toxic***)

↳ cautery is Mandatory (heavy bleeding)

⇒ Mulberry like Nasal Polyp / vocal cords

QQ Mulberry like Nasal Mucosa ⇒ Hypertrophic Rhinitis

* Sarcoidosis ⇒ Strawberry appearance of Nose.

* Rhinosporidiosis ⇒ Strawberry appearance of Nasal Mass

FESS (Functional Endoscopic Sinus surgery)

Endoscopy is from Lateral wall of Nose; which is equivalent to Medial wall of sinus; ∴ no Any scar hence is klas " FESS"

→ open approach is done through Anterior wall of sinus; hence Scar (incision) ⊕nt;

⇒ Most dangerous complication of Endoscopy

↳ CSF- Rhinorrhea

↳ 1.3 %.

Rare complication of Endoscopy ⇒ Retroorbital hematoma

↓

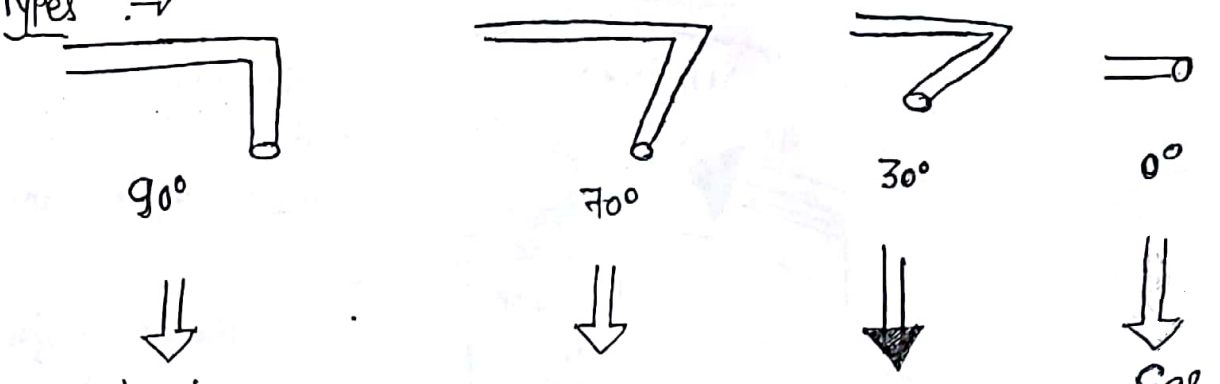
d/t Ant. ethmoidal Artery. on

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Endoscopy → 2.7mm diameter ⇒ Pediatric population

→ 4mm diameter ⇒ Adult population

Types :⇒



90° ⇓ Used in Larynx

70° ⇓ Used in Nose

30° ⇓ best used inside the Nose

0° ⇓ Ear

Stambelger approach ⇒ 1st Anterior then Posterior Approach

Wigand approach ⇒ 1st Posterior then Anterior Approach.

1st Pass ⇒ Inferior Meatus | Palate

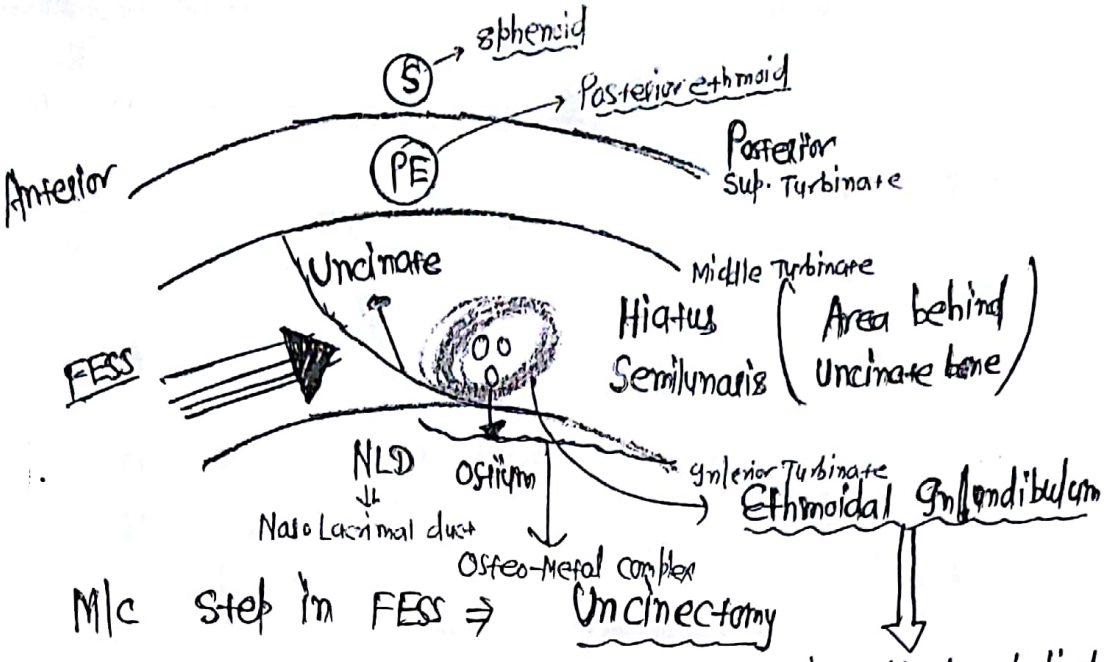
2nd Pass ⇒ Supreme | Superior | Anterior part of Middle Meatus

3rd Pass ⇒ Posterior part of Middle Meatus.

QQ. Pain sensation from Ethmoidal sinus are carried out by ??

a) Frontal N. b) Lacrimal N. c) Nasociliary br. of Trigeminal N. d) Infra-orbital N.

QQ: M/c sinus affected in children → Ethmoid (well developed @ birth).



M/c step in FESS ⇒ Uncinectomy

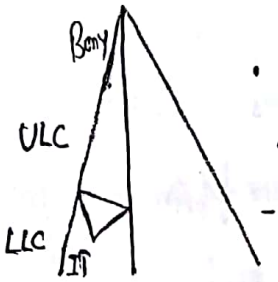
Microscopic Area behind Uncinate bone; where ostiumare open.

During Inspiration Air-flow is ⇒ Lineal flow

During expiration Air-flow is ⇒ Turbulent flow

⇓

d/t Limen Nasi (Internal Nasal valve)**



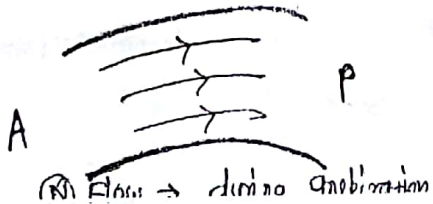
- Internal Nasal Valve → aka "Limen Nasi"
- 3 Boundries :⇒ ULC (Upper Lateral cartilage); Inf. turbinate; Septum.
- It is Narrowest space of Nostril;

⇓

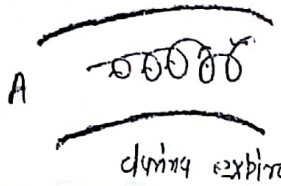
therefore Yes turbulency

⇓

this turbulent blow is More during expiration; therefore Sinus ventilation is More during expiration.



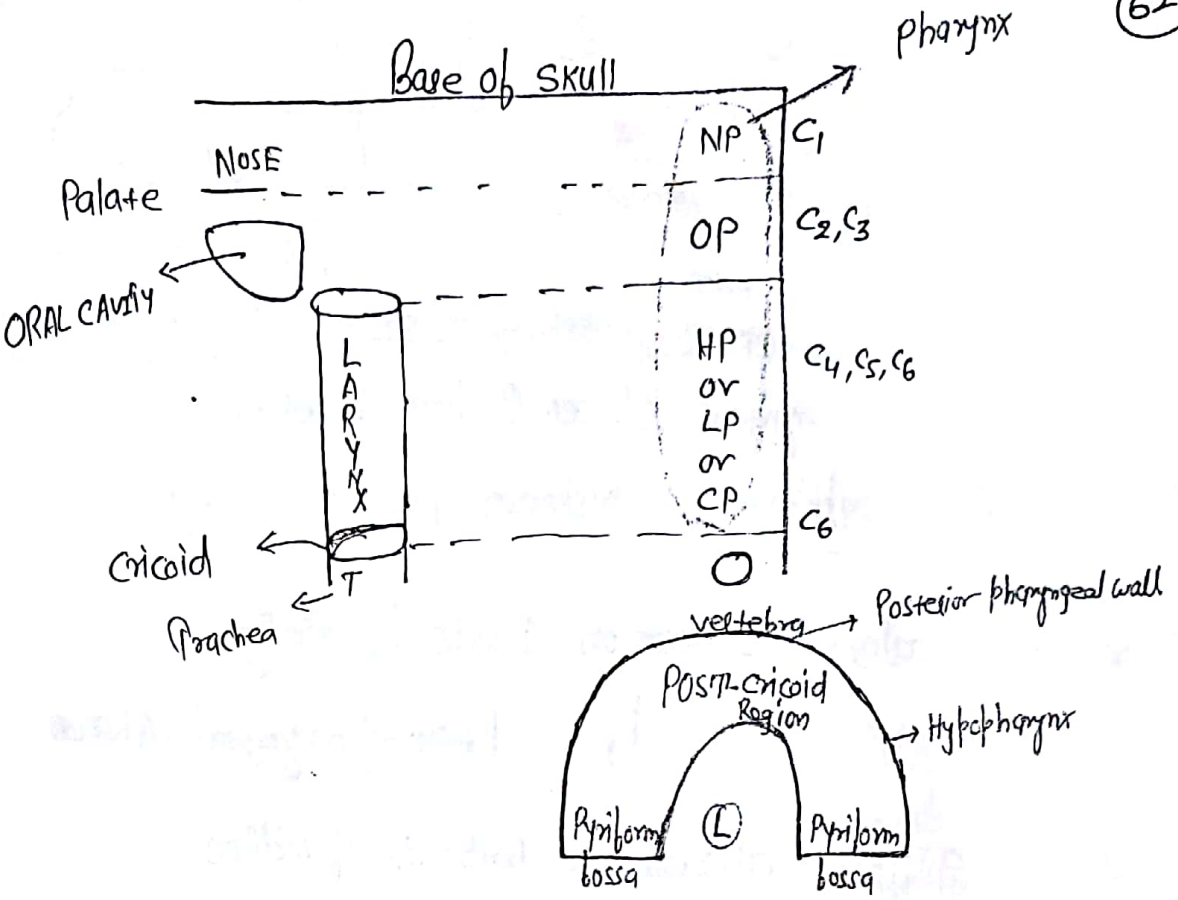
(R) Flow → during Inspiration



during expiration.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

PHARYNX ⇒ 12-14 cm Long; extending from base of skull to Lower border of cricoid cartilage



* Hypopharynx is divided into — Pyriform bossa & Post. cricoid space

* Pyriform bossa ⇒ M/c site for hypo-pharynx Malignancy.

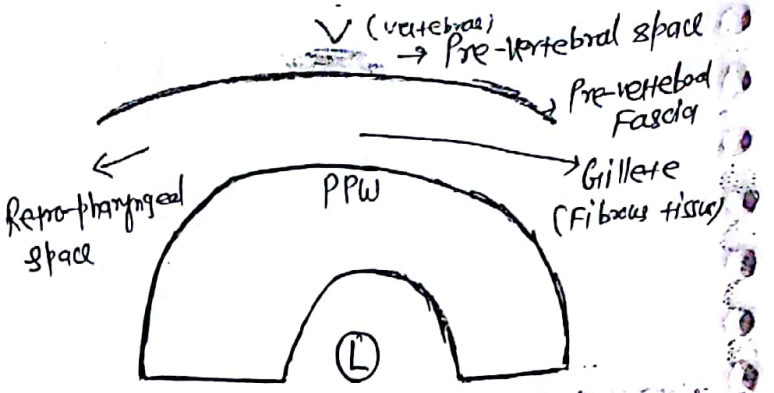
– Internal br. of SLN passes here.

– Block in Pyriform bossa for supra-glottic examination.

* Post-cricoid Malignancy ⇒ have very Poor prognosis

⇒ More Common in ♀ Suffering from Plummer-Vinson Syndrome.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397



- Retro-pharyngeal space

  - Rt. space of Gillete
  - Lt. space of Gillete

← DANGER SPACE / ALAR SPACE :⇒ Lies b/w Alar fascia Anteriorly & Prevertebral fascia Posteriorly. extends from skull base to diaphragm. just posterior to the Retropharyngeal space

* Retro-pharyngeal Abscess & pre-vertebral abscess both presents c dysphagia; dysphea.

* Localized abscess on 1 side of midline
  ↳ Retro-pharyngeal Abscess.

* Diffuse abscess on both side of midline
  ↳ Pre-vertebral Abscess

* Retropharyngeal Abscess extends upto "bifurcation of Trachea".

* M/cc of Pre-vertebral Abscess ⇒ TB Spine

* M/cc of Chronic Retropharyngeal Abscess ⇒ TB Lungs

* M/cc of Acute Retro-pharyngeal Abscess ⇒ Tonsil (Adenoid) in Pediatric age

* M/cc of Acute Retro-pharyngeal Abscess in Adult ⇒ Iatrogenic Trauma

* Mx/oc ⇒ Incision & drainage

* If TB is suspected ⇒ go for ATT firstly.

Technique ⇒ Intra-oral ⇒ For Acute cases
extra-oral, along Post. surface of scm ⇒ For chronic cases

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

M/c Abscess of Head & Neck. ⇐ Para-pharyngeal Abscess → blc of spasm in Medial Pterygoid Muscle

↳ Trismus ⇒ Masked features → Reduced opening of jaws.

— Abscess on Lateral side of pharynx from base of Skull to hyoid bone

— Tonsils pushed Medially; Swelling in upper part of Sternocleidomastoid

— Mx ⇒ I & D @ the level of hyoid Along Ant. Surface of SCM

always external Neck incision; Intraoral is Not sufficient.

PARAPHARYNGEAL SPACE

Prestyloid compartment	Post-styloid compartment
↓ contain	↓ Contains Structure of Neck
Pterygoid Muscles	Carotid A.
	Jugular V.
	9, 10, 11, 12 C.N.

QQ Swelling over & behind the Angle of Mandible & torticollis is seen in

↳ Para-pharyngeal Abscess

M/cc ⇒ Removal of Tonsil OR Tonsillitis (60+!); d/t tooth extraction (40+!).

Ludwig Abscess ← Woody Swelling below chin.

— Known as "Sub Mandibular Abscess"

— M/cc ⇒ Dental Caries (Premolar & Molar)

— Mixed flora (Aerobic & Anaerobic both)

↳ M/c Aerobes ⇒ α- hemolytic Streptococci.

— diabetic pt.

— Mx = I & D

Structure of Pharyngeal wall

1st Layer ⇒ Mucosa ⇒ Non-Keratinising Stratified sq. epithelium

↓

Except ⇒ In Nasopharynx

↳ ciliated columnal epithelium (NEET 16)

2nd Layer ⇒ Inner fascia ⇒ Pharyngobasillar fascia

3rd Layer ⇒ Inner Muscle complex ⇒ Stylopharyngeus
Salpingopharyngeus
Palatopharyngeus
(Post. to Anterior ↓)

4th Layer ⇒ Outer Muscle complex ⇒ Constrictor – Superior
Middle
Inferior

5th Layer ⇒ outer fascia ⇒ Buccopharyngeal fascia

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

TONSIL ⇒ covered by Non Keratinizing Stratified squamous epithelium

— Any Lymphoid tissue in Pharynx (64)

Types ⇒ · Palatine – @ Palate
· Lingual – @ Lingual tonsil
· Tubal (Gerlach) – @ Eustachian tube → Luschka
· Adenoid (Pharyngeal) – @ base of skull & C_1 Junction
· Faucial ← extension of Palatine tonsil.

Base of skull → Adenoid
C_1

Gr bossa of Rosenmuller → Nasopharyngeal tonsils. QQ

↳ Lined by Pseudo-stratified ciliated columnal epithelium.
↳ Lateral wall of oropharynx.

Boundry of Faucial tonsil :⇒

* Mucosa = Middle boundry
↳ Crypt formation
↳ IS in No. → Largest crypt ⇒ CRYPTA MAGNA

* Gr Inner fascia = Lateral boundry

* Tonsillar bed = Gr Inner Muscle/ outer Muscle/ outer fascia
↳ Content = Styloid & 9th CN

* Palatoglossus → Ant. pillar of tonsillar bed

* Palatopharyngeus → Post. pillar of tonsillar bed.

* Main Artery supply to the tonsil ⇒ Tonsillar branch of Facial Artery Q

* QQ Tonsil usually Reach a Maxm size @ Puberty (≈ 12yr).

* Graveyard of ENT Surgeon ⇒ Tonsillolingual Sulcus (easily Missed during oral examination).

* QQ Lymphatics from the tonsil pierce the Superior constrictor & drains into upper deep cervical Nodes (Level II); particularly the Jugulo-digastric (tonsillar) Node

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

TONSILITIS

- Also " Pharyngitis"
- caused by " Adenovirus"
  "Streptococcus" (β-hemolytic streptococcus)

DOC ⇒ Amoxiclav

⇓

Pt is Not Responding ⇒ Tonsillectomy (Tx oc)

⇓

(Rose Position) ⇒ Neck extended

* Indication of Tonsillectomy :⇒

ABSOLUTE INDICATION ⇒ Malignancy → Lymphoma (In Pediatric Age gp)

↘ Muco-epidermoid carcinoma (Adult)

- Recurrent tonsillitis

RELATIVE INDICATION :→ Non-Responding diphtherial infection

- Non-Responding Rheumatic fever

Absolute Recurrent Tonsilitis

⇓

Means Seven or More episodes in 1yr. ← 7 X 1yr = 7

five episodes/year for 2yr ← 5 X 2yr = 10

3 episodes/year for 3yr ← 3 X 3yr = 9

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

New definition of Recurrent tonsillitis ⇒ ≥ 4 episodes of tonsillitis + Single episodes of cervical LN enlargement or single episode of "Quinsy"

(65)

Quinsy ⇒ collection of Pus in the peritonsillar space; which lies b/w the capsule of tonsil & the superior constrictor Muscle.

- Usually; U/L
- Present ✓ odynophagia
  - Pt. can't swallow his own Saliva; which dribbles from Angle of Mouth.
  - So; Pt. is usually dehydrated.
- Rx ⇒ I&D of abscess ✓ Antibiotics.

"Quinsy"
- Peri-tonsillar Abscess.
- "Hot Potato Voice"

* Miscellaneous Indication of Tonsillectomy :⇒
  - Long Styloid process → K/as "Eagle Syndrome"
  - AbN 9th Nerve
    - ↓ A/c to 'Balaguchi' >3cm >4cm
    - Glossopharyngeal Neuralgia

* C/I of tonsillectomy ⇒
  - Age < 3yrs
  - Hb < 10gm (o/w)
  - Bleeding D/O
  - Acute episodes
  - Epidemic of Polio

  (b/c Polio spread by Nerve; & we exposed Nerve in tonsillectomy ⇒ 9th Nerve)

Sx after 3 weeks ← Acute episodes

Go for Laser tonsillectomy ← Bleeding D/O

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Complication of Tonsillectomy :⇒

Most Common ⇒ Hemorrhage;

1° Hemorrhage
- Bleed on table (vein > Artery)
- d/t damage to the peri-tonsillar vein (Klas" Descending Palatine vein"/ "Dennis Brown vein")

Mx ⇒ Ligate

Reactionary Hemorrhage (<24 hr)
- d/t slippage of Ligature

Tonsillar branch of Facial Artery.

Mx ⇒ Religate

2° Hemorrhage (>24 hr)
- d/t Infections

Mx = i/v Antibiotics

Rare complication ⇒ GRIESEL SYNDROME (↑ More common in down syndrome children.)

↑ evening Pain → give Analgesics

- Atlanto-Axial joint dislocation
  - ↑ Require Neuro surgery opinion.

Q Excessive hemorrhage from tonsillectomy is d/t injury of :⇒

a) External Palatine vein ; b) Ascending Palatine A.
c) Tonsillar br. of Facial A. ; d) Internal carotid A.

SINUS OF MORGAGNI

- Space b/w the base of skull & upper free border of superior constrictor Muscle.
- Through it enters :
  - The Eustachian tube;
  - The Levator veli Palatini;
  - Tensor veli Palatini;
  - Ascending Palatine A. (↳ Branch of Facial A.)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

ANGIOFIBROMA

- Benign tumor; but Locally destructive
- Age → 14 yr. boy (7–19 yr Range)
- Ixoc ⇒ CT-Scan
- Frog face deformity
- Hollman – Miller sign
- originate from sphenopalatine foramen
- Dumbell-Shaped tumor.
- Symptom → Epistaxis (M/c);
  - Nasal obstruction

- Rxoc ⇒ Surgery (Recurrence is Common)
  - Biopsy is C/I
  - Before Sx
    - CT → Vincristine
    - Hormone Rx → Flutamide
    - RT
    - Embolization → To Reduce Size of tumor
      - of Internal Maxillary A. to stop epistaxis

* RT is used; if it extends Intracranially.

NASOPHARYNGEAL Ca

(66)

- Malignant
- Klas "GUANGDONG TUMOR"
- Bimodal Distribution
  - 1st Peak → 20 yr
  - 2nd → 60 yr
- Ixoc ⇒ MRI

Origin ⇒ Behind Eustachian tube

M/c site ⇒ Fossa of Rosenmuller

- Middle ear symptoms always ⊕
- U/L cervical LAP (M/c symptom)
- Epistaxis (2nd M/c)
- A/w EBV
- TROTTER'S TRIAD is seen
  - Glue ear + 5th CN (Pain) + 6th C.N. (Palatal Palsy)
    - Mandibular Neuralgia

⇒ M/c involved N. ⇒ 5th C.N
First being to involved N. ⇒ 6th C.N

Rxoc ⇒ RT (Radiotherapy)

"RT + chemotherapy"

↳ Never Surgery.

* Small size tumor ⇒ Trans palatal approach;

* Large size tumor ⇒ Trans palatal + sublabial Approach

↓

SARDANA APPROACH

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Congenital Abnormality of Pinna :⇒

① Bat Ear :⇒ Absent Antihelix;

② Mozart Ear :⇒ Mixing of Helix & Antihelix

Result in Scaphoid Fossa absent,

③ Wilder Muth Ear :⇒ Absent Helix

Incomplete fusion of 1, 2, 3 hillocks leads to pre-auricular sinus

⇓

Symptom ⇒ Discharge

Pit ⇒ Sx.

Hillock of His 4, 5, 6

* Head Mirror :⇒ Concave Mirror;

↳ Focal Length = 45 cm

Diameter = 89 mm

Diameter of Hole = 19 mm.

* Focal Length of Microscope used in ENT Surgery :⇒

Ear → 200 mm

Nose → 300 mm

Throat (Larynx/Pharynx) → 400 mm

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

ADENOIDS

- Also " Nasopharyngeal tonsils".
- prt @ birth ; shows Physiological enlargement upto age of 6 years & then tends to Atrophy @ Puberty & almost completly disappear by 20 year of Age
- Rhinolalia clausa :⇒ 9n Adenoid hypertrophy
  - ↳ Toneless voice
  - Loses Nasal quality d/t Nasal obstruction.
- 9t has No crypts & No capsule unlike Palatine tonsil.
- Adenoid Hypertrophy ⇒ Nasal obstruction ⇒ commonest symptom;
  - Fails to thrive
    - ↳ b/c Nasal obstruction interferes c feeding or Suckling in a child.
  - Adenoid facies → elongated face c dull expression; open Mouth; Pinched up Nose; Prominent & crowded upper teeth.
  - Aprosexia → Lack of conc^{n};

Tx :→ Decongestants;
Antihistaminics;
Adenoidectomy.

- other indication → Recurrent UTI.
  Recurrent Middle ear Infections c deafness
  CSOM.
- CI in → cleft palate
  Acute infection of URT

elp.com WhatsApp: +1 (402) 235-1397

* Thornwaldt cyst ⇒ Located in the midline of Posterior wall of the Nasopharynx in the Adenoid Mass.

When Infected → Abscess can form

↓

Thornwaldt's disease

↓

Sx ⇒ Marsupialization of Swelling;
Complete Removal of Lining of cyst,

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Ophthalmology

Handwritten Note

MBBS Help

http://mbbshelp.com

http://www.youtube.com/mbbshelp

http://www.facebook.com/mbbshelp.com

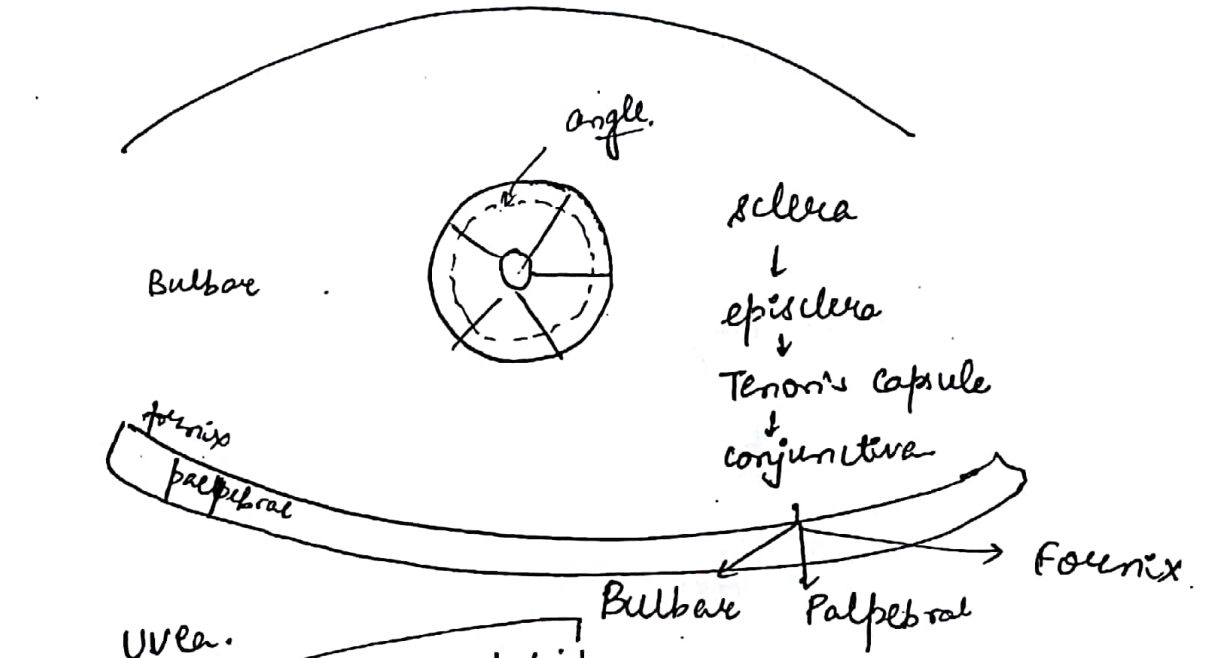
Name: _____

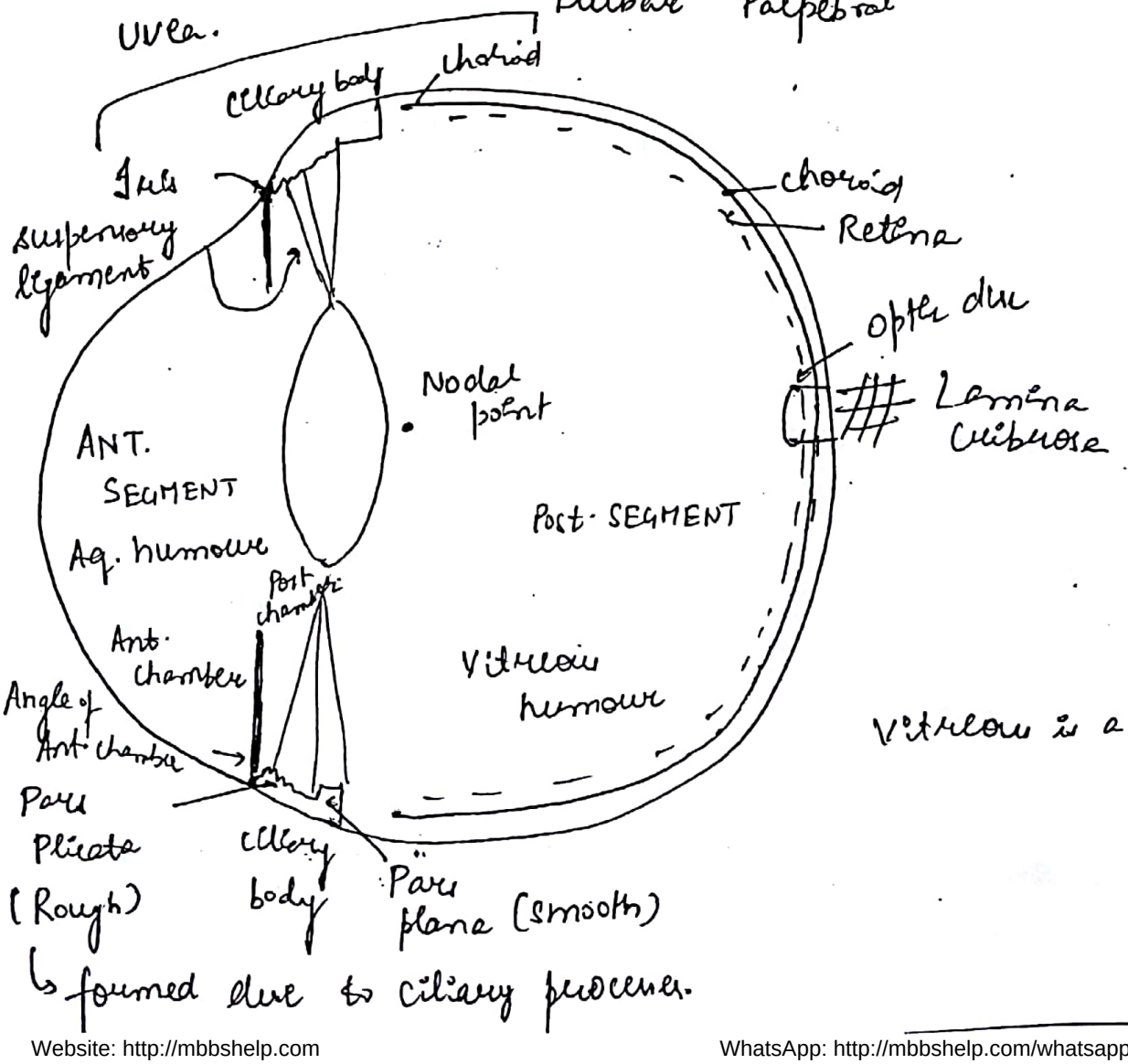
Subject: **Ophthalmology**

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

EYE

Junc^{n} of cornea & sclera → LIMBUS

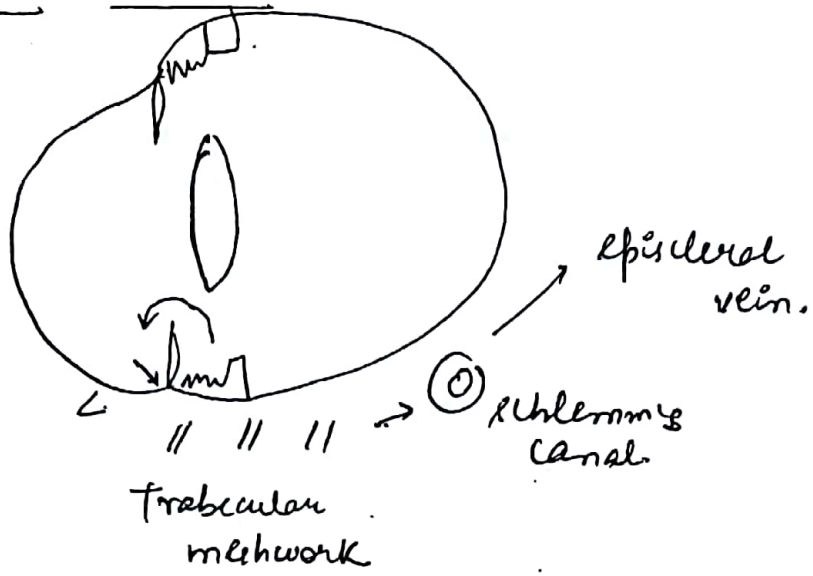




Vitreous is a gel.

↳ formed due to ciliary processes.

TRABECULAR OUTFLOW



Q. Total no. of ciliary process → 70-75.

Q. Angle is all around 360°, corresponding to limbus.

NODAL POINT

- Parallel light rays falling on the cornea & lens, ~~image is~~ so rays are focussed on nodal point
- It is the 1st focal point situated just behind the lens
- Bending of light is more on cornea as compared to lens.
  * factors
  ① curvature of cornea
  more is the curvature, more is the refractive power
  ② difference of refractive index between air & water.

Q. What is the most imp. factor to focus light rays on retina?

ans. curvature of cornea → [ant. surface].

Q. Why is the vision less when water is present in eye?

ans becoz media is water + water

↓

less bending of light

↓

loss of refraction.

Cornea & lens are avascular. as they need to be transparent

They receive nutrition from aqueous humour

OPTIC DISC

- The part where all the nerves aggregate.
- sclera here is sieve like ⇒ Lamina cribrosa.

Q. IOP - 10-21 mm Hg

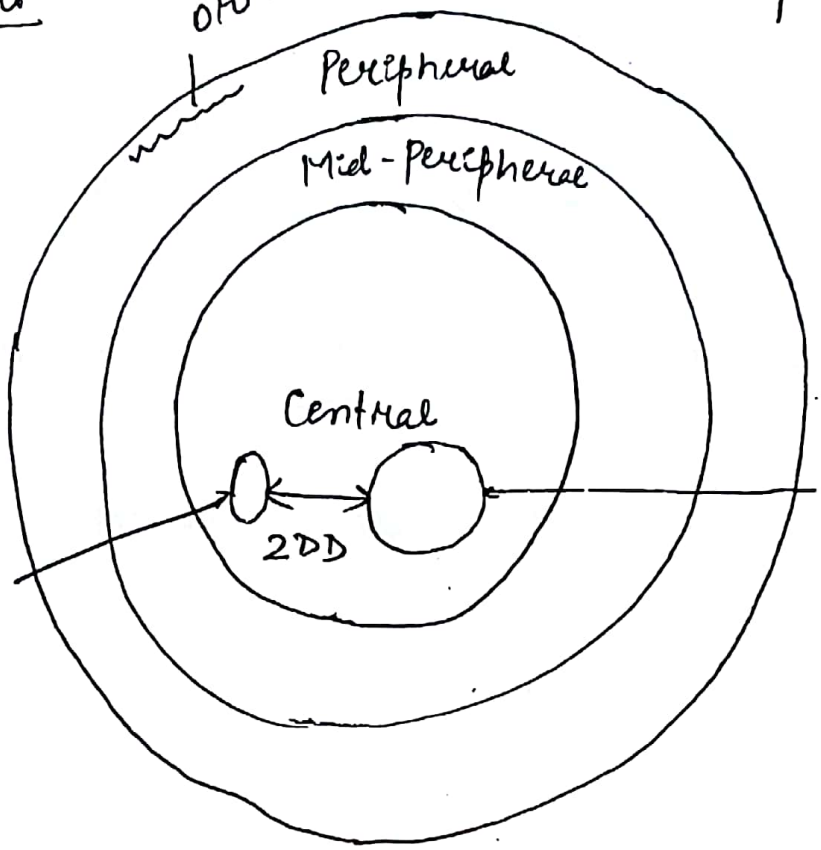
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

RETINA

Nasal Part

ora serrata

Temporal Part



central retina

Macula
(5-5.5mm)

Optic disc
(1.5mm)

Central Vision → macular func^{n} → tested by **Snellen's Chart**

Peripheral Vision → peripheral retina → tested by **Perimetry**

Scotoma -
An area in the visual field where the patient is not able to see.

Blind Spot -
Physiological scotoma corresponding to optic disc
↳ Temporal to macula.

Isopter -
Different axis on which we test peripheral vision on perimetry.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

MACULA

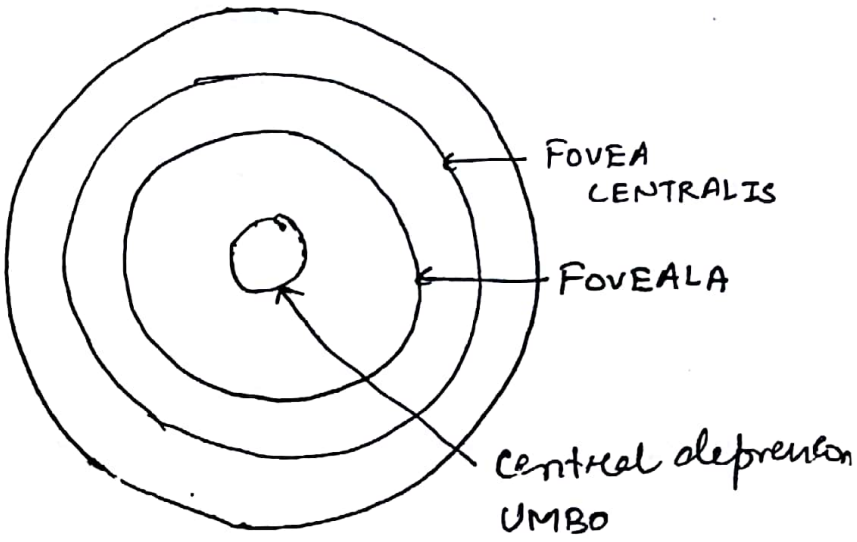
D → 5–5.5mm

*Most sensitive part of Retina.

↓

FOVEA.

(fovcola is given in often becoz cones are found max. there)



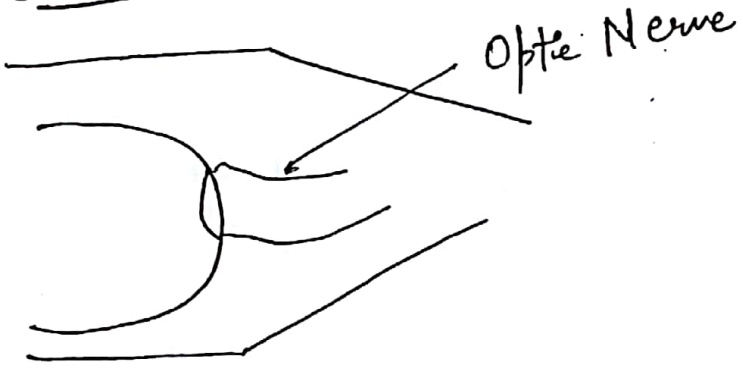
Thinnest part of Retina ⇒ **Ora Serrata**

Distance Bet^n Optic Disc & Macula ⇒ .2DD = 3mm.

Most Resistant Layer of retina → Ganglion cell layer

Most radio sensitive layer → Rods & cones

ORBIT



Capacity of Orbit - 30 cc

Shape of orbit = Quadrilateral or Pyramidal

Length of Optic Nerve = 3.5 cm - 5.5 cm. [5cm]

Axial Length of eyeball = 24 mm.
[Antero-posterior diameter].

USG

- A Scan → for measuring antero-posterior diameter
- B Scan → for post. segment of eye

Depth of Ant. Chamber = 2.4mm - 2.5mm.

2.5

→ **Anisometropia**

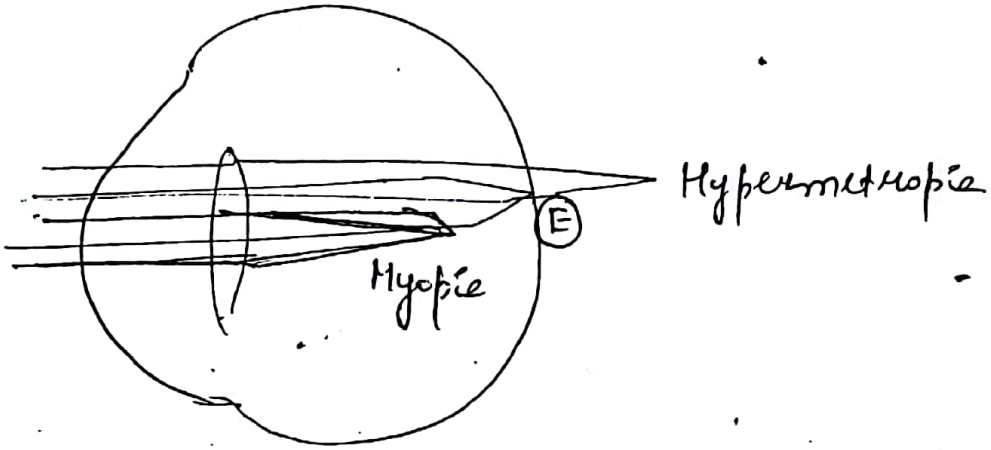
any difference of refractive power between the 2 eyes of > 2.5 diopters

- **Y Infant is hypermetropic.**

2.5 - 3 Diopters due to small eye.

HYPERMETROPIA

Total refractive power of eye is less than required

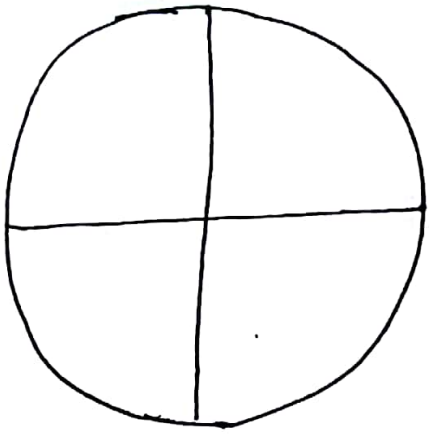


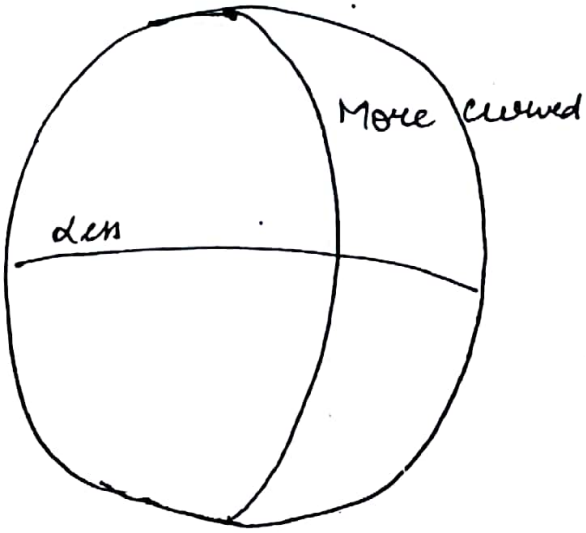
- Small eye
- Light rays are focussed behind the retina
- To correct the error ⇒ CONVEX LENS Used. (+)

MYOPIA

- Total Refractive Power is more than required
- Large eyes
- Light rays are focussed in front of retina.
- To correct the error ⇒ CONCAVE LENS used. (−).

ASTIGMATISM





Difference of refractive power between 2 principal axis

REFRACTION

- Total Refractive Power of Eye = 58-60 D.
  or
  Reduced eye

- Reduced Eye:-
  Simplified optical System of Eye

- Refractive Power of Cornea → 43-45 D Q
- " " " Lens → 16-17 D. Q.

- Refractive Index of cornea → 1.37 Q.
- " " " Lens → 1.39 Q.

- Maximum Refractive Index → @ centre → 1.4-1.41

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

RETINOSCOPY -

- Objective method of refraction.

FUNDOSCOPY -

- for retina fundus is synonymous.

PAPILLA - for optic disc.

QQ

OPHTHALMOSCOPE.

DIRECT

Magnification = 15 times

Image → Virtual, Erect

Area/Field - 2 DD

Used for
Central Retina

INDIRECT

5 times.

Real, Inverted

8 DD.

Peripheral Retina + Central Retina
(but magnification is less)

Distant Direct Ophthalmoscopy :-

for viewing media
↓
all the str. of comea in the way of light

Distance for DDO = 25cm

C Lenticular opacity is best seen by DDO
= Post. Subcapsular Cataract

CORNEA

Shape – aspheric
curvature is gradually ↓

Diameter – 11-11.75 mm

Megalocornea >13mm.
Microcornea <10mm [adult].

LENS

shape – BiconvEx

Diameter – 9-10 mm [9].

Microphakia – small lens.
<9mm

Microspherophakia – small spherical lens

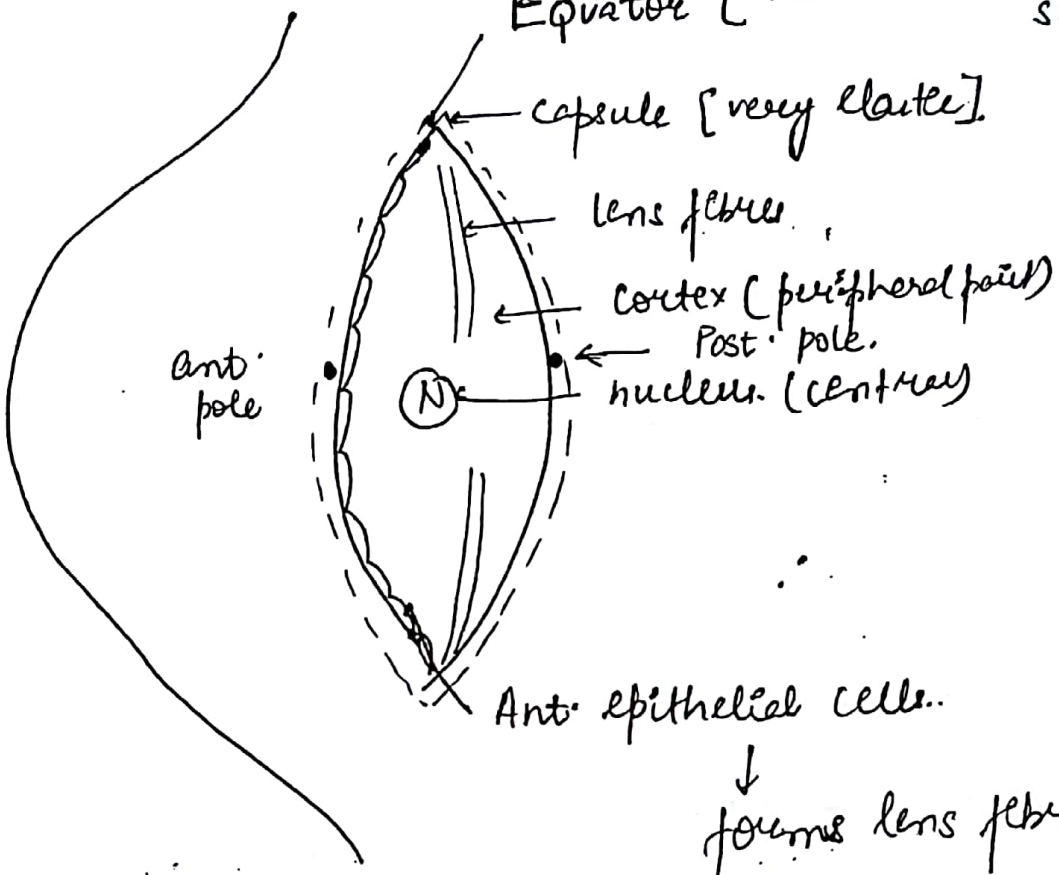
Aphakia → absence of lens

Pseudophakia → artificial IOC

DISEASES OF LENS

Power - 16-17D

Refractive index - 1.39.



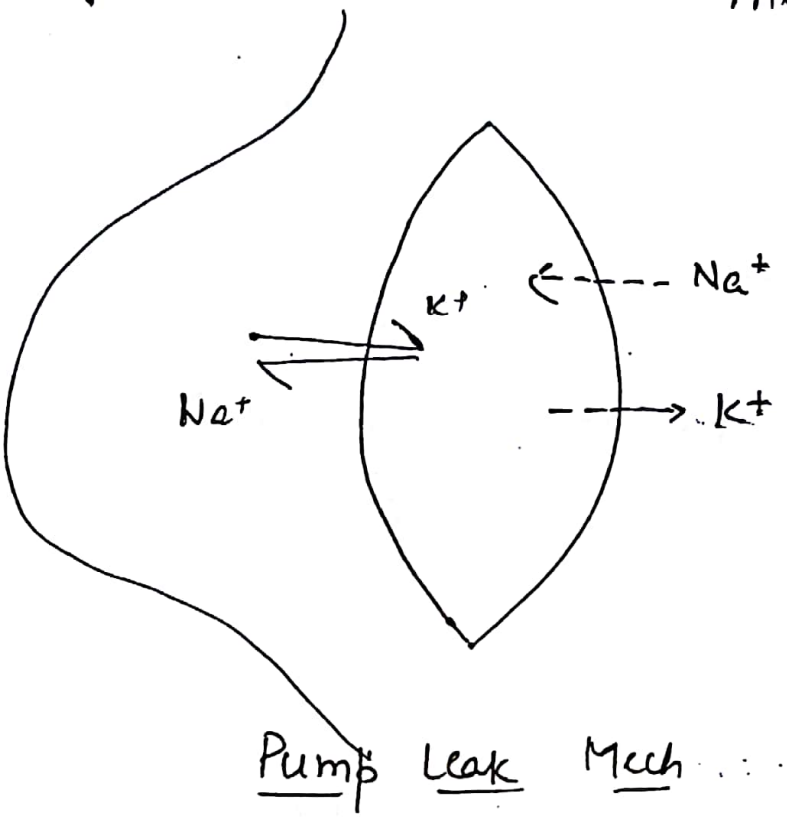
Q. ☾ is the thinnest part of Lens
↳ capsule at posterior pole [thickness 4μ].

Q. ☾ are the youngest fibres - Cortex

Q. Till what time period lens fibres are formed → throughout life.

PHYSIOLOGY

- Avascular
- Dehydrated [lens maintain this by Pump leak mechanism]



Pump Leak Mech.

Q 1° Metabolism = Anaerobic [80% of glucose metabolised anaerobically]

- Lens derives its nutrition from Aqueous Humour only.
- Lens is derived from Surface Ectoderm.

HM3 & HM4 are insoluble high molecular wt proteins found in CATARACTOUS LENS.

EMBRYONIC DEVELOPMENT

SURFACE ECTODERM

① Epithelial lining of cornea + Conjunctiva
② " " " Lacrimal Gland
③ Lens Q.
④

NEUROECTODERM

① Retina
② Optic ~~cup~~ Nerve
③ Epithelial lining of Iris + Ciliary Body Q
④ Smooth M/s of Iris → ① Iris sphincter Q.
② Dilator Pupillae

⑤ 2° & 3° vitreous Q.
↓ adult ↓ suspensory ligament

NEURAL CREST

1) Sclera except temporal part
2) Choroid
3) Corneal Stroma Q
4) Corneal endothelium Q
⑤ Ciliary M/s Q.
⑥ Trabecular Meshwork

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

MESODERM

① Temporal Part of sclera
② EOM.
③ Blood vessels.
④ 1° vitreous Q.
↳ vitreous during embryonic period

CATARACT

Any opacity in lens or its capsule ∠ hinders its optical homogenity

Classification

- CONGENITAL/ DEVELOPMENTAL
- ACQUIRED

CONGENITAL CATARACT

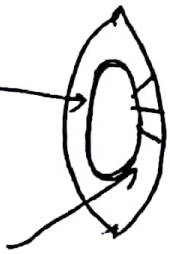
Etiology - ① TORCHS Infection
② Radiation exposure in 1st Trimester
③ Teratogenic Drugs eg Thalidomide
④ Malnutrition
⑤ Anoxia

Types

1) BLUE DOT CATARACT-
Opacities are seen as Bluish Dots.

2) CATARACTA PURVULENTA-
Opacities are powdery

3) LAMELLAR/ZONULAR CATARACT-
single lamella is cataractous.



Additional spoke like opacities over the cataractous lamella → RIDERS

Vit D deficiency causes Lamellar Cataract

Rubella infection also causes.

4) Ant. POLAR CATARACT

5) Post. POLAR "

5) TOTAL CONGENITAR CATARACT

Q. M/c type of congenital Cataract - Blue-Dot

Q. M/c type " " causing diminition of vision - Lamellar.

CONG. RUBELLA SYNDROME

CHD

Cataract → M/c type
1) Nuclear Pearly
2) Lamellar.

Heart Defects

Deafness

* Ocular Features of Rubella :-

1) Micro-ophthalmos
   → Any axial length of eyeball < 21 mm. or 1 year of age < 19 mm.
2) Rubella Keratitis.
3) Angle anomaly leading to Glaucoma
4) Nuclear Pearly Cataract
5) Salt & Pepper Fundus.
   ↳ pigmentary disturbance of retena due to diffuse chorio-retinitis.

D/D of Salt & Pepper Fundus

1) Rubella
2) Syphilis
3) Retinis Pigmentosa sine pigmento

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

④ Myotonic Dystrophy
↓
Type of cataract ⇒ Christmas Tree.

⑤ Leber's Amaurosis

Amaurosis :- Total Loss of vision.

Amblyopia :- Partial Loss of vision

Amaurosis Fugax :- Transient loss of vision.
↓
curtain like manner.

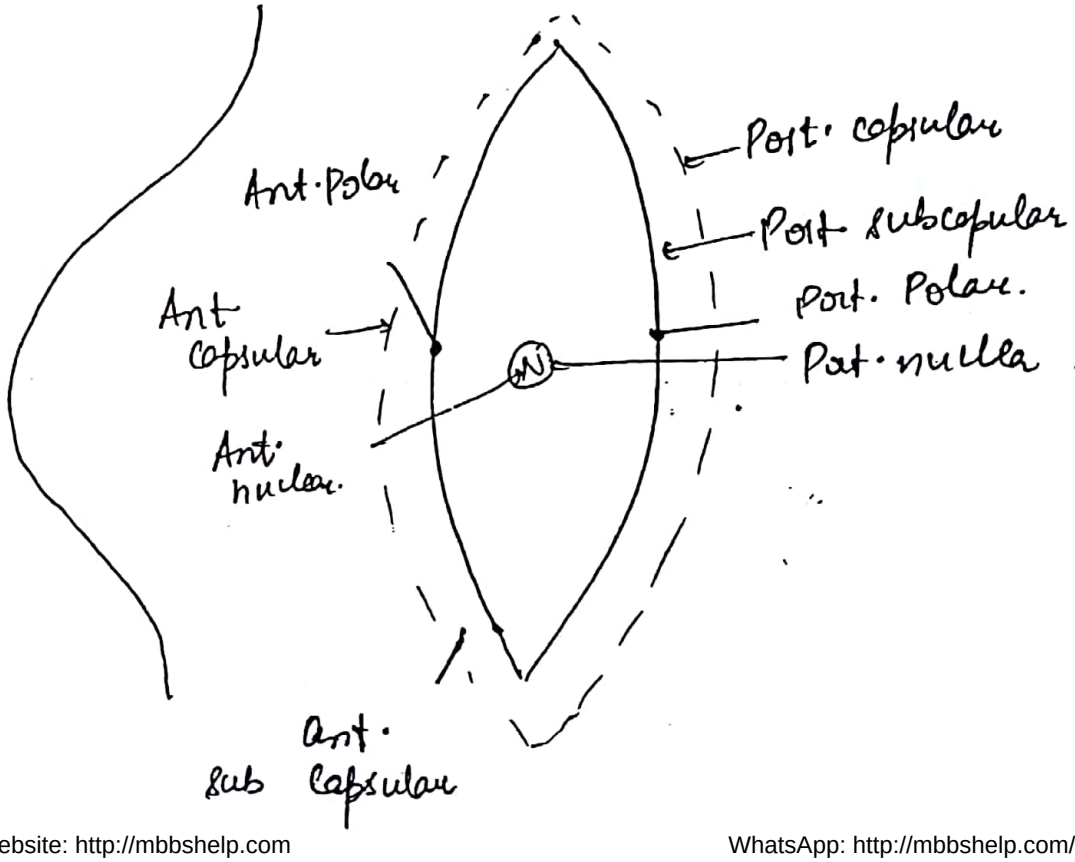
ACQUIRED CATARACT

CLASSIFICATION

Anatomically

A/c to maturity

Etiology



Ⓒ Cataract will ↓ vision most = post subcapsular.
↓
as it is near to the nodal point.

* A/c to Maturity -

1) Immature

2) Mature

3) Hypermature
   - degenerative changes ↑nt
   - wrinkling of capsule occurs
   - liquefaction of cortex

* Etiological classification

1) Senile → M/c
2) Metabolic
3) Complicated
4) Toxic
5) Traumatic
6) Radiational

SENILE CATARACT

CORTICAL

Etio - Hydration

C/F

I - Stage of Lamellar separation.

II - Stage of Incipient Cataract [Immature cataract]
little hydration

III - Stage of Intumescent Cataract
(max. hydration)

IV Mature Cataract

V Hypermature/ Morgagnian Cataract
↓
M/c Complication
↓
PHACOLYTIC GLAUCOMA

NUCLEAR

Etio - Nuclear Sclerosis

- Insoluble protein deposition
- Pigment Deposition.
  - Melanin
  - Urochrome

I. Immature

II. Mature

III. Hypermature or Nuclear Sclerotic Cataract
↓
M/c complication QQ
↓
Subluxation of Lens.
(Partial dislocation)

Phacolytic Glaucoma

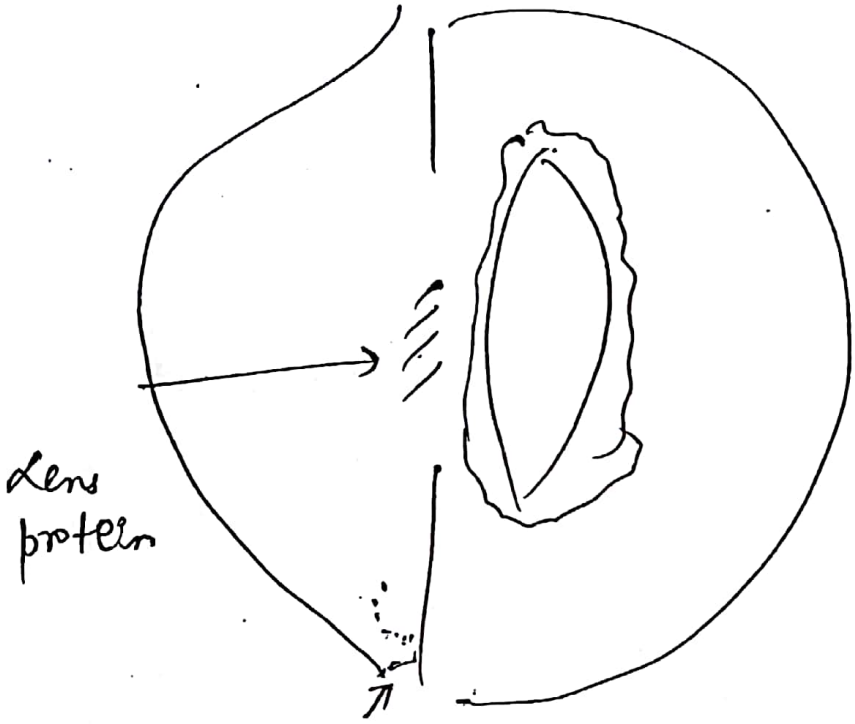
Leakage of Lens protein in the aqueous

↓

Block TMW.

↓

Leading to Glaucoma



Block TMW ⇒ Glaucoma

Radial Spokes ⇒ Seen in Cortical Cataract

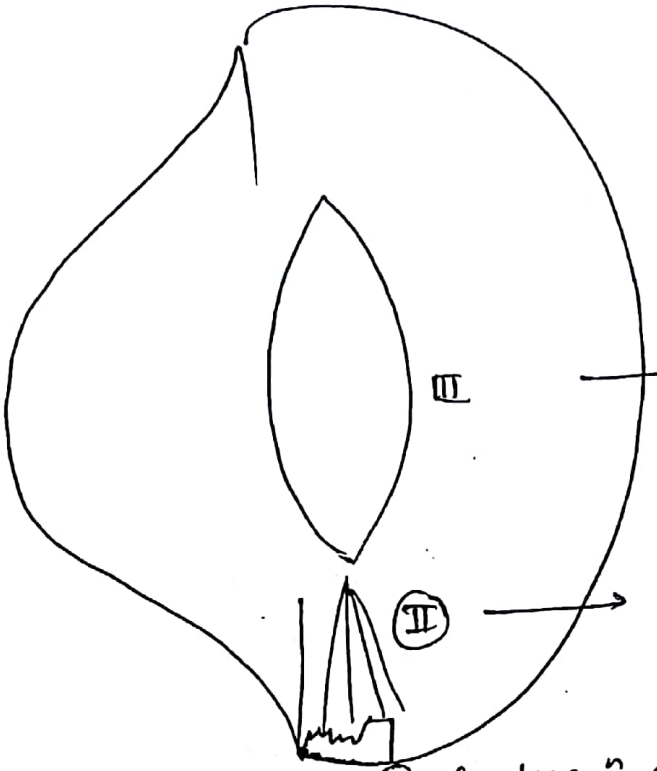
also k/n/a Cuneiform cataract

Cupuliform Cataract - Post Subcapsular Cataract

II^nd Sight Of Old Age :-

- Improvement in near Glasses.
- occurs due to nuclear sclerosis in early stage

ACCOMODATION



III → Curvature ↑ ⇒ More refractive power.

II → Relax^n of zonules

I Contrac^n of Ciliary M/s

AGE RELATED CHANGES

1> Weakening of ciliary M/s

2> Less elasticity of Lens..

∴

⇓

PRESBYOPIA – error of accomodation.

Sets at the age of 40 yrs.. [≥ 40 yrs]

Presbyopic glasses [Near Glass]

↓

CONVEX LENS.

METOBOLIC CATARACT

(I) DIABETES

Cause - Accumulation of Sorbitol.

↓

Hyperosmotic nature

↓

Imbibe H_2O

⇓

CATARACT

Enzyme responsible for sorbital Pathway -
NADPH dependent aldose reductase

Type of Cataract ⇒ Snow flake or Snow storm Cataract

↓

More common in **Type-I DM**

(II) GALACTOSEMIA [Reversible Cataract] Q

↓

Galactokinase deficiency

⇓

LAMELLAR CATARACT

↓

GPUT (Galactose phosphate uridyl transferase)

⇓

Q. OIL-DROPLET CATARACT

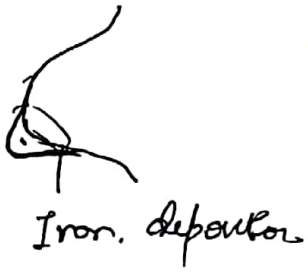
(III) CHALCOSIS

- Cu containing F.B. → SUNFLOWER CATARACT.
- Wilson's Disease → K.F. Ring. (on cornea)

Cu deposited on Descemet's membrane → Reversible

FLEISCHER'S RING

- Seen in pts. of Keratoconus.
- occurs due to Fe deposition
- Deposition on Epithelium

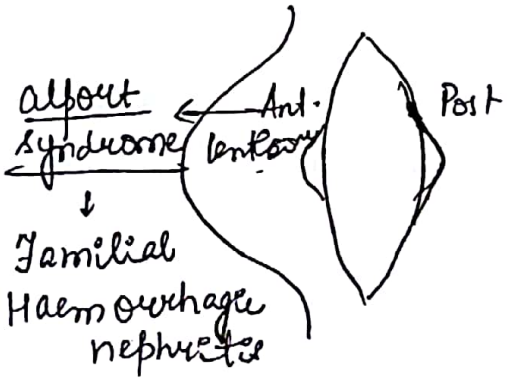


(IV) LOWE'S SYNDROME / OCULO-CEREBRO RENAL SYNDROME

Ocular features

(A) LENS

1) Microphakia
2) Metabolic Cataract
3) Posterior Lenticonus



(B) GLAUCOMA-

Ant. Lenticonus → Oil-globule reflex +ve
is more common in ♂

1) Alport's syndrome
2) Waardenburg Syndrome
   a) Telecanthus - medial canthus are far apart
   b) Poliosis - Greying of eyelashes
   c) Heterochromia Iridis (HI)
      Difference of iris colour between 2 eyes
   d) Anterior Lenticonus

TELECANTHUS	HYPERTELORISM
• Soft tissue problem.	• Bony Defect
• Interpupillary Distance (N)	• Interpupillary Distance ↑

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

COMPLICATED CATARACT

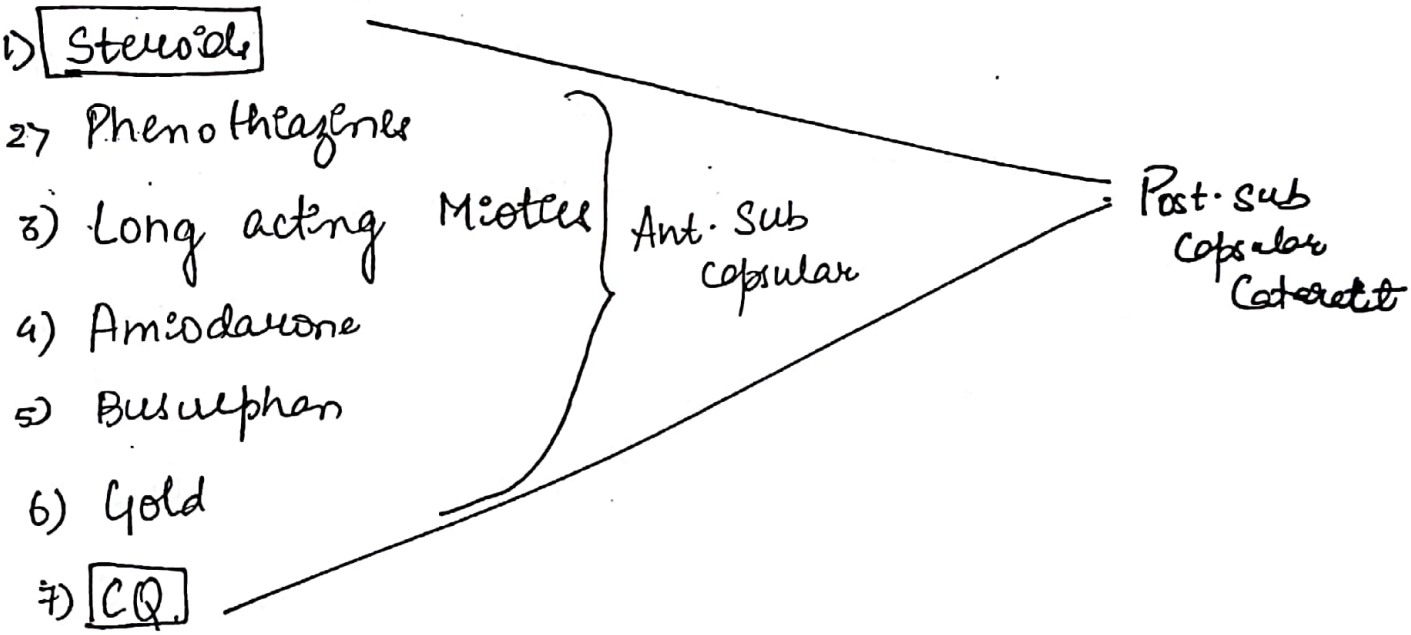
Cataract is occuring as a complication of ant. + post segment disease

C/F -

1) Polychromatic Lusture
2) Bread crumb appearance of opacities.
3) M/c type ⇒ Posterior subcapsular

TOXIC CATARACT

Due to Drugs.



M/c comp^n of steroids in eye ⇒ Glaucoma
(OAG - open → blockage in TM w)

Steroid
- Systemic → Cataract (PSC)
- Topical → Glaucoma

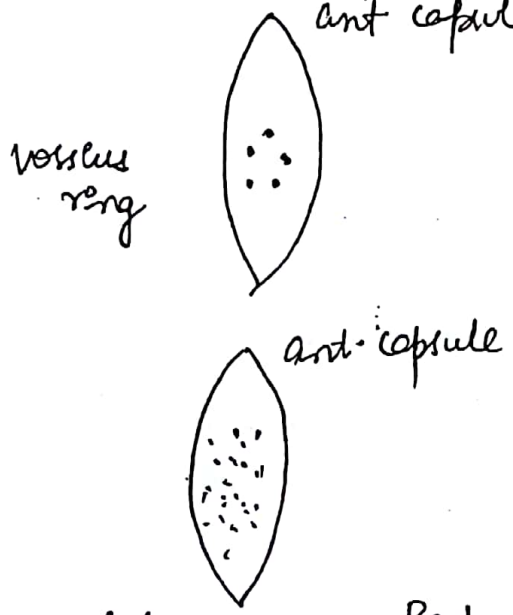
TRAUMATIC CATARACT

Trauma

- Perforating (O)
- Blunt (concussion injury).

Blunt

- Rosette shaped or Sunflower cataract
- Vossius Ring
  - Imprint of Iris pigment in shape of Pupil on the ant. capsule of lens.



  - Glaucoma flecken → Past H/O attack of acute congestive Glaucoma
- Berlin oedema or Commotio Retinae
  - Oedema at the macula
  - CHERRY RED SPOT
- Angle recession glaucoma
  - Due to tear in ciliary body
  - Damage to TM
  - Glaucoma

RADIATIONAL CATARACT

1) All electromagnetic radiation can cause Cataract
   CT Scan ✓
   MRI ✗
2) M/c type of radiational Cataract ⇒ Post. subcapsular

PSC

1) M/c type of complicated Cataract
2) " " " Radiational "
3) Steroids cause
4) ℂ type of cataract ↓ vision most
5) ℂ type of cataract is best seen by DDO

Most radioresistant in Eye → Sclera
Most radiosensitive " " → Lens

Retina < most radio resistant ⇒ Ganglion cell Layer
" " sensitive ⇒ Rod & Cones

C/F of cataract :-

Blurring of Vision

(E) → 5/minute

2) Diminution of Vision

Vision < 6/6

Denominator is normal

- All letters form an angle of **5 minute** at nodal point
- Margin of every letter subtend an angle of **1 minute**

3) Glare

4) Polyopia

→ 2 images.

- Incipient cataract (✓) (More)
- Intumescent Cataract

5) Coloured Haloes

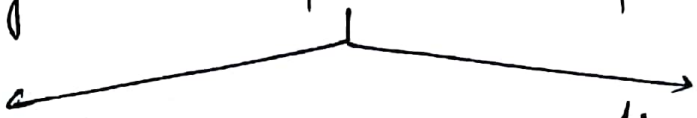
Breaking of white light

Causes

- CATARACT
- ACUTE CONGESTIVE GLAUCOMA → IOP ~ 60 mmHg → Corneal edema → lead to coloured Haloes
- MUCOPURULENT CONJUNCTIVITIES → causes diffraction of light

Fincham's Test :-

- Test to differentiate Between coloured halos of Cataract & Acute Congestive Glaucoma
- Passing a stenopic slit in front of eyes



If halos break → CATARACT

If not break → Acute Congestive Glaucoma

T/t

SURGICAL

(I) ICCE [Intra capsular Cataract Extraction]

↓

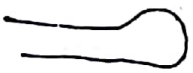
Removal of lens including capsule

METHODS.

a) Forceps Extraction.
By Arruga's forceps.

b) Cryo extraction
-40°c temp.
lens sticks to the probe & can be taken out.

c) Wire Vectis Method.

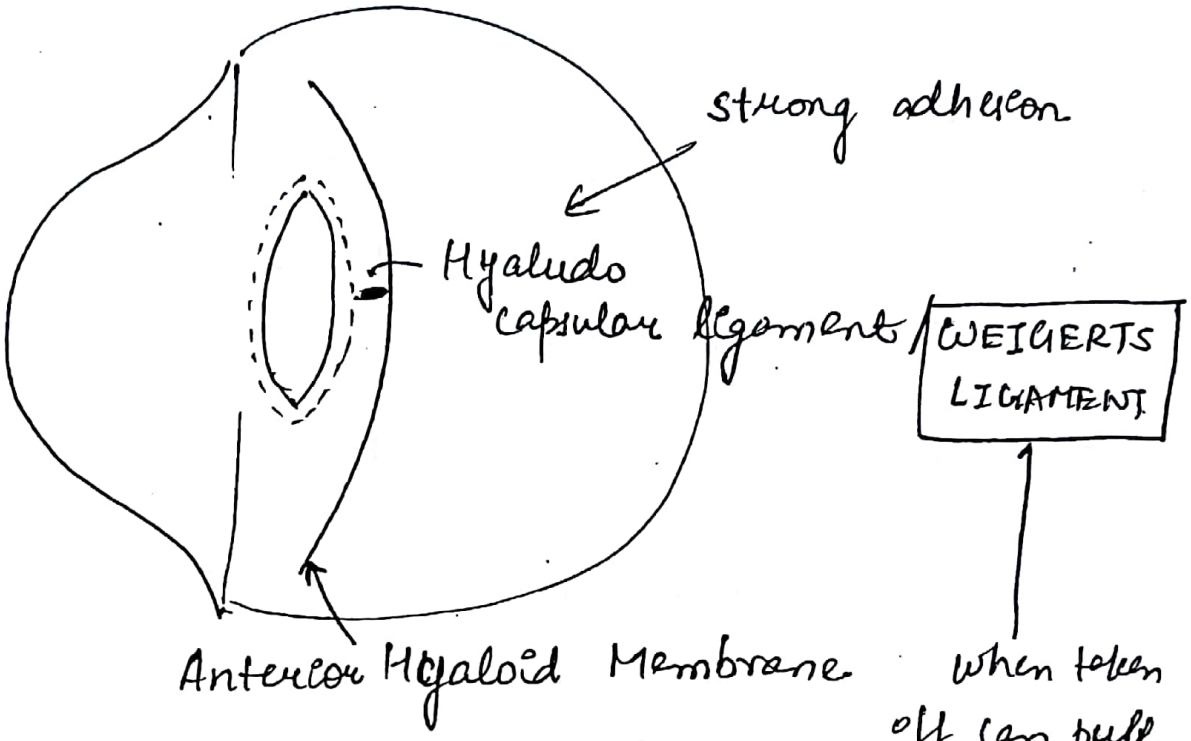


d) Indian Smith Method.
pressure & counter pressure method.

Only Indication ⇒ Subluxation of lens

Best Method ⇒ Cryoextraction

C/I in children

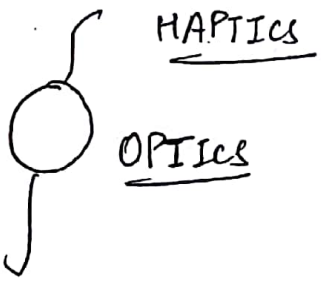


(II) ECCE + PCIOL Implantation.

Ant. capsule — Capsular Bag. — Post. capsule

↓

IOL is implanted.



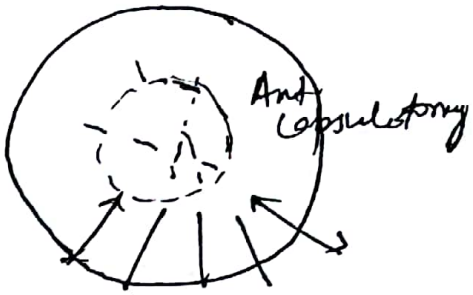
IOL is formed of PMMA (Poly Methyl Metha Acrylate)

METHOD

Full thickness scleral incision

↓

Ant. capsulotomy



↓

H_2O injected under the margin

↓

Hydrodissection.

↓

Removal of nucleus by pressure, counter pressure

↓

Clean the bag ⊂ irrigation & aspiration.

↓

IOL Implantation

↓

Suture the section by radial sutures.

[equal length., equidistant]

⇓

Less astigmatism post-op.

(III) SICS (Small Incision cataract surgery)

- Small incision
- Sutureless surgery

Manual

5 - 5.5 mm

↓

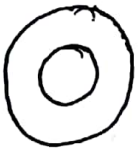
Partial thickness incision

↓

Scleral Tunnel formation.

↓

Capsulotomy



Continuous Curvilinear Capsulorrhexis

[the type done in SICS]

Can-opener technique

↓

Hydrodissection

↓

Remove nucleus

↓

Clean the bag

↓

IOL implanted

↓

NO SUTURES REQUIRED

Phacoemulsification

2.75 - 3.2 mm. Q

↓

Incision on cornea

[Clear Corneal Incision]

↓

CCC

↓

Hydrodissection.

↓

[for confirmation rotate the lens.]

↓

Phacoprobe

[frequency - (40 kHz) Q.
Break nucleus into bits & aspirate simultaneously]

↓

Clean bag

↓

Foldable IOL used

- ← Acrylin
- ↓ Silicon
- → Hydrogen

Acrylin

↓

M/c ly used.

(IV) MICS [Minimal Incision Cataract Surgery].

By Phacoemulsification - length of incision 1.8 - 2.4mm

(V) PHACONIT

Incision length - 0.9mm.

↓

Rollable IOLs [Acrylic].

(VI) FEMTOLASER Most Recent

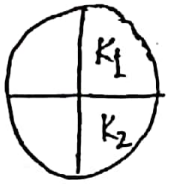
Infrared.

λ = 1052 nm.

Pulse Duration - 10^{-15} sec Q.

BIOMETRY

Method of calculating Power of IOL

- Axial length by USG.
- Keratometry 

~K.

SRK formula - Power = A - 2.5L - 0.9K.

where A = constant

L = Length axial

K = Keratometry K

Foveal Reflex formation / Fixation Reflex / Macula Maturation.

↓

form by 5-6 month of age

↓

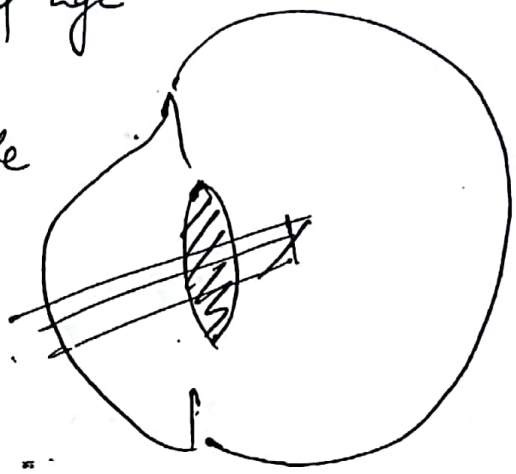
Operate as soon as possible

↓

To prevent amblyopia

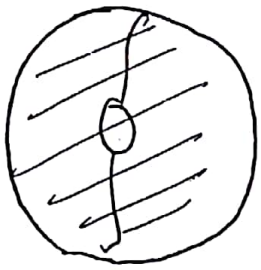
↓

also nystagmus develop..

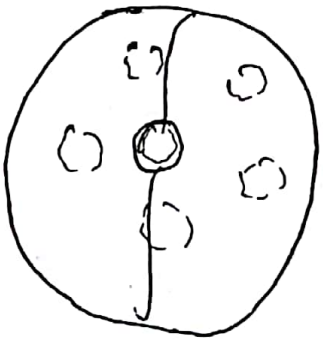


T/t of choice in cong. cataract ⇒ Lensectomy + Vitrectomy (Phaco + ECCE)

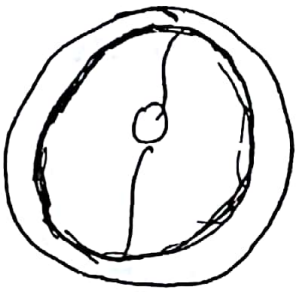
AFTER CATARACT / 2° CATARACT / POST. CAPSULAR OPACIFICATION



Diffuse opacification.



Migrated ant. epithelial cell. [ELSCHNIG PEARLS]



Fibrotic Ring [SOEMMERING RING]

⇓

Vision not affected

Management :- Post. Capsulotomy through NdYAG Laser

SUBLAXATION OF LENS

Congenital ⇒ ECTOPIA LENTIS

- Simple Ectopia Lentis → only ectopia lentis
- Ectopia Lentis et pupillae → Pupil is displaced in opp. direction. + Ectopia Lentis.
- Ectopia Lentis associated with syndrome

MARFAN'S SYNDROME
M
Superio temporal ectopia

Homocysteinuria
H
Infero-nasal

Weil Marchesani
① Downward & forward
② Microspherophakia

Ehler Danlos
① Ectopia Lentis
② Blue Sclera (Thin sclera)

Ocular features of Marfan :-

1) Axial Myopia
2) Megalocornea → Most prominent feature
3) Supero-Temporal Ectopia Lentis → Most common
4) Lattice Degeneration.
5) Retinal Detachment

LASERS IN EYE

Photo-Disruptive

1) Nd YAG

* Indications -

a) After cataract

b) Peripheral iridotomy (PI)

2) FEMTOLASER

Cataract surgery

Refractive surgery

↓

Keratomileusis

↓

changing curvature of cornea.

Age. ≥ 18 yrs

Photo-Coagulative

1) ARGON

2) DIODE

3) Double frequency Nd YAG.

Indications

a) vascular pathologies of retina

b) Trabeculoplasty

Photo-ablative

1) Excimer

eg of Argon cl

Argon flouride

Xenon cl/flouride

↓

used in eye.

Indication

Refractive Sx

WAVELENGTHS

1) Nd YAG - 1064 nm (Pulse Duration - 10^{-9} s)

2) EXCIMER - 193 nm.

3) ARGON - 514 nm.

4) DIODE - 780 - 850 nm.

5) Double frequency Nd YAG - 532 nm.

6) Femto Laser - 1052 nm. (Pulse Duration - 10^{-15} s)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

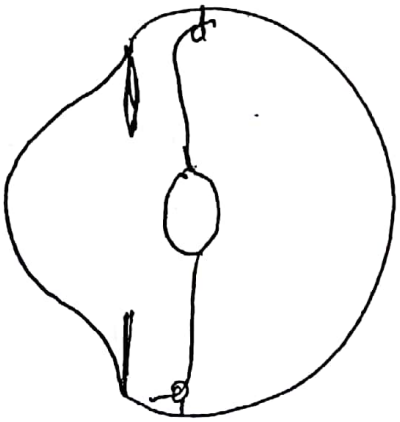
FemtoLaser

LASIK

- To raise a flap containing epithelium & little bet of strome (cornea). by femtolaser

SMILE Procedure [small Incision Lenticule extraction)

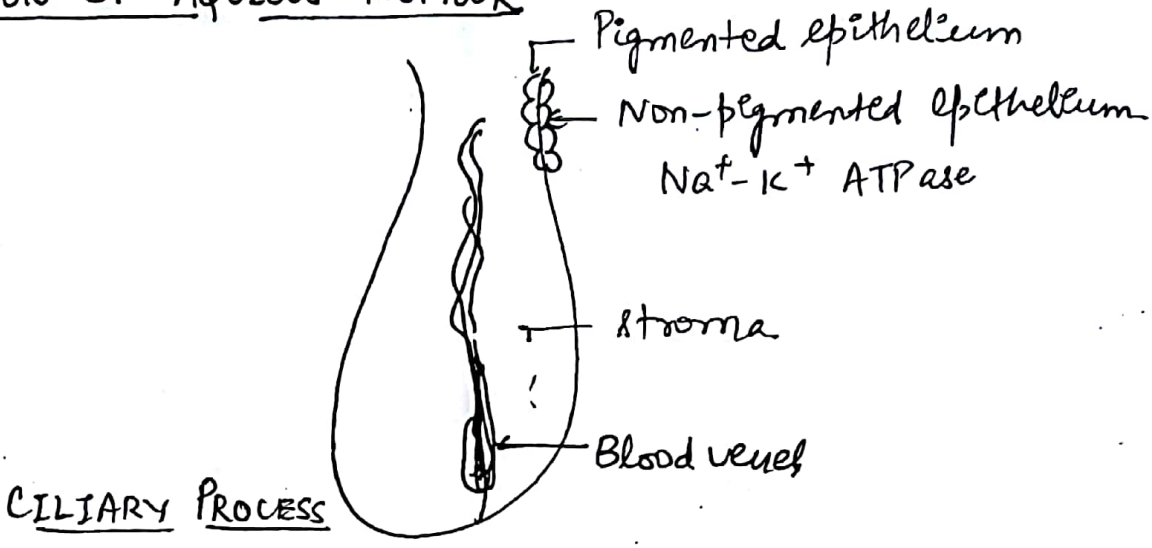
- No need to raise a flap
- Focus on Strome & cut small part of strome
- Give incision (small) & remove the lenticule (strome).



Scleral Fixated IOL [when post. capsule not int]

GLAUCOMA

*FORMATION OF AQUEOUS HUMOUR -



Non-pigmented epithelium is the site of aqueous formation.

Process

1) Secretion [Max. aqueous is formed by this]
2) Diffusion
3) Ultrafilteration.

Rate of formation of aq. humour = 2-3 µL/min.

Hypersecretory Glaucoma ⇒ When more formation of AH.

↓

Due to Epidemic Dropsy. [TOXIN- SANGUINARINE]

OUTFLOW OF AQUEOUS

CONVENTIONAL [90%]

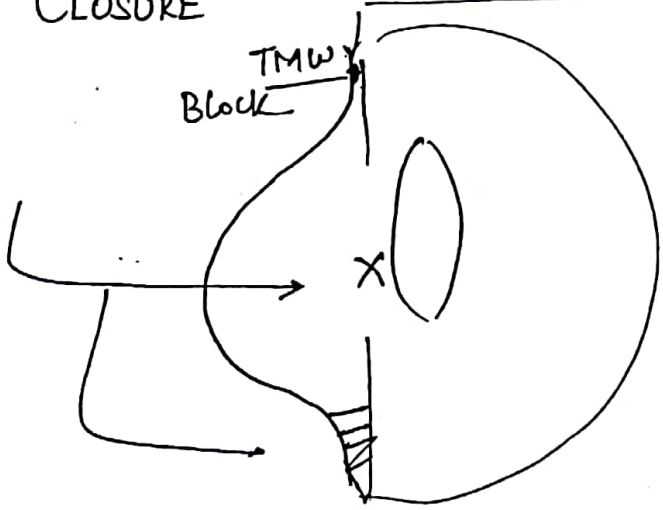
PC
↓
Pupil
↓
AC
↓
Angle [cornea - Descemet's ↳ Schwalbe's line]
↓
TMW
↓
Schlemm's Canal
↓
Episcleral Vein

UVEO-SCLERAL [10%]

Directly crosses uveal tissue + sclera

TYPES

ANGLE CLOSURE



Obstruction at the pupil or actual obliteration of ∠.

OPEN ANGLE

More common

Block in Trabecular Meshwork

Def^{n}:- Glaucoma is multifactorial optic neuropathy associated c risk factors like increase IOP, +ve family history.

CLASSIFICATION

- CONGENITAL / DEVELOPMENTAL
  - True congenital
  - Infantile (< 3 yrs of age)
  - Juvenile (3 yrs to adolescents)
- ACQUIRED.
  - OAG → 1° 2°
  - ACG → 1° 2°

1° - idiopathic
2° - cause known

BUPHTHALMOS

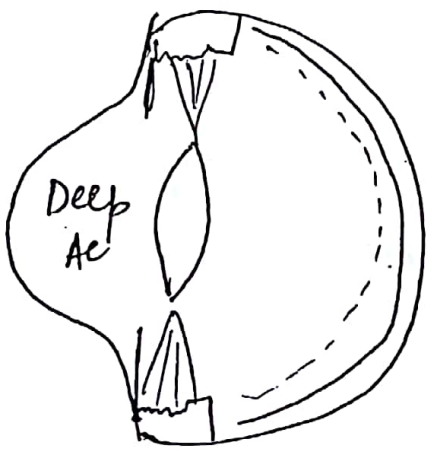
Due to enlargement of eyeball

1° CONGENITAL GLAUCOMA

Etiology - 1) Trabecular Dysgenesis
2) Ab (N) Iris Insertion ⇒ FLAT IRIS / PLATEAU IRIS
3) Barkan's Membrane at the angle

C/F -
1) Watering
2) Photophobia - intolerance to light
3) Blepharospasm

O/E.



① Large cornea
② White cornea
due to corneal oedema

③ Haabs striae -
break in Descemet's Membrane

④ Iridodonesis -
Tremulousness in IRIS is due to loss of support from lens.

⑤ Flattening of Lens
⑥ Break in suspensory ligament ⇒ Subluxation of Lens

D/D - Megalocornea

⑦ Angle anomaly may be +nt:
⑧ Cupping of disc

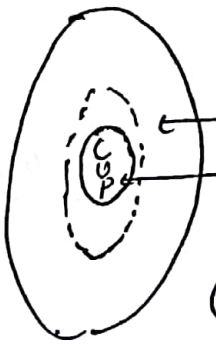
T/t of choice

1) GONIOTOMY
Cutting through the angle [Trabecular meshwork].

Trabeculotomy :- cornea when Hazy, Goniotomy can't be done
Cut in TMW & Schlemm's canal

CUPPING OF DISC

(N) Optic Disc has central Pale area ⇒ CUP AREA
The area beside the CUP is Neuro-retinal Rim.



Neuro-retinal area
Non-neuronal area

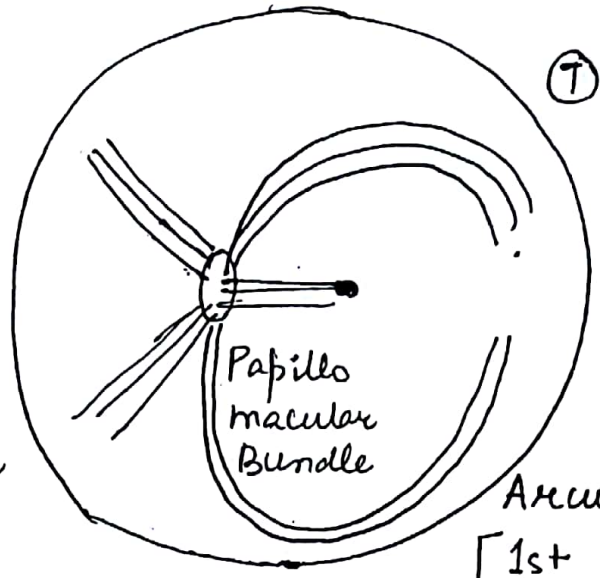
(N) C:D ratio ≤ 0.3

When C:D ration ↑ ⇒ Cupping.

Cupping ⇒ neuronal area is getting damaged
Non-neuronal area is increasing.

In case of glaucoma cupping is vertically oval due to damage to arcuate fibres.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp



Arcuate fibres.
[1st Damage in Glaucoma occurs in arcuate fibres]

⇓

1st Field Defect seen in
Bjerrum's Area

BJERRUM'S AREA

Area in the visual field where 1st scotoma appears corresponding to arcuate Fibres

Physiological ~~Glaucoma~~ Cupping

① Horizontally round cup

② B/L symmetrical [Glaucoma is never B/L symmetrical.]

2° CONGENITAL GLAUCOMA

① ECTROPIAN UVEAE

Iris pigments everting from pupillary boarder

② Naevus of Oculodermal melanosis
subepithelial conjunctival melanosis
Associated ∈ angle Anomaly

③ Nano-Ophthalmos
Very small eye
lens size may be normal
No other structural abnormality.
[In Micro-Ophthalmos → Structural Abnormality are present]

↓
angle may get obliterated.

④ PHACOMATOSIS

NF1
Von-Recklinghausen Disease
↓
∠ anomaly

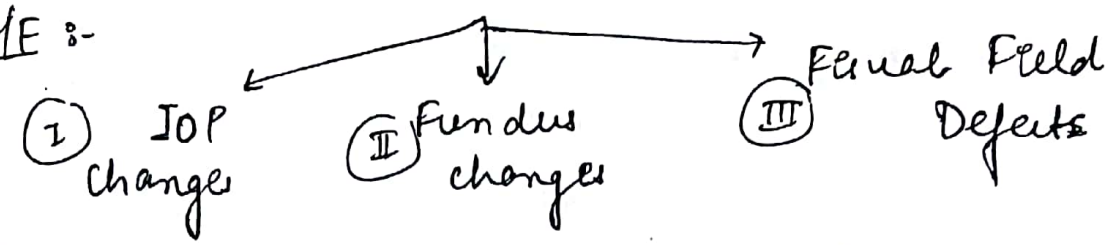
Sturge-Weber Syndrome
TRIAD
- Angioma of face on 1 side
- I/L angioma in Brain
- Angle Glaucoma

1° OPEN ANGLE GLAUCOMA.

R/F :-
1) Age > 40 yrs
2) +ve Family History
3) High Myopia [>6 D]
4) DM.

Pathogenesis :-
Blockage in TM

c/E :-



(I) IOP Changes

* (N) IOP → 10-21 mmHg
* Normal Diurnal Variation ~ 5mmHg
  5-8 mmHg - Suspicious
  >8mmHg - Glaucomatous.

IOP More in Morning as cortisol level are ↑ in morning

* NTG (Normal Tension Glaucoma) -
  Normal IOP
  Fundus changes (+)
  Field Defects (+)

* Ocular HTN -
  IOP ↑
  Fundus (N)
  No Visual Field Defects

IOP varies according to Central Corneal Thickness (CCT)

In thick cornea → overestimate IOP.
In thin " → Underestimate IOP.

TONOMETRY

- INDENTATION → SCHIOTZ
- APPLANATION
  - Fixed force → area α IOP
    - (1) MAKLAKOV T.
    - (2) BARRAQUER T.
  - Variable force → area is fixed, Force α IOP. [Imbert-Fick law]
    - Most RELIABLE.
    - (1) GOLDMANN
    - (2) PERKINS
    - (3) DRAEGER
    - (4) TONOPEN — for irregular corneas; For infants
    - (5) MAC KAY MARG
    - (6) PULSAIR — non-contact
    - (7) AIR-PUFF — non-contact
    - (8) REBOUND — for self measurement

Q. C is more Reliable? ⇒ Applanation.
Bcoz reading of schiotz depend on scleral rigidity of pt.
In myopia → scleral rigidity is less.

Q. Non-contact Applanation
Air-Puff
Pulsair

Q. For self measurement ? ⇒ Rebound Tonometer

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

C tonometer used for scarred & irregular cornea
① Tonopen
② Mac Kay Marg

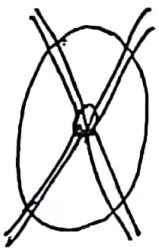
For Infants ① Tonopen
② Perkins

Pascal's ⇒ Dynamic Contour Tonometer
- It is more reliable than Goldmann
- Becoz reading doesn't depend on CCT.

TONOGRAPHY
measuring facility of aqueous outflow.
used for research purpose.

(II) FUNDUS CHANGES

① C:D :- >0.3
② Difference of C:D b/w 2 eyes >0.2
③ Notching of Neuro-retinal Rim.
④ Thinning of Neuro-retinal Rim
⑤ Laminar Dot Sign
⑥ Changes in Blood vessels.
a) nasal shifting of blood vessels.



Nasal shifting

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

b) Bayonetting Sign.
sharp kinking ↳ double bending of blood vessel.

Ideal Method → Slit Lamp Biminroscopy

↓

Putting lens in front of eye ↳ then looking through slit-lamp.

- Contact
  - ↓ Goldmann Three-mirror
- Non-Contact
  - Convex
    - +60
    - +78
    - (+90) Best among this
  - Concave
    - HRUBY LENS −58.6D

(III) VISUAL FIELD DEFECT

(N) Extent → Temporal 100° or 90°
Inferiorly 70°
Nasally 65°
Superiorly 50°

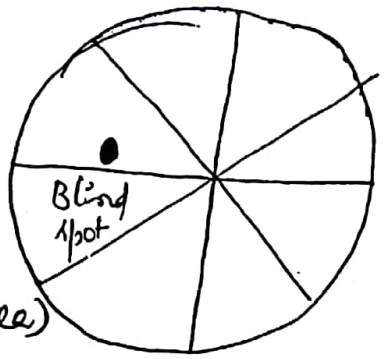
Blind spot located between 10°-20° inofter

VFD in 1° OAG

Early

Earliest VFD

Central or Paracentral Scotoma (in Bjerrum's area)



2) Siedel's Scotoma
Paracentral scotoma + Blind spot

3) Baring of Blind spot or Isopter contract

Late

④ Arcuate Scotoma

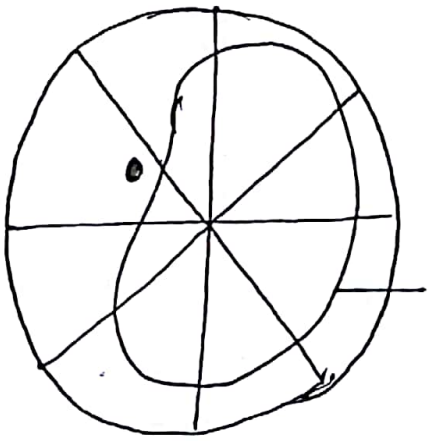
⑤ Double arcuate Scotoma when inf. field is also involved

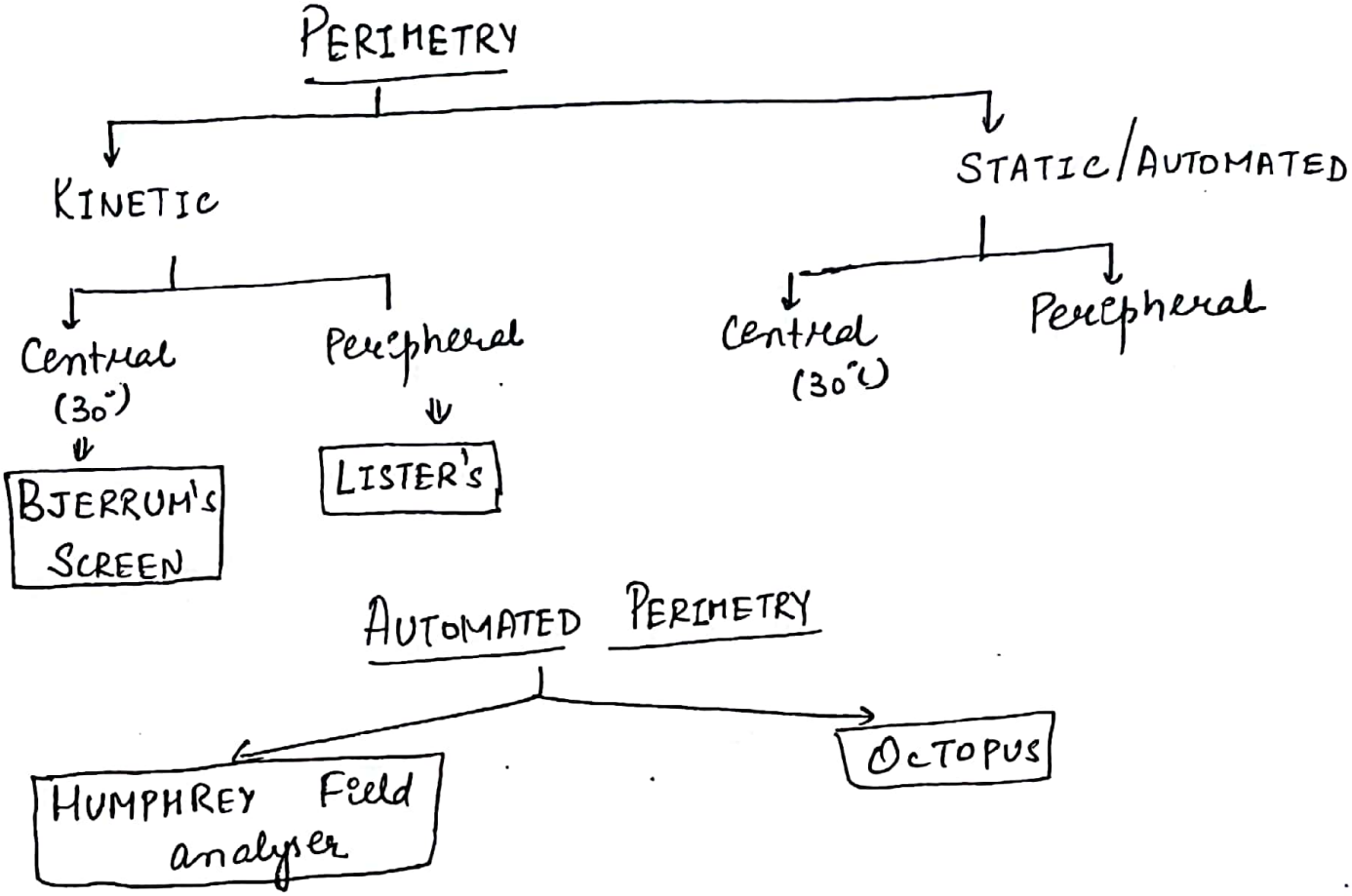
⑥ ROENNES NASAL STEP

⑦ Central + Temporal Island of vision is left behind.

⑧ Last → Temporal Island of Vision

Baring of Blind Spot :-
- isopter contract
-





1° ANGLE CLOSURE GLAUCOMA

R/F :-

1. Small Eye
2. Hypermetropia
3. Shallow AC.
4. Narrow angle
5. MC - ♀

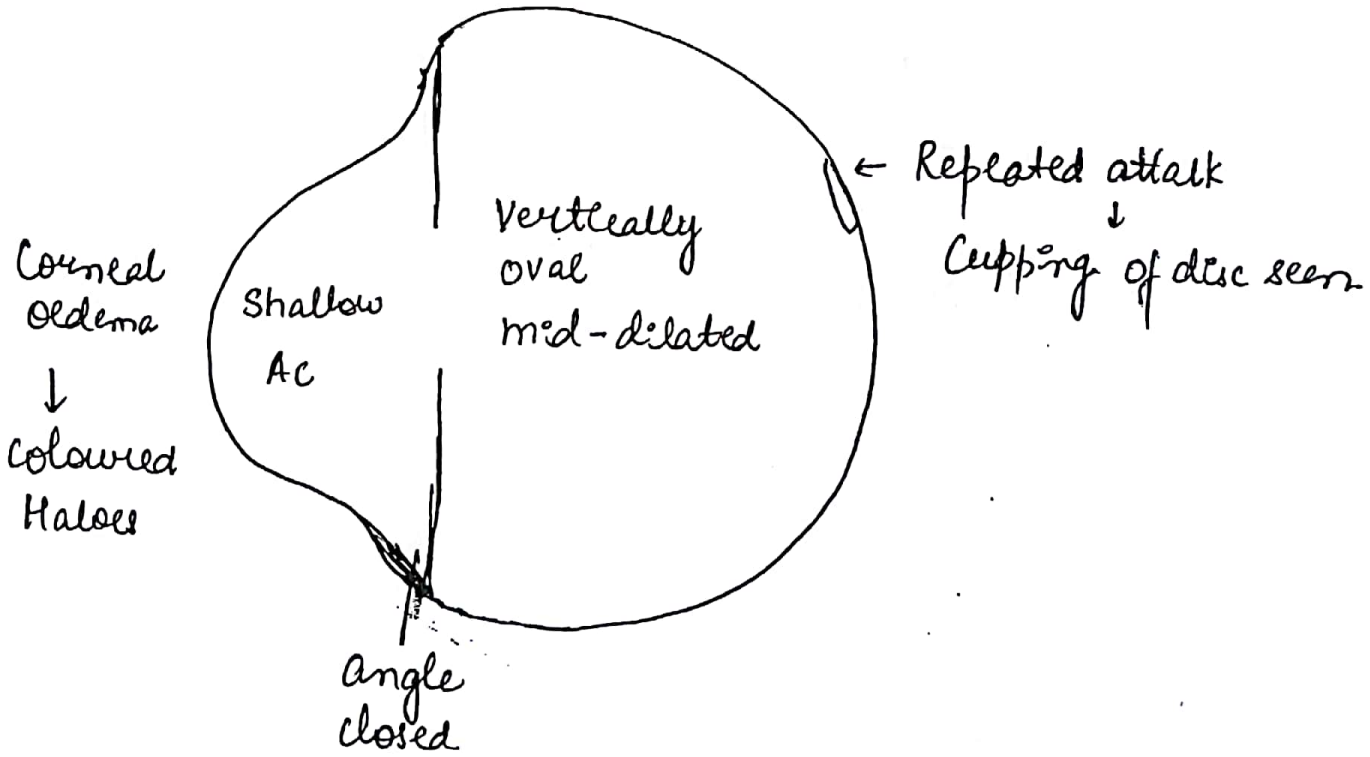
Max. closure of angle occurs ⇒ when pupil is MID-DILATED.

C/F

(I) → PRODROMAL
Asymptomatic

(II) → STAGE OF CONSTANT INSTABILITY
Some part of angle blocks & reopens by itself

(III) → ACUTE CONGESTIVE GLAUCOMA
all 360° angle is closed.
IOP ~ 60 mm Hg
Pain ↑↑, associated c nausea & vomiting
Redness, Photophobia, Blepharospasm.



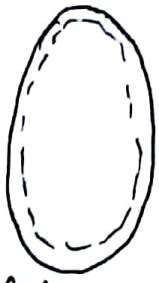
(IV) - CHRONIC CONGESTIVE GLAUCOMA

IOP change
Fundus change
Field defects
+ Angles are closed

For Inv. to see angle ⇒ we need constricted Pupil

(V) - ABSOLUTE GLAUCOMA

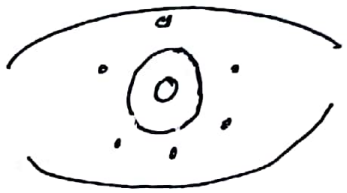
Painful Blind Eye.
IOP ↑↑↑
Stony Hard Eyes
100% cupping



Glaucomatous optic atrophy

TOC of Absolute Glaucoma

- **Cyclocryotherapy**
  - ↓
  - Damage few ciliary process
  - If excessive damage occurs by overtreatment
    - ⇓
    - PA: PTHISIS BULBI occurs



OTHER MODALITIES OF T/t

a) Absolute Alcohol Injection → suppresses ciliary ganglion.

b) Evisceration

Definitive T/t of ACG

Peripheral Iridotomy by Nd YAG.
+
Prophylactic PI should be done in other eye.

OAG does not need any prophylactic T/t.

DOC for Angle Closure G/C ⇒ PILOCARPINE.

Doc for Acute Congestive Glaucoma ⇒ MANNITOL or ACETAZOLAMIDE. followed by pilocarpine

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

2° GLAUCOMA

1) LENS INDUCED GLAUCOMA

a) **Phacolytic Glaucoma**

It is the leakage of lens protein blocking the TMw.
It is seen in Morgagnian Cataract

b) **Phatoxic Glaucoma**

T → T
due to trauma
Any trauma causes capsular rupture
↓
Lens protein blocking TM
⇓
2° OAG.

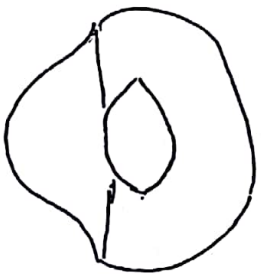
c) **Phacoanaphylactic Glaucoma**

Lens protein
↓
Immune Reac'
↓
release of macrophages
↓
engulf lens protein
↓
Blocks the TMw.
⇓
2° OAG

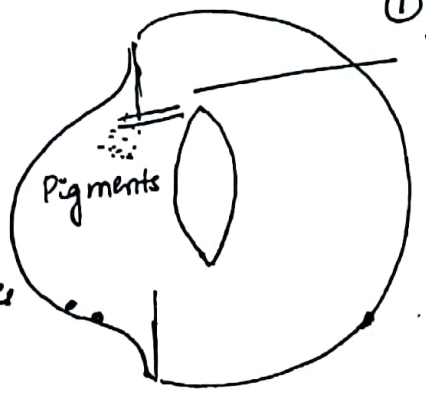
Q. ē type of antigen is Lens Protein → **Sequestered antigen**

d) **Phacomorphic Glaucoma**

Due to morphology of lens
When intumescent cataract swells up.
too much ↳
↓
Pupillary Block
⇓
2° ACG



2) PIGMENTARY GLAUCOMA



① Transillumination Defect
less pigment hence more light passes through

② Keratic precipitates

Release of pigments
↓
Blocking TM.

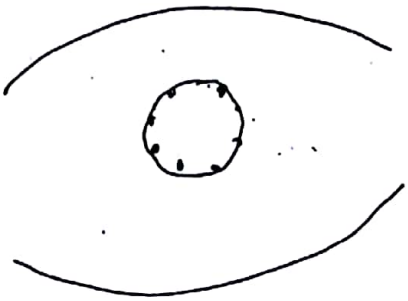
KP → spindle shaped
Krukenberg spindles

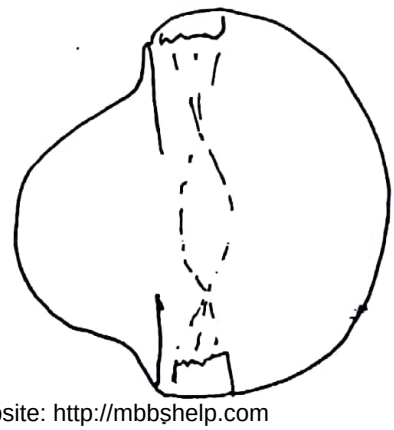
3) PSEUDOEXFOLIATION SYNDROME / GLAUCOMA CAPSULARE

Dandruff like material is released from lens capsule & suspensory ligament
↓
released into aqueous
↓
Blocking TM.

Not true ~~exfoliation~~ exfoliation ⇒ ~~les~~ proteinaceous secretion.

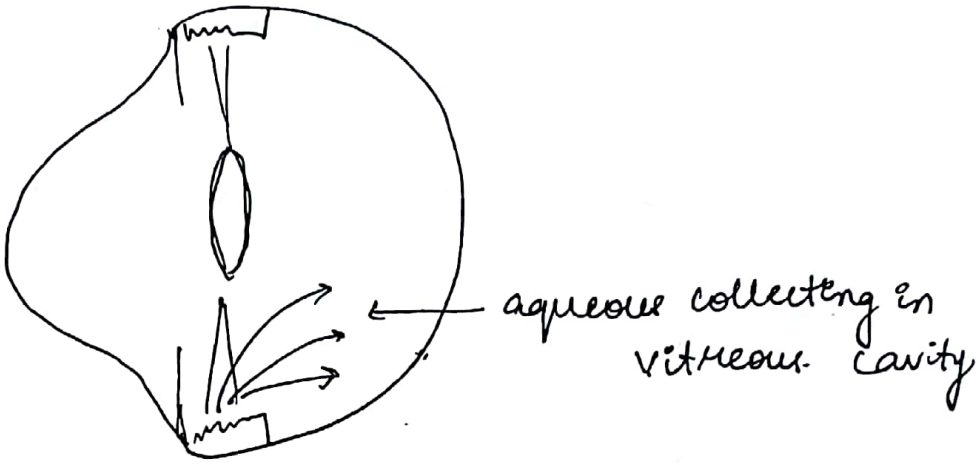
M/c 2° Glaucoma





Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

4) MALIGNANT GLAUCOMA / CILIARY BLOCK GLAUCOMA



Aqueous formed collects in vitreous cavity
↓
Lens + Iris pushed forward
↓
very shallow AC

Cause :- It occurs after any intraocular Sx
c surgery chances of malignant glaucoma more
Trabeculectomy

Mx

1) Atropine - 1st Line T/t.
strongest cycloplegic.
Dilatation also opens the block.

2) Nd YAG anterior hyaloidotomy
aqueous starts leaking anteriorly
↓
block opens.

3) Pars Plana Vitrectomy
cutting out aqueous from vitreous

Inverse Glaucoma

Glaucomas' t/td by Mydriatic

Eg. 1> Malignant Glaucoma

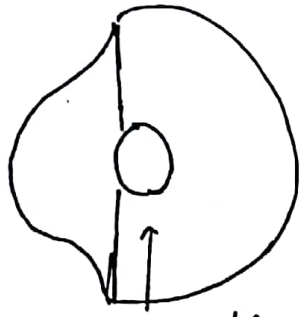
2> Spherophakia

↓

Spherical lens blocks the pupil

↓

a T/td by Mydriatic



Spherical lens

5) NEOVASCULAR GLAUCOMA

Cause: Hypoxia in retina

↓

neovascularisation.

↓

If hypoxia is not t/td.

Ant segment also hypoxic

↓

Rubeosis Iridis

New blood level are more leaky & have fibrous tissue also.

So, initially it is OAG.

↓

Later associated fibrous tissue contracts.

leading to angle closure

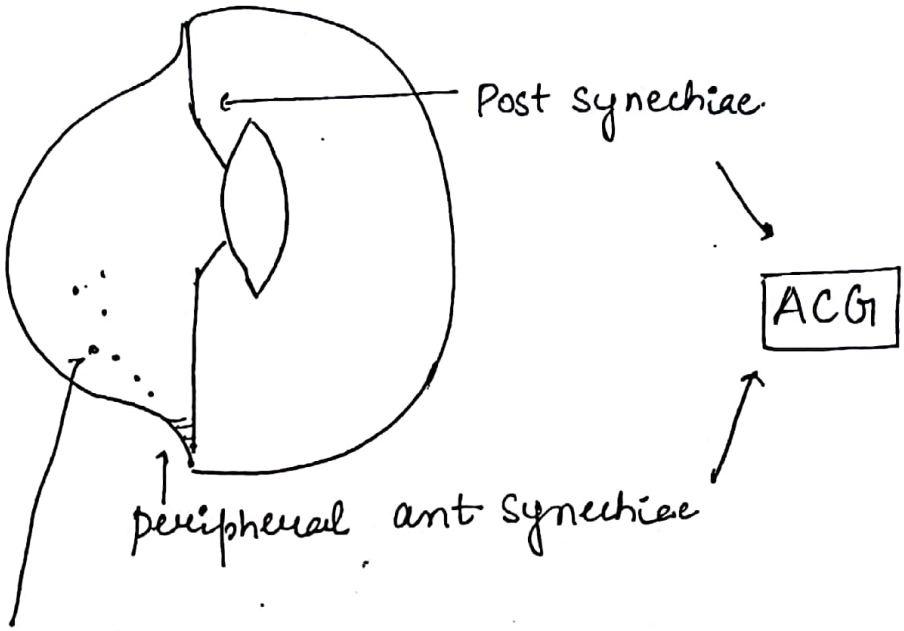
↓

ACG

TOC 1) Pan retinal Photocoagulation.

2) Anti-Glaucoma Drugs.

6> GLAUCOMA ASSOCIATED WITH UVEITIS



when aqueous cells block TM ⇒ OAG.

Glaucomacyclitic crisis / Hypertensive Uveitis / Posner-Schlossman Syndrome.

In uveitis, pupil is miotic : ACG pupil → mid-dilated or Dilated.

↑ This helps in diagnosis of this syndrome

TOC

1) Anti-Glaucoma Drugs

2) Atropine.
for uveitis

when pressure is controlled ⇒ go ↓ steroids.

7) STEROID INDUCED GLAUCOMA

M/c ocular complication of topical steroids.

Deposition of Mucopolysaccharides in TMW.

⇓

OAG.

8) ICE Syndrome [Irido-corneo-endothelial Syndrome]

Endothelial never regenerates (N)

In this syndrome,

endothelium starts proliferating

↓

Block's angle

Proliferative endotheliopathy + 2° Glaucoma

- Progressive Iris atrophy → Iris atrophy
- CHANDLERS SYNDROME → Corneal oedema
- COGAN REESE SYNDROME → Nodules + Naeves on Iris

Rx OF GLAUCOMA

- Medical
  - Topical
  - Systemic
- Laser
- Sx

TOPICAL DRUGS

1) β BLOCKER

MOA - ↓ formation

Eg - TIMOLOL
BETAXOLOL
LEVOBUNALOL

Q. c/I in β blocker = asthma

Selective β blocker = Betaxolol

c/I β block called ● NLD obstruction = Timolol

2) α - AGONIST

MOA - Dual action

- ↓ formation
- ↑ drainage [Uveoscleral outflow] Preferred

Eg - EPINEPHRINE / ADRENALINE
DIPIVEFRINE
BRIMONIDINE
APRACLONIDINE

α agonist C/I – HTN
Heart Disease

Selective α agonist - Brimonidine
Apraclonidine

c anti glaucoma Drug causes drowsiness = Brimonidine

c " • C/I in Infants = Brimonidine
↓
can cause CNS depression

conjunctival pigmentation → by adrenaline

3) MIOTICS

MOA -1) ↑ conventional outflow [trabecular] Q.

2) Miosis in ACG opens up angle.

Eg Pilocarpine ↓ uveoscleral outflow.
↳ C/I in pts of uveitis bcoz miosis aggravates inflammation

↑ capillary permeability

miosis

4) PROSTAGLANDIN ANALOGUE [PG $F2_\alpha$ agonist]

MOA - ↑ uveoscleral outflow.

Eg - LATANOPROST
BIMATOPROST
TRAVOPROST

c Drug causes Heterochromic Iridis - Latanoprost
↓
Becoz it causes IRIS Pigmentation

C Antiglaucoma drug ↑ (B) outflows = Bimatoprost.

C/I in uveitis as they are mediators of inflammation.

5) CARBONIC ANHYDRASE INHIBITOR

MoA - ↓ formation of aqueous humour

Topical CA inhibitors = DORZOLAMIDE
BRINZOLAMIDE.

C/I in sulpha allergies

SYSTEMIC DRUGS

- CARBONIC ANHYDRASE INHIBITOR
  - C/I in sulpha allergies
- HYPEROSMOTIC AGENTS
  - MANNITOL
  - GLYCEROL
  - ISOSORBIDE
  - UREA.

LASER

- OAG
  - Trabeculoplasty by photocoagulative Laser.
    - ↓
    - apply Laser on pigmented TMW
- ACG
  - Peripheral Iridotomy by Nd YAG

Sx

1> GONIOTOMY

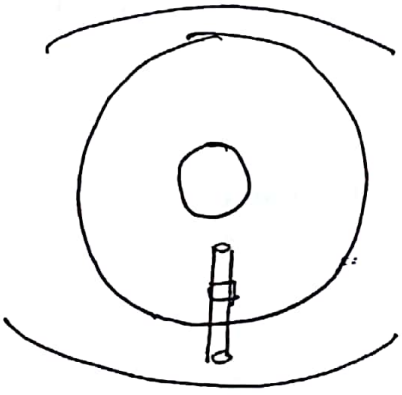
Cut in TMW ⇒ TOC of Congenital Glaucoma

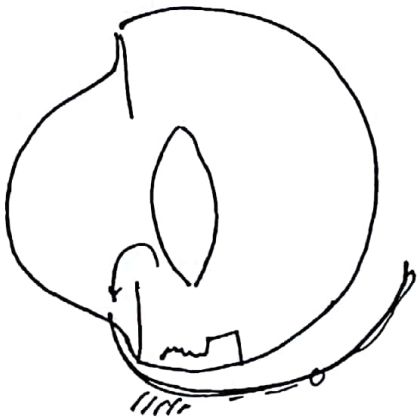
2> TRABECULOTOMY

Cong. Glaucoma
When cornea is not clear.
Cut in TMW + Schlemm's Canal.
It is also done along with Trabeculectomy.

3> TRABECULECTOMY

Cutting TM
↓
Direct connec"

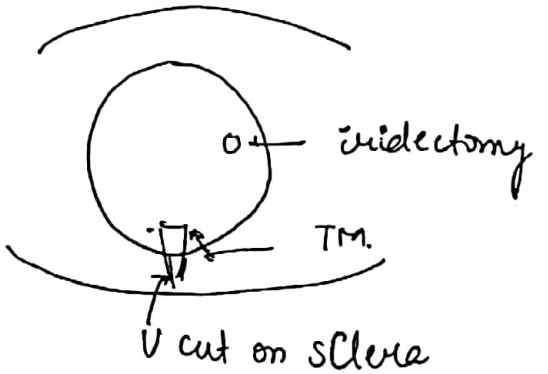




Resection of TM
↓
making a fistula bet^n AC & P Subconjunctival space
↓
Direct connection.

Steps :-
Constricted Pupil
↓
Cut Conjunctiva & raise a flap.
↓
resect tenon's capsule
↓
on sclera. → V shaped partial cut
↓
directing
↓
On limbus. cut a block of TM
↓
Do iridectomy
↓
Put flap. & loosely
Suture it.
↳ so that aqueous flow.

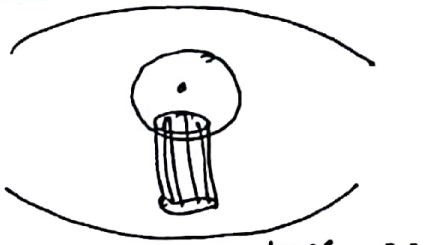
BLEB - Conjunctival flap is raised due to aqueous flow underneath.
Once of bleb indicates success of process.



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

PRECAUTION for closure of fistula

- Anti-Mitotic Drugs
  - Mitomycin c
  - 5FU
- ~~5FU~~



aqueous drainage implant

Aqueous Drainage Implants

1> MOLTENO IMPLANT (older)

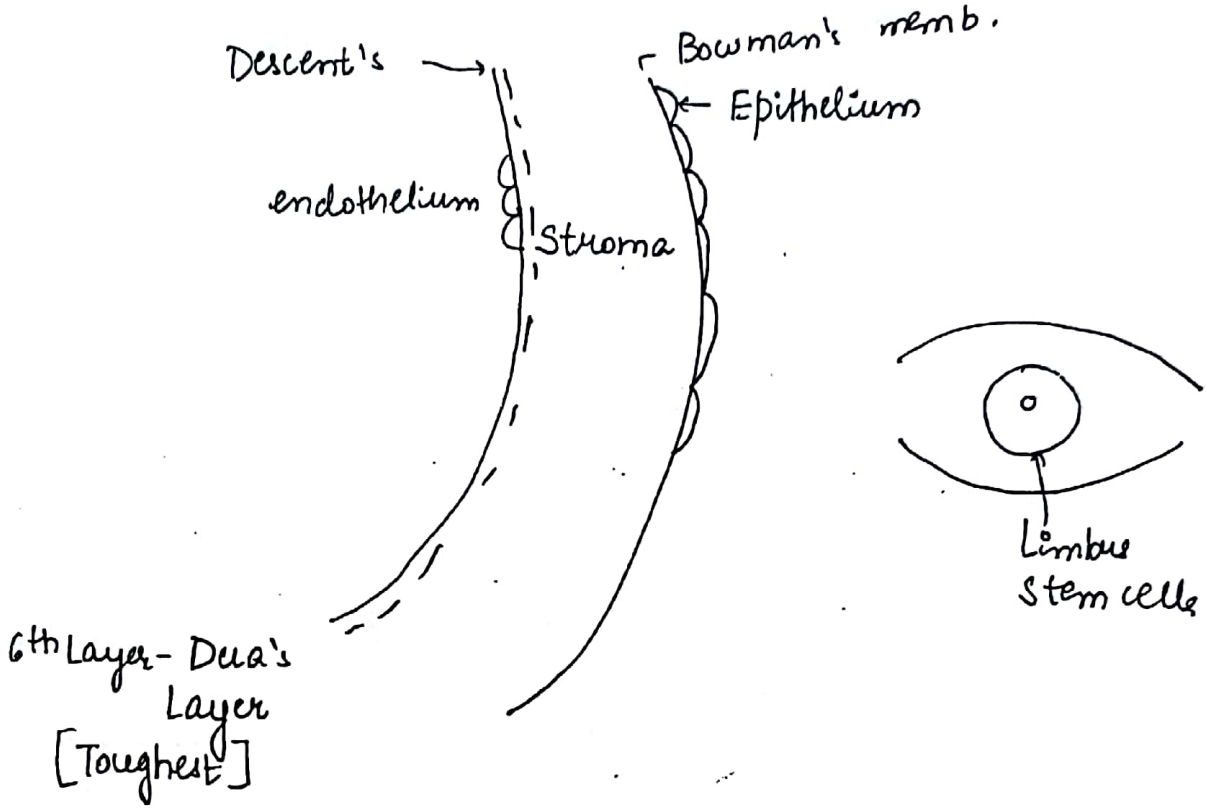
It causes hypotony. [Iop < 10mmHg]
made up of ~~two~~ polypropylene

2> AGV (Ahmed Glaucoma valve)
made up of silicon.

3) EXPRES IMPLANT
made up of stainless steel.

CORNEA

STRUCTURE OF CORNEA



Epithelium grows from Limbus stemcells

PHYSIOLOGY

1> Avascular

2> 1° metabolism ⇒ AEROBIC

- O_2 from air
- Nutrition from aqueous humour

3) Dehydrated

- endothelium act as barrier
- Pump function :- Na^+ K^+ ATPase pump
  - ↳ continuously pumps out water.

(N) No. Of endothelial cells.
adults - 2500 - 3000 cells/mm^2.
children - 3500 - 5500 cells/mm^2.

Polymegathism
whenever endothelial cells damage compensatory change occurs in size ⇒ Size enlarges

Pleomorphism
Morphological change in shape when endothelial cells get damaged.

When Total No. Of cells. <500 cells/mm^2 ⇒ Further No compensation.

⇓

Pump function ↓

⇓

Hydration.

↓

initially Stromal oedema

later epithelial "

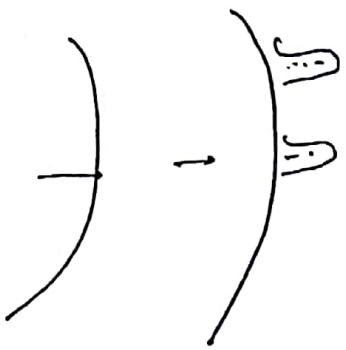
↓

Bully filled ± fluid

⇓

BULLOUS KERATOPATHY

It is a sign of corneal decompensation.



Metabollicaly Most Active Layer = ENDOTHELIUM

∴ Layer in involved in Bullous Keratopathy = EPITHELIUM.

∴ are layers of cornea ∴ do not regenerate

1) ENDOTHELIUM
2) BOWMAN'S MEMBRANE

FACTORS REBPONSIBLE TO MAINTAIN TRANSPARENCY

1) Regular arrangement of epithelium
2) " " of stromal lamella

Distance Bet" 2 lamella $< \frac{1}{2}$ (λ of light).

3) Dehydration
   - Pump func"
   - Barrier "

   } of endothelium.

4) Avascularity

ULCER

Breech in the continuity of epithelium.

ORGANISMS ∴ PENETRATE INTACT EPITHELIUM.

NNLDH

N - Neiseria Gonorrhoea
N - " Meningitis.
L - Listeria
D - Diphtheria
H - Haemophilus

INV. RELATED TO CORNEA

① Keratometry — measure curvature of cornea
Scanning central part

② Corneal Topography
Curvature of cornea measurment
Scan whole cornea

③ Phacymetry
thickness measurment
(N) 0.5-0.6 mm (centre)
at Limbus - 1 mm.

④ Specularmicroscopy Q
Examine endothelial cells [Both No. & Morphology]

⑤ Corneal Sensation
ASTHESIOMETER - hair like projection touches corneal surface.

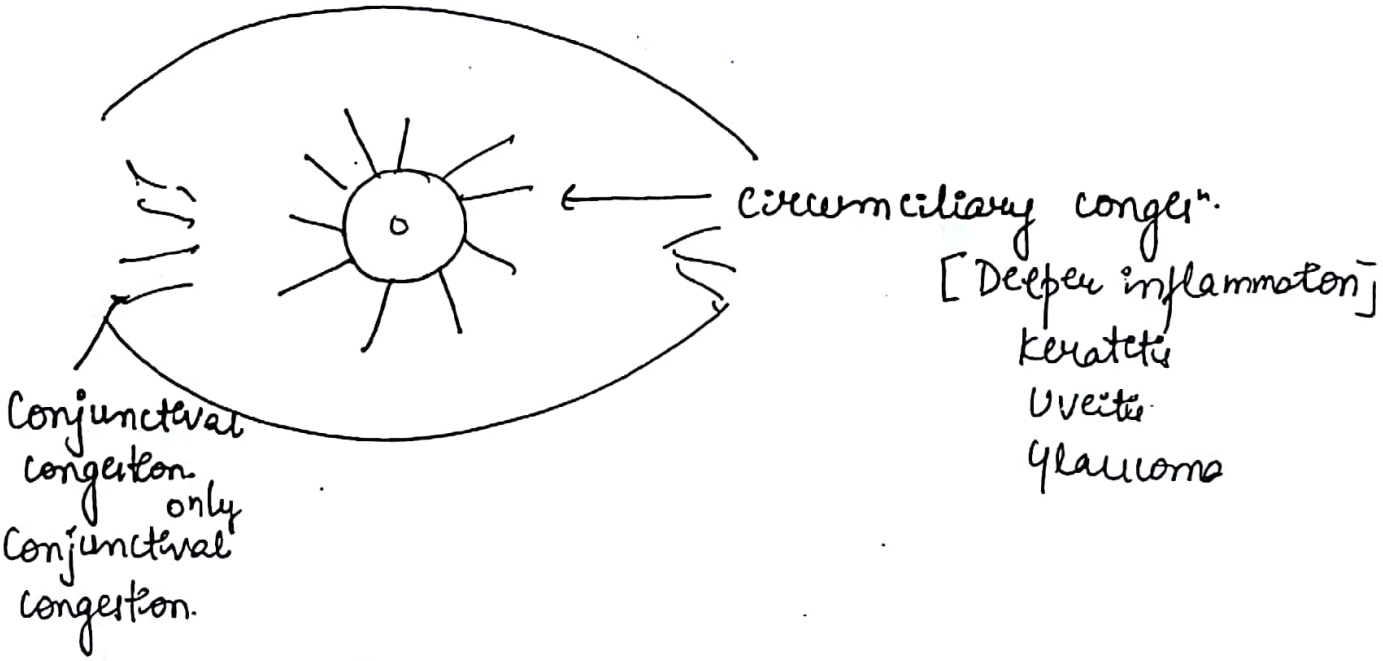
⑥ Microbiological
- staining
- culture

KERATITIS

Inflammation of Cornea.

- Pain
- Redness
- Photophobia
- Blepharospasm
- D/c

REDNESS

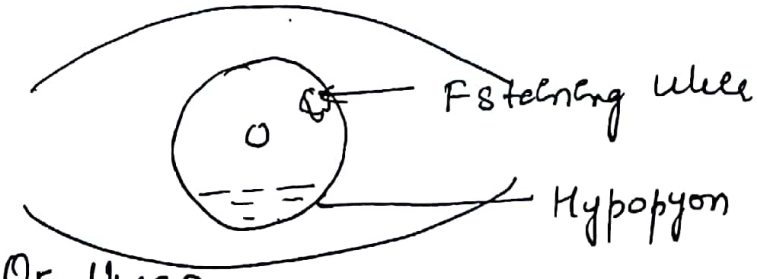


BACTERIAL KERATITIS

Presents ī (5) above features

O/E → Flourescene stained +ve ulcer

Pus in AC [Hypopyon] → Sterile



FATE OF ULCER

- **Localised**
  - It - heals ⇒ opacity
- **Perforating**
  - causes corneal thining leading to perforation
    - when iris gets adhered & seals perforation [Leucoma adherence]
- **Sloughing**
  - Virulent organism
    - Necrosis
      - Replaced by inflammatory exudate [Pseudocornea]

Hypopyon Corneal Ulcer :- PNEUMOCOCCUS
or
ULCUS SERPENS

Rx

1) Antibiotics — Broad spectrum, culture sensitivity

2) Fortified antibiotic drops
   - CEFAZOLINE → 50 mg/mL
   - GENTAMYCINE → 15 mg/mL

3) Antibiotic Ointment applied - HS

4) Atropine.
   Since Keratitis may cause UVeitis.

5) Oral Anti-inflammatory

6) Oral Vit A / Vit C

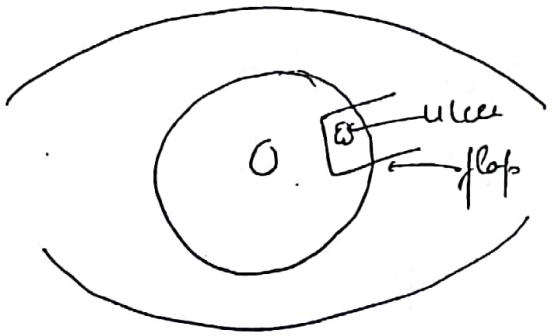
For any infective corneal ulcer ⇒ No steroids
No Bandage
↓
Flaring

Rx of Non-Healing Ulcer

1) **Debridement**
Remove necrotic tissue from periphery using sterilized cotton bud

2) **Chemical Cauterisation**
TCA (trichloroacetic acid)
↓
local antiseptic effect

3) **Conjunctival flapping**
raise a flap of conjunctiva + cover the ulcer
Gundersan's Conjunctival flapping



Rx of Impending Perforation

1) Anti-Glaucoma Drugs.
↓ IOP

2) Cyanoacrylate Glue application on thin area.

③ Bandage contact Lens

Soft lens

High water content

More H_2O → More O_2 transfer ability

CONTACT LENS

Soft ← → Semi-Soft

↓

Rigid Gas Permeable

FUNGAL KERATITIS / KERATOMYCOSIS [AIIMS]

CAUSE - Trauma by Vegetative matter

common in farmers

Signs are more than symptoms compared to bacteria

M/C Fungus ⇒ ① ASPERGILLUS FUMIGATUS Q

↓

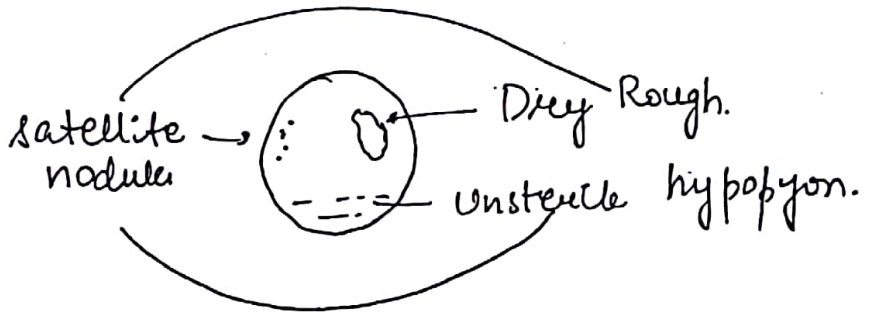
② FUSARIUM. Q.

M/C Fungus infecting dids → Candida albicans

C/F:- 5 features

O/E → 1) Ulcer is dry & rough.

2) Projecting ends → HYPHAE



3) Unsterile Hypopyon.

4) Satellite nodules Q

Inv -

Staining

1) KOH Smear
2) Gommori's Methamine Silver Stain.

Culture

- Sabouraud's Agar
- Brain Heart Infusion Broth.

Keratitis caused by NOCARDIA ASTEROIDES, ↓ is a filamentous bacteria closely resembles FUNGAL CORNEAL ULCER ∞

℞

DOC → NATAMYCIN

Others - Nystatin eye ointment

Fluconazole → Most effective against Candida

VIRAL KERATITIS

↓ is more common = Herpes Simplex M/c than Herpes Zoster. Ophthalmicus

Pathognomic feature

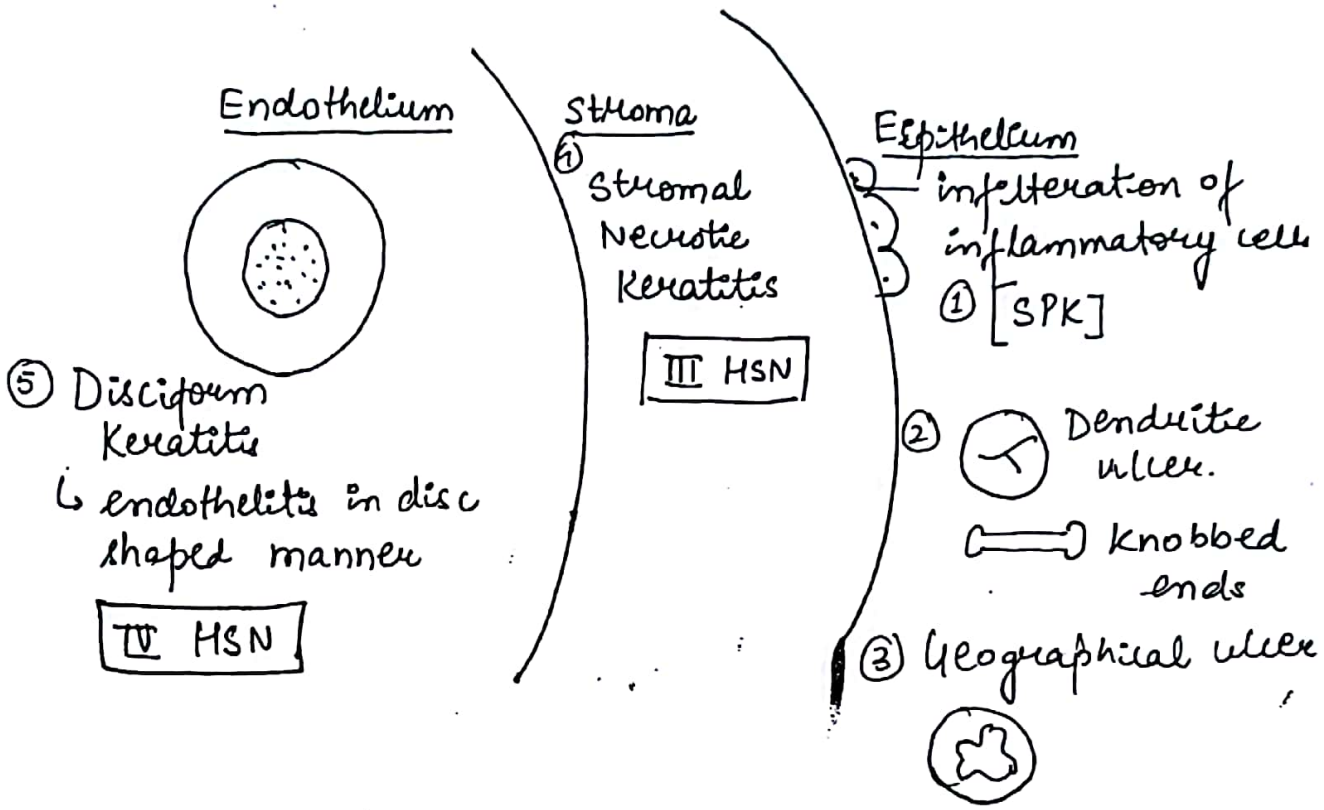
↓ corneal sensation.

CAUSES OF ↓ CORNEAL SENSATION

1) Leprosy
2) DM
3) Absolute Glaucoma
4) Phthisis Bulbi
5) any chr. degenerative disease of cornea
6) Section of trigeminal n/v
7) Viral keratitis

HERPES SIMPLEX KERATITIS

O/E :-



Stromal Necrotic keratitis & Disciform keratitis may be a manifestation of HSN Reac^{n}.

℞ :-

1/3 Acyclovir Eye Ointment - 5 times/day. [

acyclovir drops not available

- Ideal duration - not exceeding 14 days.

HERPES ZOSTER OPHTHALMICUS

Skin ← | ↓ Eye | → Trigeminal neuralgia

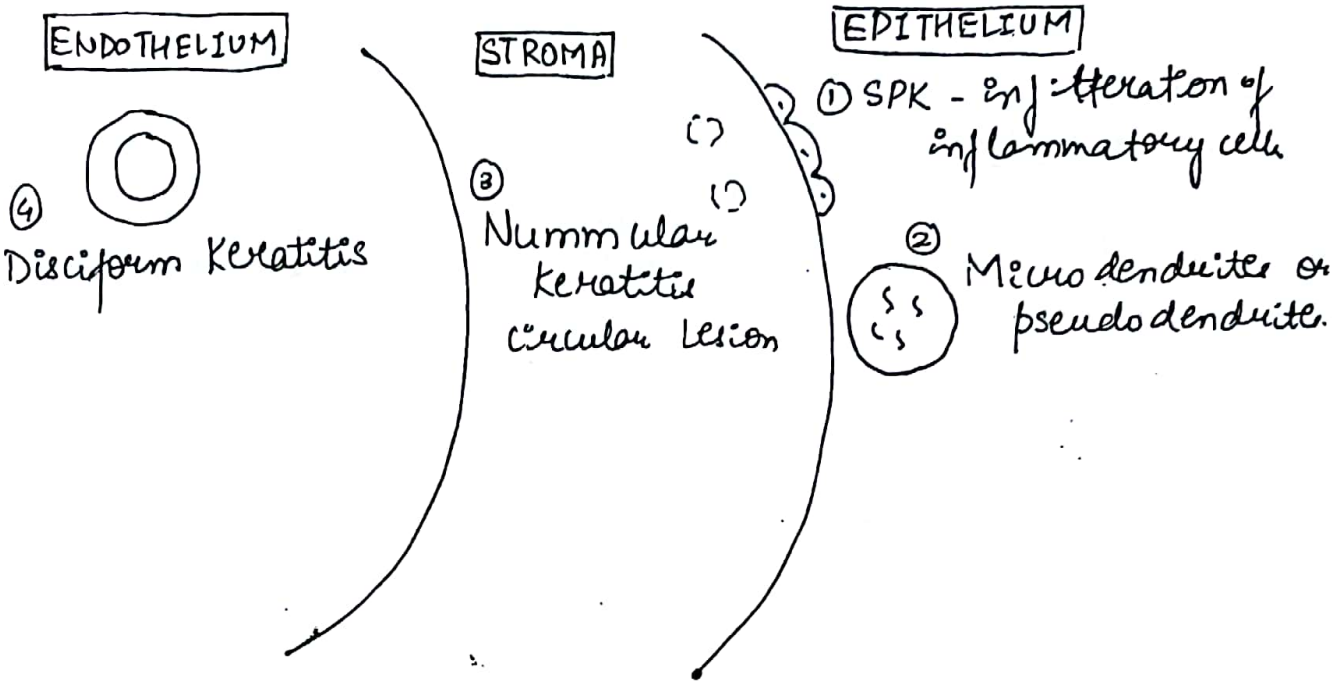
Hutchison's Rule :-

If tip of nose is involved, eye will be involved.

Indicates involvement of Nasociliary N/V

C/F :- ⑤ same severe inflammation.

O/E :-



⑤ Uveitis

⑥ Cranial n/v Palsies

③ 4, 6
M/c

M/c N/V involved in zoster = FRONTAL N/V

Rx :-

1) Topical is same
3% Acyclovir eye ointment - 5 times/day

2) Oral Acyclovir (800mg) tab - 5 times/day] till 14 days.

3) Valcyclovir (1000mg) tab 3 times/day.]

Metaherpetic Keratitis -
Over t/t ⇒ antivirals.
Toxicity → T/t — ① Stop antivirals
② start Lubricating eye drops

ACANTHAMOEBA KERATITIS

Rare infection

cause:- 1) users washing soft contact lens ~~c~~ tap water

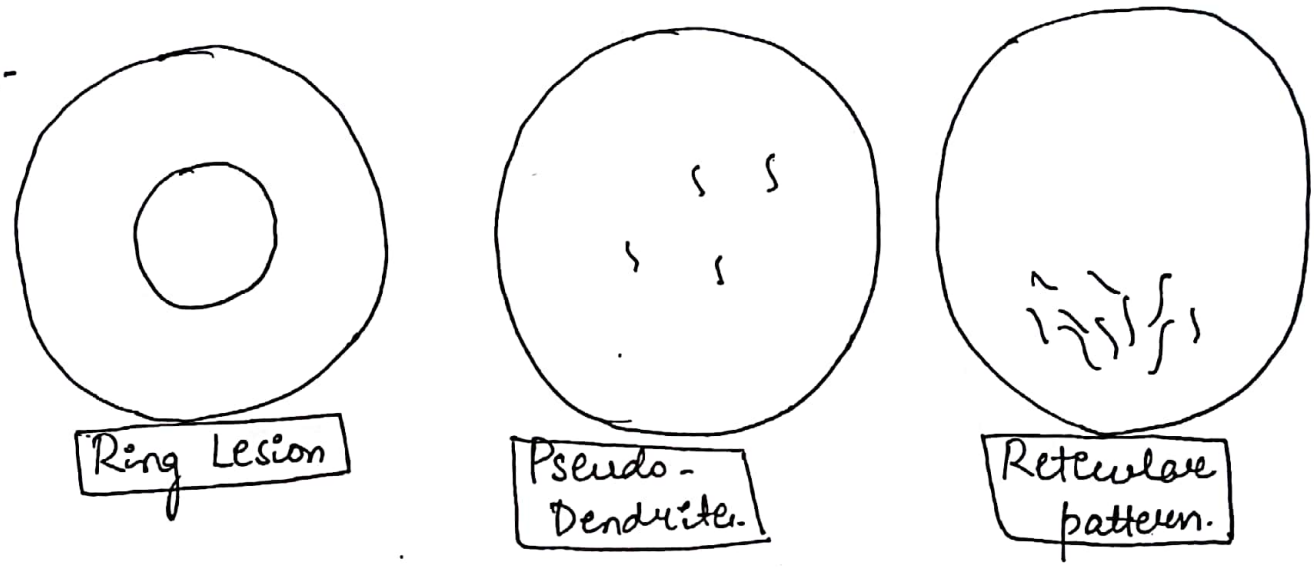
2) swimming ~~c~~ out goggles in soft contact lens user

C/F- (5) same

Pain is disproportionately much more

↳ due to perineural invasion.

O/E -



Inv :-

Staining

1) Calcoflour white
2) Acridine orange
3) Lactophenol Blue.

Culture

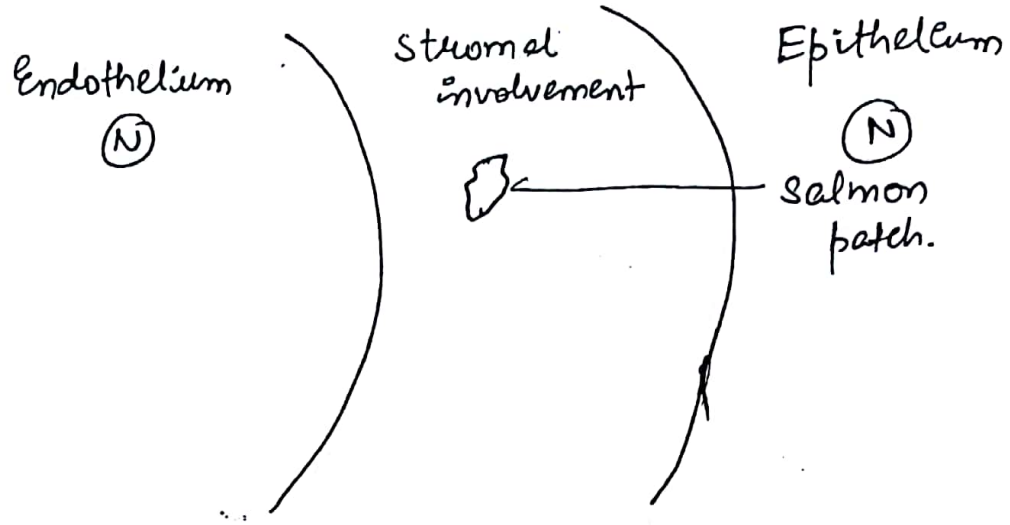
Q. Op Non-nutrient agar ~~c~~ E.Coli

Rx :-

1) PHMB [Poly Hexa Methylene Biguanides]
2) Propamidine isethionate
3) Neomycin.

DOC → PHMB

INTERSTITIAL KERATITIS



IK Syp Le TB Ca Sar.

Causes :- 1) Syphilis
2) Leprosy
3) TB
4) Sarcoidosis
5) COGAN SYNDROME → IK + Deafness

other causes- 1) acanthamoeba
2) Herpes simplex
3) Herpes zoster

Not a feature of Chlamydia

SALMON PATCH → is a feature of Syphilis

KERATOCONUS

- Ectatic Dystrophy of Cornea characterised by conical protrusion.

~~No~~ Dystrophy is idiopathic spontaneous change ∴ no inflammatory component

- Genetic Disease : AD
- Slowly Progressive

If whole cornea is protruded out = Keratoglobus → Myopia.

In Keratoconus → Myopia + Irregular Astigmatism.

↓

Pt complains of Diminution of Vision.

O/E :-

1) Fleischer's Ring
   Fe Deposition in Epithelium

2) MUNSEN'S SIGN
   V shaped deformity of lower lid on downgaze

3) CORNEAL TOPOGRAPHY
   → irregular astigmatism.

4) RETINOSCOPY
   → scissor's reflex. Q.

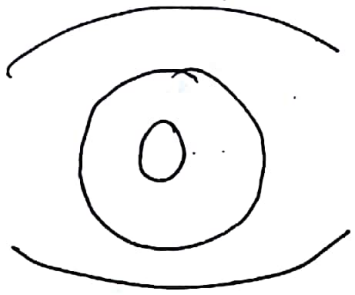
5) Prominent corneal n/v
   ↳ it is due to thinning of cornea

6) Vogt's Striae
   Break in Descemet's membrane
   in keratonus → parallel to steeper axis.

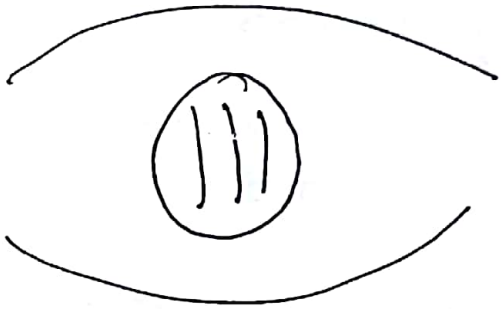
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Thickening of Corneal N/v
1) Leprosy
2) NF-1
3) ~~1~~

Q How to differentiate bet" Haab's & Vogt's Striae?



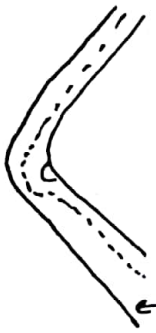
Haab's - Circular



Vogt's = Vertical

Rx:-
1) Specs
in early stage. effective

2) Contact lens
Rigid Gas Permeable lens
↓
3) C_3R
Corneal collagen cross-linking
ī Riboflavin



← rigid gas permeable

expose ~~the~~ it to UV-A rays for 30 minutes.
↳ it arrests progression of disease

4) ~~Ke~~ Penetrating Keratoplasty (PK)

Keratoplasty

- Corneal Transplantation (Donor)
- Replacement of Diseased cornea by normal cornea
- Donor cornea from Cadeveric Eyes
  c in 6hrs death.
  may extend to 12 hrs.
- Storage Media

Short-term
for 48 hrs
in Moist chamber

Intermediate storage
for 4 days
MK [McCarey Kaufmann media].

Long-Term storage
30 day organ culture
Indefinite time period
Cryopreservation

Types

PENETRATING
(full thickness)

LAMELLAR LK
(partial thickness)

DALK [Deep ant.]
epi
sb
Endo

DELK [Deep endothelial] or DSEK

DSEK - Descemet Stripping endothelial Keratoplasty

↓

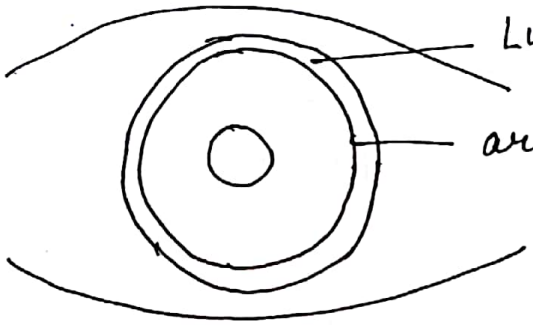
% of endothelial cell loss - 20-25%

* Min. endothelial cells in corneal graft
= 1500 cells / mm^2

CORNEAL DEGENERATIONS

Age Related

ARCUS SENILIS



cause :- Lipid Deposition.

↳ in **Stromal Layer**

BAND SHAPED KERATOPATHY

It is deposition of calcium in form of a band.
Subepithelial Deposition.

CAUSE

1) Idiopathic - H/c
2) Chr. Uveitis in children suffering from JRA (Juvenile Rheumatoid arthritis)
3) Phthisis Bulbi
4) Hypercalcemia → also seen in Sarcoidosis

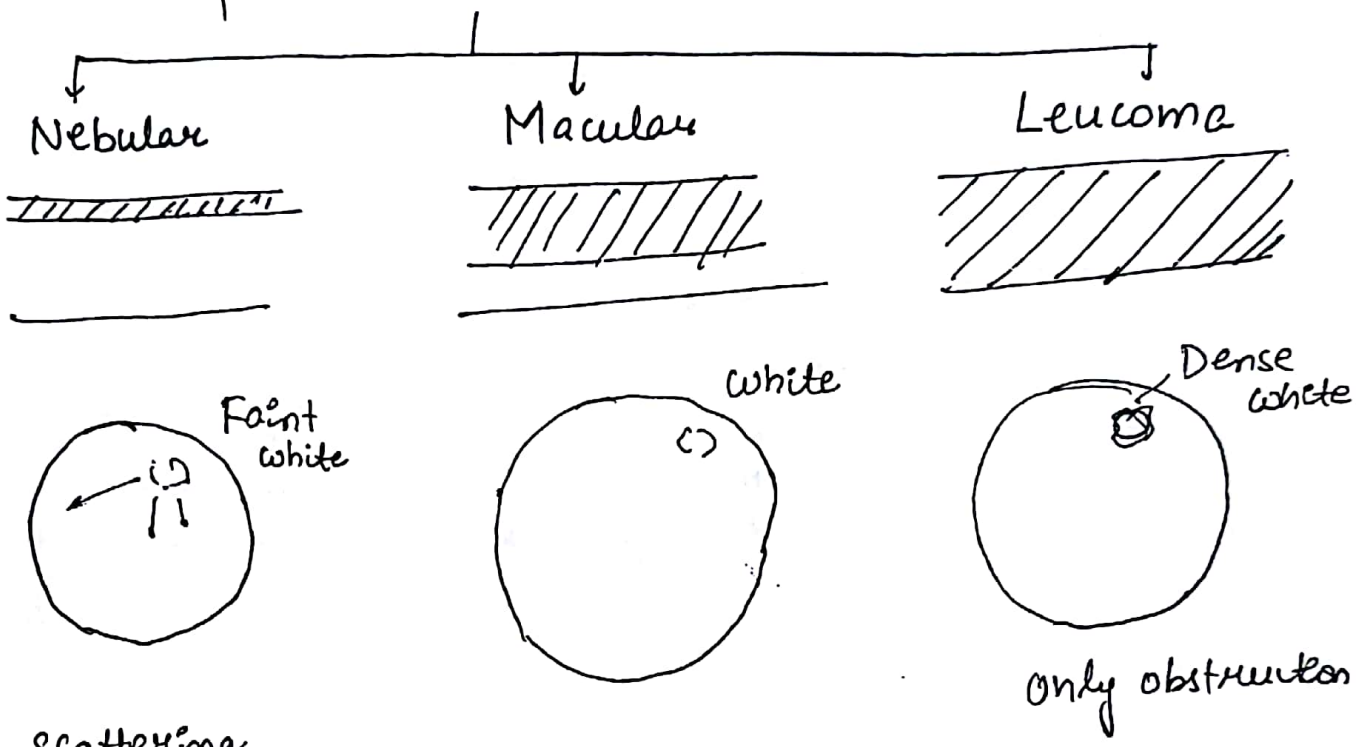
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Rx-

1) Chelation ī EDTA

CORNEAL OPACITIES

Scar formed when stroma is involved



Scattering
Defraction
↓
interfere ī func" of clear cornea.

Diminishes vision most

Pannus = Neovascularization on cornea.
from Limbal capillaries

CORNEAL DYSTROPHY

- Epithelial
- Stromal
- Endothelium.

1) EPITHELIAL DYSTROPHY-

Pt. presents ⊂ recurrent ~~corneal~~ epithelial erosions

R_x - ① Pad/Bandage ⊂ antibiotic ointment

② Keratoplasty

TYPES

- Micro-cystic / Finger Print / Map Dot
  - ↳ M/C type. overall
- Meesmans Dystrophy.
- Reis-Bucklers
  - Main pathology in Bowmans Membrane

2) STROMAL DYSTROPHY -

Present ⊂ Diminition of Vision

R_x - Keratoplasty

TYPES

- Macular
  - ↳ overall
  - ① Least common
  - ② AR inheritance
  - ③ a/w Mucopolysaccharidosis
- Granular
- Lattice
  - a/w amyloidosis
  - Lattice Type II
  - M/C Stromal type

3) ENDOTHELIAL DYSTROPHY

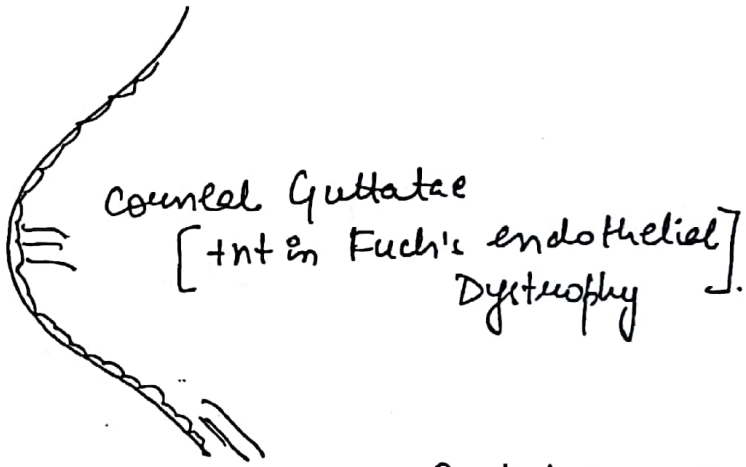
C/F - Corneal oedema

T/t → ① Hypertonic saline eye drops

② Keratoplasty

- Fuch's endothelial Dystrophy
- Posterior Polymorphous dystrophy.

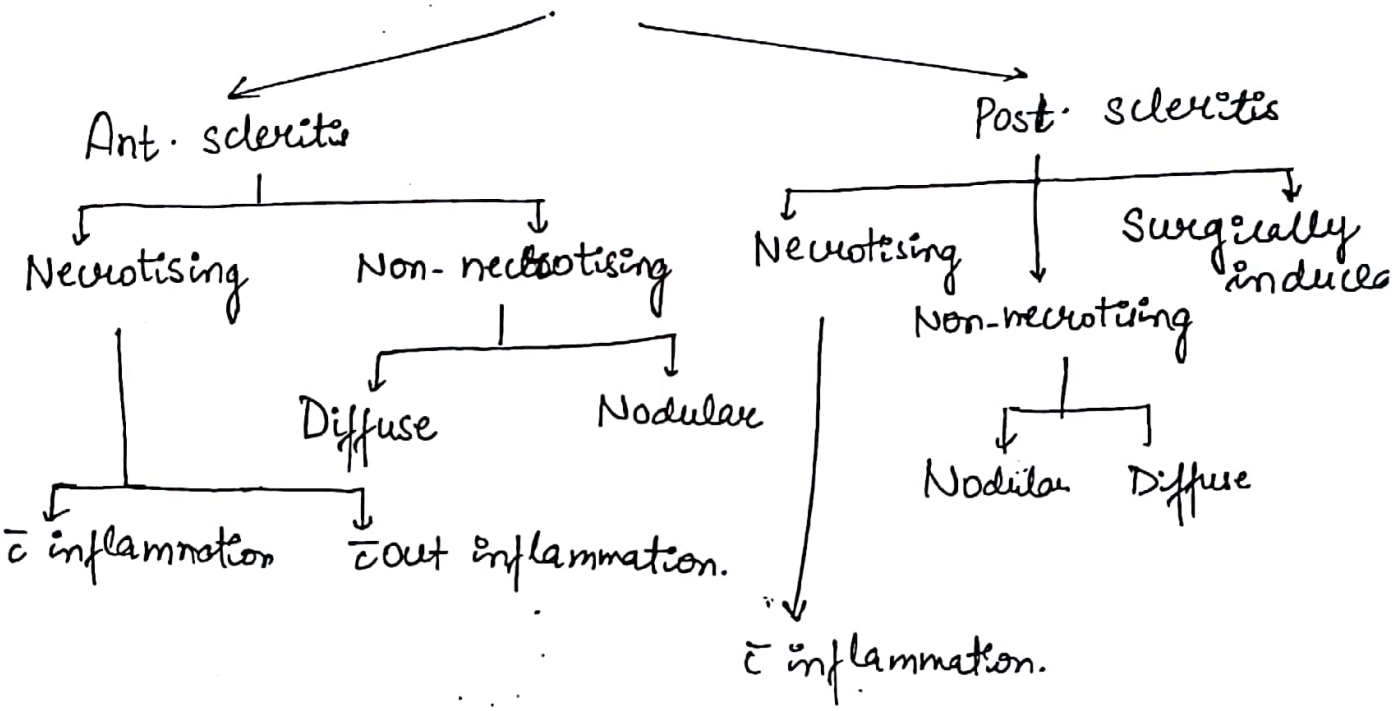
Corneal Guttatae.
Collagenous protuberances if present on central cornea



SCLERA

SCLERITIS

1) Granulomatous Inflammation of Scleral Coat
2) Development
   1) Neural crest
   2) Temporal part - mesoderm
3) Thinnest part of sclera
   post to m/s insertion.



They are associated c connective tissue Disorder

1) RA
2) Polyarteritis nodosa
3) SLE.

Rx - 1) NSAID
   Topical.

2) Steroids

③ Immunosuppressive Drugs in necrotising sclerosis.

SCLEROMALACIA PERFORANS

- Necrotising Ant. Scleritis ~~&~~ ~~otd~~ c out inflammation
- Seen in pt of ~~R~~ long standing Sero +ve RA.

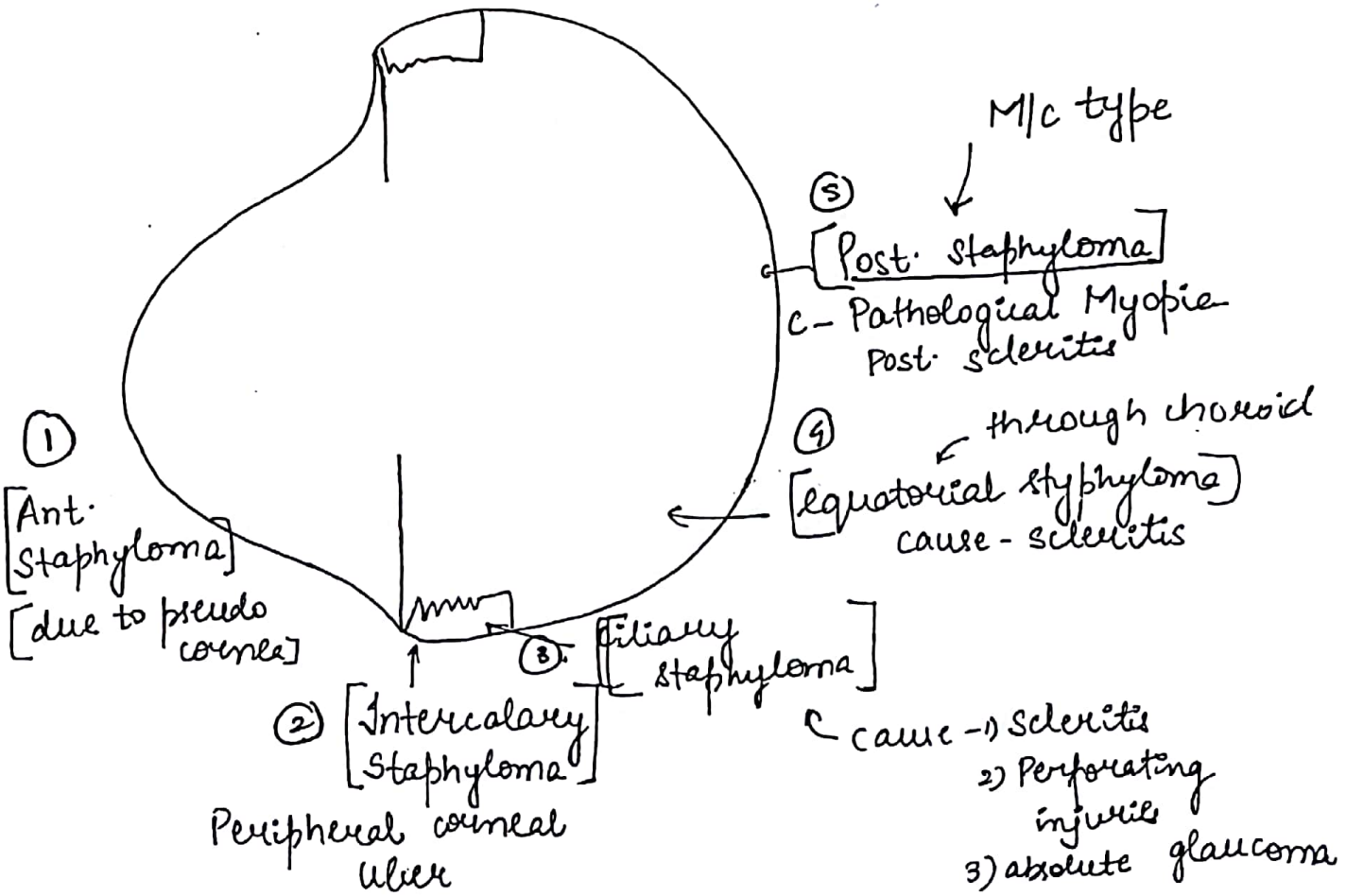
c/F → yellow necrotic patch on sclera
↓ later marked thinning of sclera
↓ exposed uveal tissue

Perforation is rare.

STAPHYLOMA

Ectatic cond^n of Eyeball c herniation of uveal tissue.

TYPES



UVEITIS

Inflammation of uveal tissue

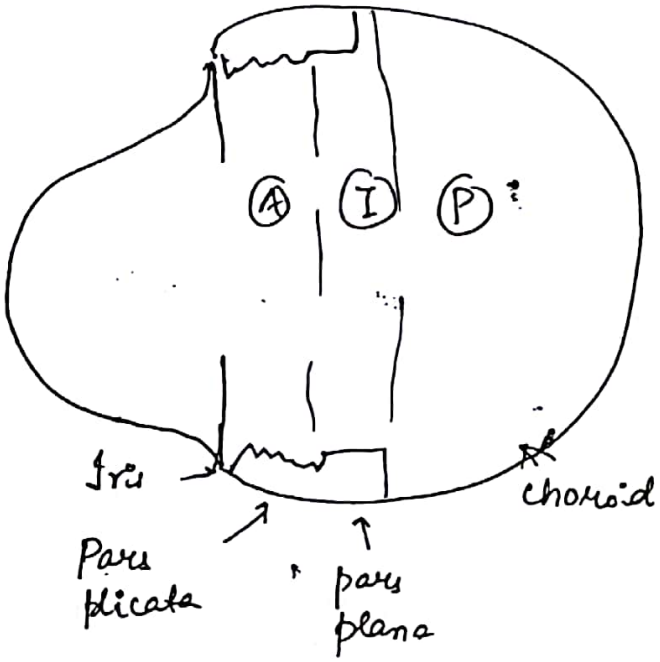
CLASSIFICATION

ANATOMICALLY

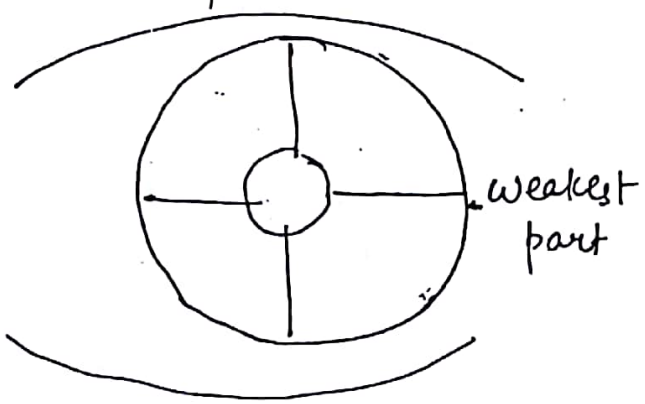
- Ant. Uveitis
  - Iris + Pars plicata
  - [Iridocyclitis]
- Intermediate uveitis
  - Pars Plana
  - [Pars planitis]
- Post uveitis
  - Choroiditis

PATHOLOPICALLY

- Granulomatous
  - ↓
  - Nodule formation.
- Non-granulomatous



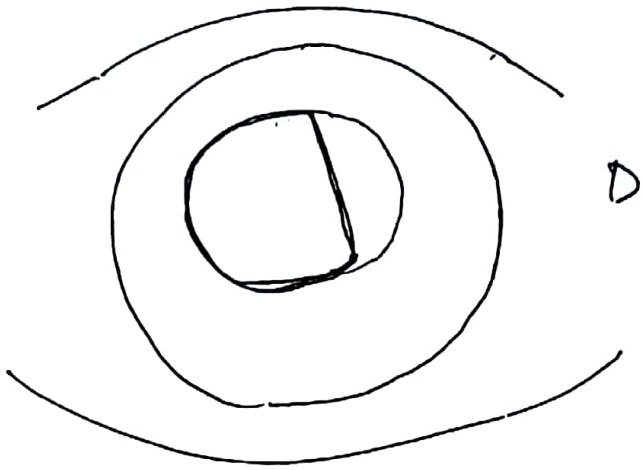
Weakest part of Iris → ROOT → where it is attached to ciliary body



Any disinsertion is called **Iridodialysis**

↓

D shaped Pupil



D shaped Pupil.

ANTERIOR UVEITIS

C/F

(5) - Those (5) features.

Redness - ciliary

D/c - watery / serous

O/E

(5) Busaca nodules (at Base)

(2) Aqueous flare [due to protein leakage]

(1) Aqueous cells

(4) Miosis [Toxins from inflammed tissue]

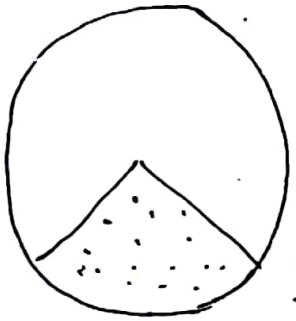
(3) Muddy Iris [oedematous]

(6) Koepp's nodules (at pupillary margin)

Hallmark feature of Ant. Uveitis ⇒ KP'

Non-Granulomatous	Granulomatous
Fine,	Large, Greesy [MUTTON FAT]

KP's are seen on lower cornea due to convec" current in aqueous humour.

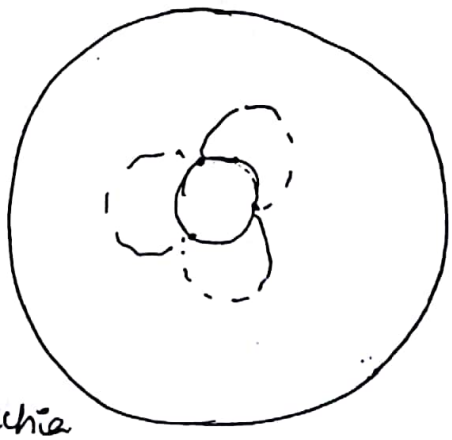


ARLT'S Δ

Pathogenesis

Inflammation causes ↑ capillary permeability
↓
Leads to leakage of cell + protein.

(7) Feestoned shaped pupil.
post. Synechiae
on dilatation, this appearance



(8) Seclusio Pupillae / Ring Synechia
Aq. humour starts collecting in Pc.
Synechia forms.

⑧ Iris Bombe

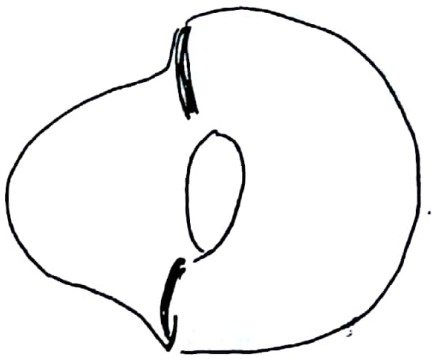
Aqueous humour push iris forward

↓

causes angle block later on.

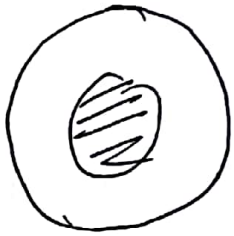
↓

ACG.



Fibrous tissue forms all over pupil

⑨ ↳ occlusio Pupillae →



Cyclitic Membrane

Inflammatory membrane formed behind Iris

℞

1) TOC of Ant. Uveitis → Topical Steroids.

2) Topical Cycloplegics.

Adv

a) ~~release~~ relieves spasm give rest to ciliary m/s ↳ Better vasculature

b) relieves pain

c) prevents post synechiae.

d) Breaks the post. synechiae

LUMINATE Programme –

Study to find non-steroidal t/t of Uveitis.

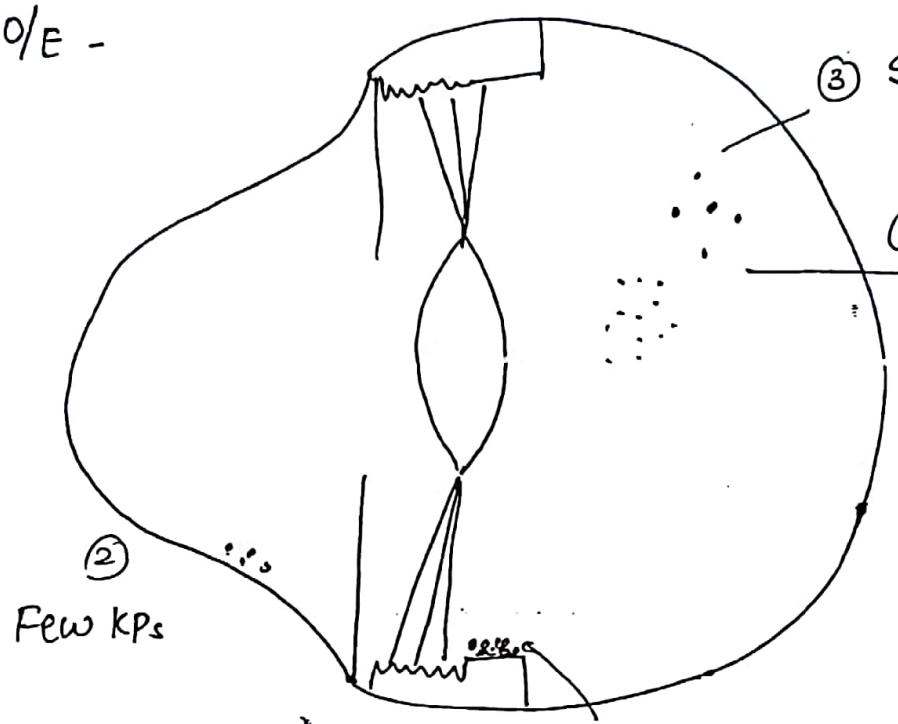
Drugs being studified – Voclosporin

INTERMEDIATE UVEITIS

1) Young ♂

2) C/F - Blurring of vision (U/L)

3) O/E -



℞

Indications -

1) if vision goes ↓ < 6/6

2) ↳ it is a/w CME.

☆ I → IV Step Approach

(I) LOCAL STEROIDS

Subtenon injen of Triamcinolone acetate

↓

(II) SYSTEMIC STEROIDS

↓

(III) APPLY CRYO corresponding to snow banking

damaging blood supply of snow banking

(IV) PARS PLANA VITRECTOMY

clear blurring of vision

Bulk of inflammation ↓ hence pt respond to t/t now.

C/F

POSTERIOR UVEITIS

[1 Image]

① CHOROIDITIS
round yellow patches

② VITRITIS

③ Papillitis

④ Retinal edema

⑤ Cystoid Macular Edema

⑥ Periphlebitis
Hallmark feature ⇒ Venous sheathing.

Periphlebitis

Rx -

1) Local Steroids
Subtenon inj^{n} of Triamcinolone Acetate

2) Systemic steroids

DISEASES ASSOCIATED C UVEITIS

1) ARTHRITIS

- HLA-B27 associated
- Sero-negative. - RF ⊖ve
- Non-Granulomatous Ant. Uveitis

1) ankylosing spondylitis
2) psoriatic arthritis
3) Reiter's syndrome

TRIAD

a) Urethritis
b) arthritis
c) conjunctivitis.

4) JRA. - early onset pauciarticular sero-neg.

JRA -

arthritis of <16yrs

Classification

- Pauci articular — <5 jts
  - Early onset → associated ~ Uveitis
  - Late onset
- Poly articular — ≥ 5 jts
- Systemic onset — Still's Ds

Atypical Uveitis → white Uveitis. [in JRA]
↳ (5) features absent
↳ No redness

Child presents ~ complication.

- Complicated cataract
- 2° Glaucoma
- Band shaped keratopathy Q.

2) SARCOIDOSIS

OCULAR FEATURES

a) Sarcoid nodules on episclera & sclera.

b) Interstitial keratitis } cornea
   Band shaped keratopathy }

c) ~~Granulo~~ Granulomatous Pan Uveitis.

d) Venous sheathing of periphlebitis in sarcoidosis is very thick like candle wax
   ↳ Candle Wax Dripping Sign [Image] QQ.

Landau's sign:-
Pre-retinal nodules

---

3) BEHCET's Ds / Transient Hypopyon Syndrome

Obliterating vasculitis due to circulating immune complexes.

HLA B5
HLA B51

Pt presents :- Recurrent Hypopyon.
Non-Granulomatous < ant. post

4) EALES Ds / PERIPHLEBITIS RETINAE

- Recurrent Vitreous Haemorrhage
- young ♂
- HSN Reac towards Tubercular Ag. [Type IV HSN]

O/E - 1) Venous sheathing
2) Vitreous haemorrhage

Rx -
1) Check for active TB
↓
Start ATT if yes.

2) Mx of vitreous haemorrhage

- Partial → Posture management → propped up position for drainage. → Blood doesn't come before macula
- Total → Pars Plana vitrectomy

57 HIV

M/c ocular feature → Microangiopathy
manifest as
a) H'ge
b) Micro aneurysm
c) Cotton wool spots ← Most Imp
(Soft exudates)
↓
Composed of axonal debris

M/c opportunistic Inf"
CMV Retinitis
↓
Sauce x cheese retinopathy
H'ge necrosis (Image)

Microaneurysm	Macroaneurysm
① Diabetic Retinopathy	HTN Retinopathy

$\gg 100\mu$

* Other opportunistic Infn :-

1) Toxoplasmosis
2) Pneumocystis carini
3) Herpes zoster → ARN [Acute Retinal Necrosis]

} cause choroiditis

Rx -

1) Anti-HIV Drugs.

Pt is on HAART therapy

↳ H/c ocular S/E ⇒ Immune recovery Uveitis

↓

Non Granulomatous Post. Uveitis (Vitritis)

6) TOXOPLASMOSIS

Ant. | Post

↓

Intense Vitritis

QQ. Head Light in fog appearance (Toxo) → Tattoo.

Gr. | Non. Gr.

Presents c Punched out Pigmented Lesion (Image) mainly involving Macular area

Rx → Clindamycin.

7> SYPHILIS

Ant. / Post

Post → Diffuse chorioretinitis → Salt & Pepper Fundus

Post → Localised choroiditis → Q. Juxta-papillary Choroiditis

Gr. / Non. Gr.

Non. Gr. → IRIS ROSEOLA

Rx - Penicillin

8> TB

Granulomatous Panuveitis

- M/c Ocular → Uveitis
- M/c allergic → Phlyctenular Keratoconjunctivitis [Type IV HSN]

Rx - ATT.

9> VKH [Vogt Koyanagi Harada Syndrome]

Granulomatous Panuveitis + Systemic Features

HLA-DR4

1) encephalitis — VV TAEP
2) Vestibular Dysfunc
3) Tinnitus
4) Alopecia
5) Vitiligo (Suguiras sign)
6) Poliosis

Uveitis + encephalitis ⇒ VKH Syndrome.

107 SYMPATHETIC OPHTHALMITIS

Perforating injury in 1 eye causing uveitis in the othe eye

↓

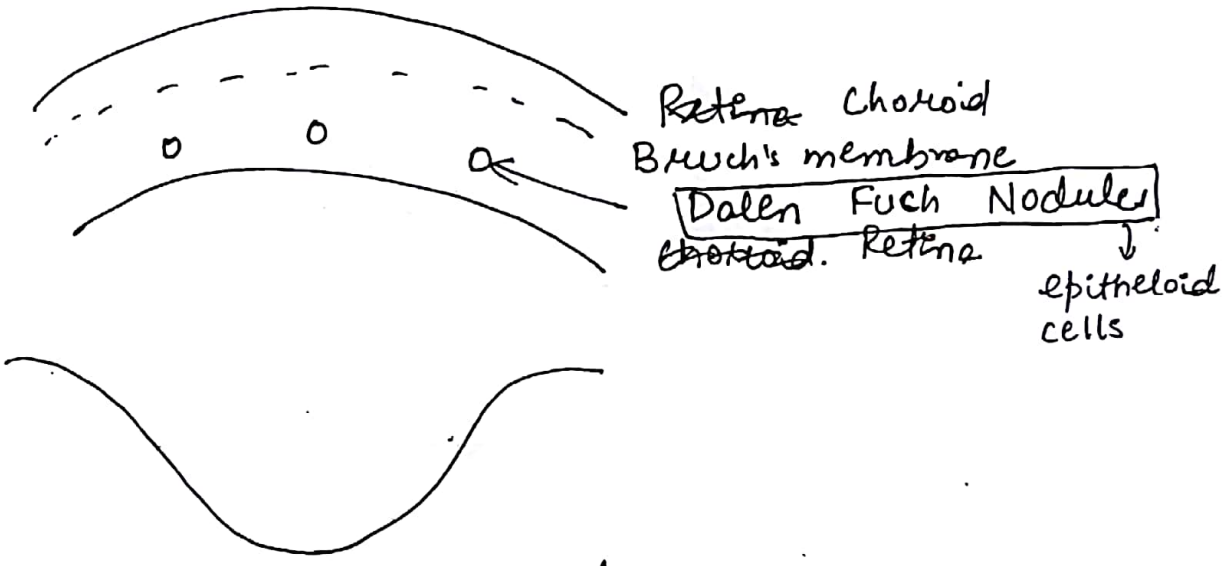
causing autoimmune reac" in uveal tissue

↓

Never before 2 weeks.

Max. cases manifest bet" 2 weeks to 3 months

Granulomatous Panuveitis



1st sign of → Retrolental flare

1st symptom → Difficulty in near vision

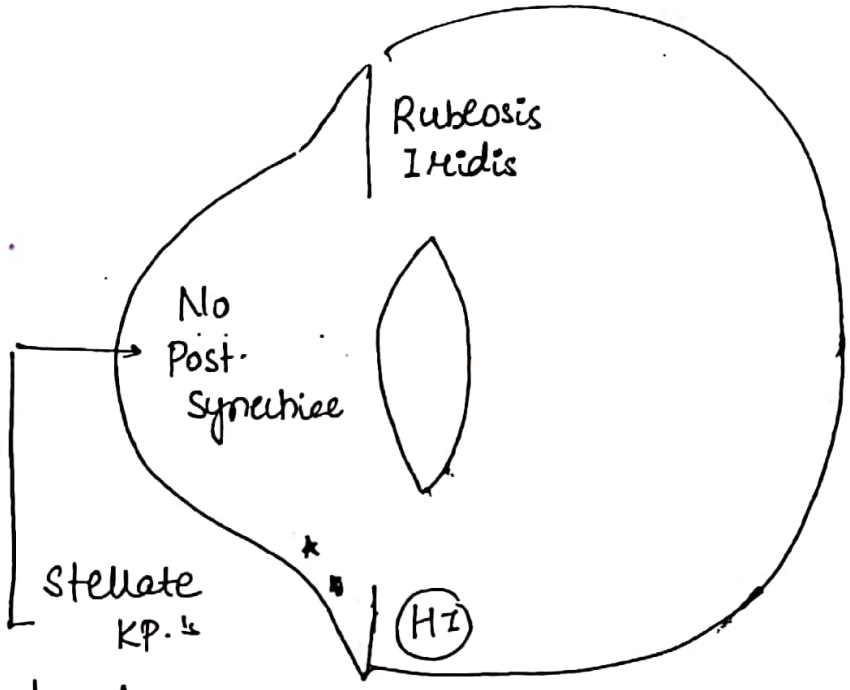
Dangerous area of Eye :- CILIARY BODY

↓

Bcoz. any trauma to ciliary body is a big risk of sympathetic ophthalmitis

117 FUCH's HETEROCHROMIC CYCLITIS

- Atypical Ant Uveitis
- Non-Gr Ant-Uveitis.
- U/L → characterised by Heterochromic Iridis



No role of Steroids & Cycloplegics.

Pt. presents c/ complicated cataract
2° Glaucoma.

IOL & c/I in JRA.

127 ONCHOCERCIASIS

RIVER BLINDNESS

caused by Onchocerca Volvulus

Non-Granulomatous : Ant / Post

cause of Blindness - Sclerosing Keratitis
It is included in Vision 2020.

℞ - Ivermectin.

13) OPHTHALMIA NODOSUM

- Due to intense Granulomatous inflammation
- Due to Caterpillar Hair in Eye

VISION 2020

WHO programme to control 5 Disease by 2020.

INDIA

1) Cataract
2) Trachoma
3) Onchocerciasis
4) Childhood Blindness
5) Refractive Errors

No onchocerciasis

+

3 < DM, Glaucoma, Corneal Blindness

LEPROSY:- Ocular involvement more in Lepromatous Leprosy than tuberculoid leprosy.
Iris Pearls - pathognomic feature.

CONJUNCTIVA

Thin mucous membrane over the ocular surface

CONJUNCTIVITIS

Inflammation of conjunctiva

C/F :- (5) features. + F.B. sensation + Discomfort to eye.

Redness - Conjunctival

D/C - depends on etiology.

Bacterial ⇒ Purulent

Chlamydial ⇒ Mucopurulent

Viral } ⇒ Watery.
Allergic }

Pathology

Follicular → Formation of follicles. → aggregation of lymphoid cell

Papillary → Epithelial Hyperplasia

T/t

B } → Antibiotic
C }

V ⟶ Antibiotic to prevent 2° infn

A ⟶ antiallergics + steroids (mild)

MEMBRANOUS CONJUNCTIVITIES

All features + Membrane formation.

- Bleeds on peeling. Q
- cause - Corynybacterium Q. Diphtheriae

PSEUDOMEMBRANOUS CONJUNCTIVITIES

All features + Membrane formation.
↳ doesn't bleed on peeling

cause → 1) mild diphtheriae
2) severe adenoviral infn
3) streptococcus haemolyticus.

ANGULAR CONJUNCTIVITIES

Conjunctivitis at 2 canthi ~ excoriation of skin.

causes - 1> Moraxella Axenfield Q
" Lacunata
" Catarrhalis

2> Staph aureus

Rx Antibiotic Drops
Q ZnO → inhibits proteolytic enzymes

HAEMORRHAGIC CONJUNCTIVITIES

S Conjunctivitis + Subconjunctival haemorrhage

Cause

Q Bacterial — Pneumococcus, Haemophilus

Viral Q.

1) Enterovirus - 70
2) Adenovirus
3) Coxsackie 24
4) Echovirus 34

CAUSES OF SUBCONJUNCTIVAL HAEMORRHAGE

1) Haemorrhagic Conjunctivitis
2) Trauma
3) HTN
3) Bleeding Diathesis
4) Whooping Cough.

TRACHOMA

Chronic conjunctivitis of children

Age - 1-9yrs

Cause - Chlamydia A, B, Ba, C Q.

Chlamydia D to K ⇒ Adult Inclusion Conjunctivitis

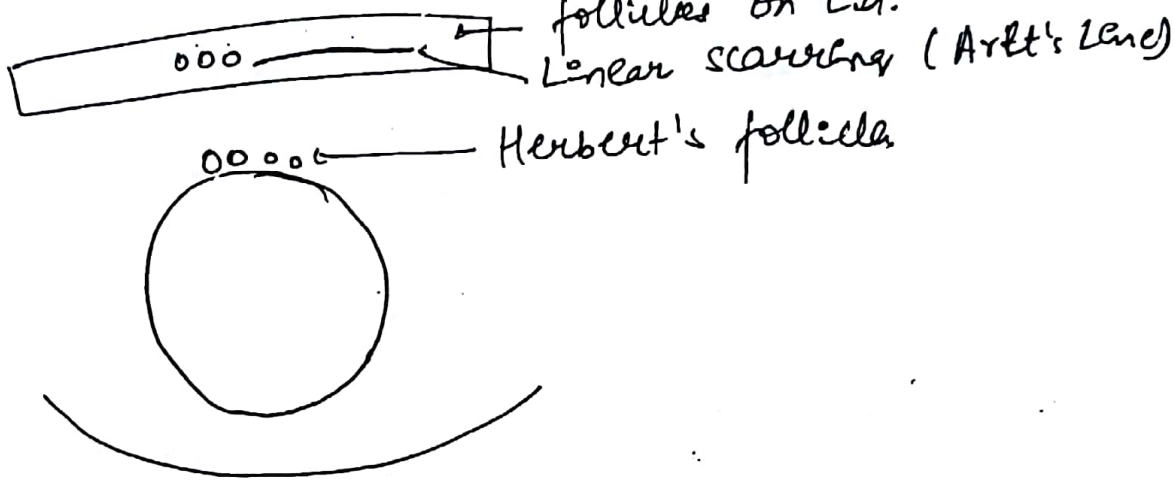
or

Q Swimming pool conjunctivitis

↳ It is also caused by adenovirus.

C/F - Itching
watering

O/E - sagogram
1) Follicles on the upper palpebral conjunctiva.
2) follicle on upper limbus ⇒ Herbert's follicle



3) Arlt's Line - Linear scarring on Upper palpebral conjunctiva

4) Herbert's pit - scarring on Herbert's follicles. (upper limbus).

WHO Classification

F → Follicle
No. ≥ 5 follicles
Upper palpebral conjunctiva.

I → Inflammatory stage
Itching
watering

S → Scarring
Arlt's Line
Herbert's pits

T → Trichiasis
misdirection of eyelash

O → corneal opacity

Complication of Trachoma ⇒ Corneal Ulcer

Pathology

Both follicular + papillary reac^{n}

Intracytoplasmic inclusion bodies
↓
HP Bodies
[Halberstaedter Prowazeki].

Community ophthalmology
→ SAFE Strategy
WHO programme to control Trachoma
S - Surgery → only trichiasis Sx
A - Antibiotics →
F - Facial hygiene
E - Environmental cleanliness

Azithromycin
1g in adults.
20mg/kg children.

Topical Tetracycline
1% ointment

Atropine ointment i also 1%

Prevalence of Trachoma follicles in Age group 1-9yr
if >10% ⇒ follow SAFE. Strategy
5-10% ⇒ F & E.

< 5% - Nothing is done.

→ Vision 2020 programme

DOC for Blanket therapy ⇒ AZITHROMYCIN.
↳ for prevention

℞ - DOC → AZITHROMYCIN QQ

Other options - 1) Tetracyclin
2) Sulphacetamide eyedrops

ALLERGIC CONJUNCTIVITIES

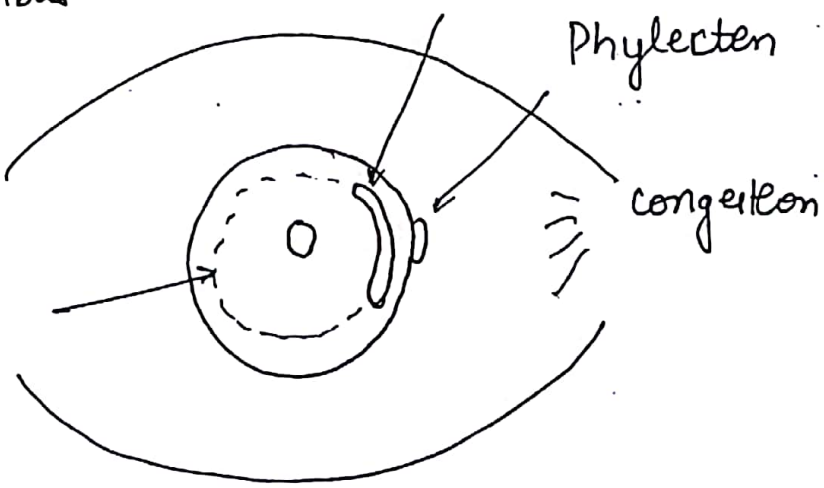
PHYLCTENULAR KERATO CONJUNCTIVITIES

Endogeneous antigen.
1) Staph aureus
2) TB

C/F
- Itching
- Watering

O/E
Phylecten at Limbus

(When cornea is involved
Fascicular Ulcer.



Fascicular ulcer
Later forms → Ring ulcer

Type IV HSN (P)

℞ ① OLOPATADINE ② EPINASTIN] → Mast cell stabilizer + Antihistaminic

③ Na cromoglycate - mast cell stabilizer

④ Steroids - fluoromethalone

VERNAL KERATOCONJUNCTIVITIS or SPRING CATARRH

1) Disease of summer

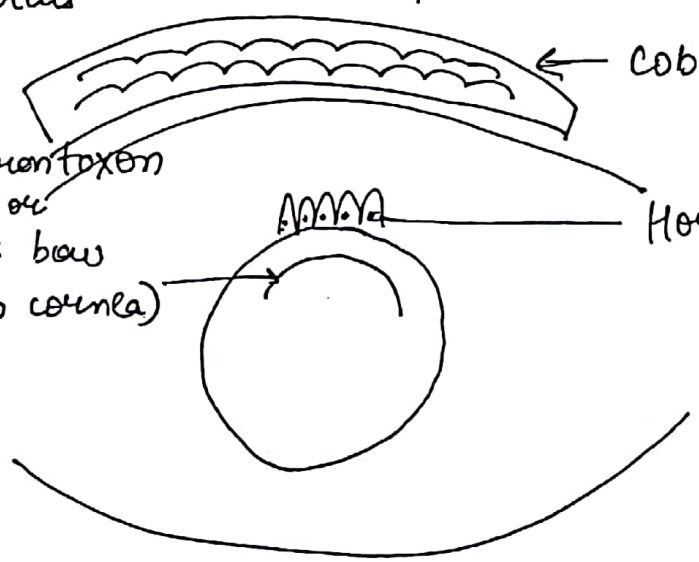
2) - Age group - ♂ children

3) Exogeneous Antigen. → Dust, Pollen.

4) No follicular Reac^{n}.

C/F- → Itching, Watering + Ropy Discharge ↓ fibrin threads in D/c

O/E- looks like arcus



→ cobblestone appearance

Pseudogerontoxon or Cullen's bow (Opacity on cornea)

Hornet Trante's spots → eosinophils ↓ Type I HSN ®

Maxwell- Lyon sign
true eosinophils in Ropy D/c

Rx - same as phlyctenular

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

OPHTHALMIA NEONATORUM

NEONATAL CONJUNCTIVITIES

Defined as conjunctivities in 1 month of age

Cause-

1) Chlamydia → H/c cause → 4-10 day
2) Gonorrhoea → 2-4 days
3) chemical conjunctivities
4) Herpes simplex virus.
5) Staph aureus

CREDES METHOD-

1% $AgNO_3$ in (B) eyes to prevent Gonorrhoeal Conjunctivities

Not followed now as it causes chemical conjunitivities

VITAMIN-A DEFICIENCY

XEROPHTHALMIA

Conjunctival xerosis.

TYPES

- EPITHELIAL XEROSES
  - xerophthalmia.
- PARENCHYMATOUS XEROSES
  - all cause of Scarring conjunctival.
    - → Trachoma
    - → all types of burn (chemical, thermal, electrical, radiational)
    - → Steven Johnson Syndrome

Alkali is more dangerous as it can penetrate eye

XEROPHTHALMIA

* WHO GRADING

X_N → Nyctalopia / Night Blindness

$X I_A$ → Conjunctival xerosis

I_B → Bitot's spots

$X II$ → Corneal xerosis

$X III_A$ → Keratomalacia $< \frac{1}{3}^{rd}$ of cornea

B → " $> \frac{1}{3}^{rd}$

X_S → Corneal scarring

X_F → Xerophthalmic Fundus
(White spotted Fundus)

Q. Earliest feature of vit A Def^n - Nyctalopia

Q. Bitot's spot more common c side → temporally

* 2° signs -

X_N ✓ (rest are 1° signs)

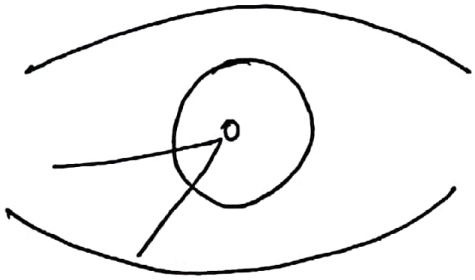
X_S ✓

X_F ✓

℞ >1yr = Inj^{n} vit A 1 lakh IU [0, 1, 14 days.]

<1yr = [Half] the dose

PTERYGIUM



Subconjunctival fibrovascular tissue encroaching the cornea.

Q. Not Inflammatory. It is connective tissue disorder.

Q. M/c side → Nasal.

ETIOLOGY

Due to exposure to UVB rays

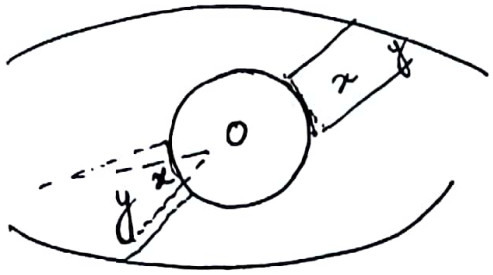
C/F-

1) Cosmetic
2) Astigmatism → curvature is affected
3) If encroaches pupil → leads to diminution of vision.

℞

→ Excision

. Recurrence is main challenge



Bare sclera Technique → High Rate of Recurrence

↓

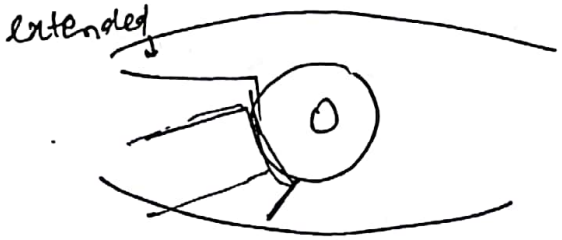
Prevent Recurrence

- Mitomycin-C
- Autografting (Best method)

PERFECT Surgery :-

[Pterygium extended Resection Followed by Extended Conjunctival Transplantation].

Recurrence = 0.



Pterygium	GLASS ROD TEST	Pseudopterygium
Not passed		Glass rod passes easily

DRY EYE

LAYERS OF TEAR

1) Lipid Layer → By meibomian Gland → helps to prevent evaporation of tear.

2) Aqueous → secreted by Lacrimal & Acc. lacrimal glands helps in lubrication

3) Mucin (Innermost) → from Goblet cells Q.
   - helps to spread tear on ocular surface
   - Max. Goblet cells → Inferonasal conjunctiva

Deficiency of any of the 3 layers = Dry Eye

✱ KERATOCONJUNCTIVITIES SICCA (KCS)

Deficiency of AQUEOUS Layer.

KCS + Xerostomia = 1°

↓

1° Sjogren's Syndrome

+

Connective tissue Disorder

↓

2° Sjogren's Syndrome

C/F →

1) Burning sensation
2) Gritty sensation
3) severe → Precorneal Tear film ⇒ D/W

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Inv.

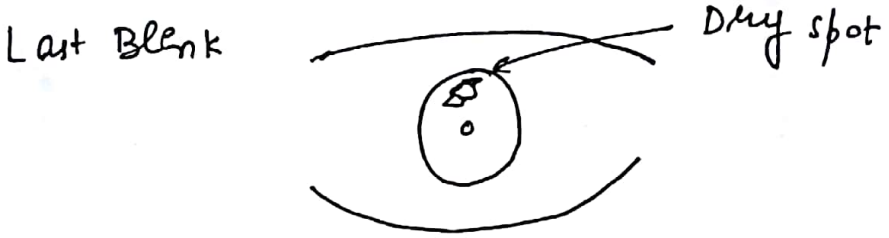
1) SCHIRMER's TEST :-

Tear strip is put under lower lid for 5 mins

Any wetting of $\boxed{< 5\ mm}$ = severe Dry Eye

2) TEAR FILM BREAK UP TIME :- (BUT)

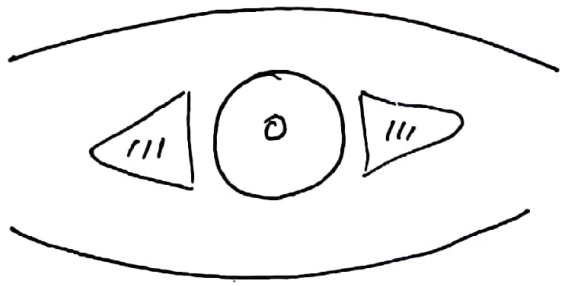
From Last Blink, how much time is taken for 1st dry spot to appear



If <10 sec → Dry Eye

3) ROSE BENGAL STAIN :-

Stains dead cells, mucus



4) TEAR OSMOLALITY -

↑ seen in patients of Dry Eye

AIIMS 00

PHENOL RED DYE Test :- measures the production of tears ↓ Out topical anaesthesia, as the dye changes its colour to red on contact ↓ tears. It doesn't require pH meter for reading the result

Rx

MEDICAL

↓

Lubricatory Eye Drop

↓

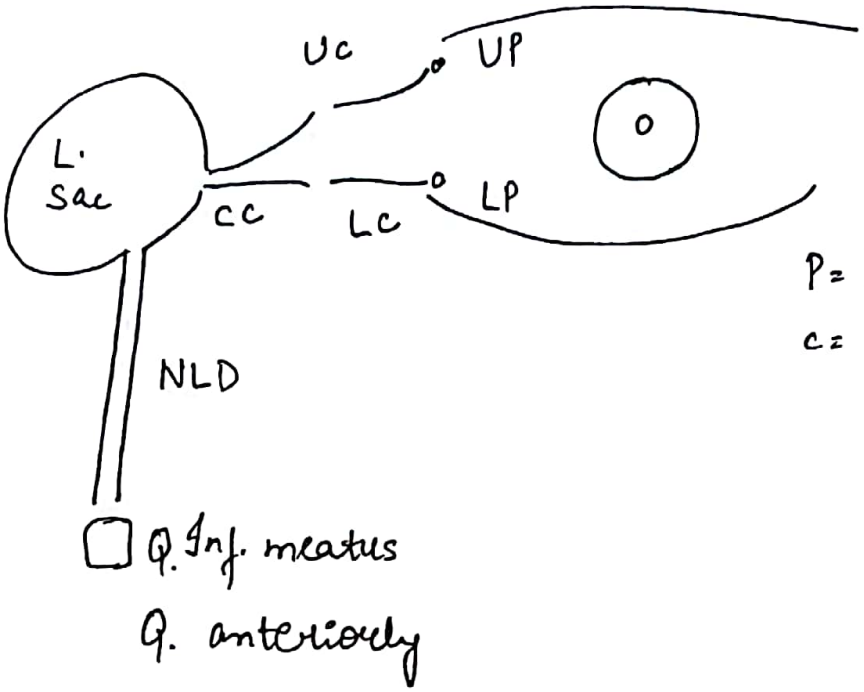
Methyl cellulose derivatives

SURGICAL

Lacrimal punctal occlusion.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

LACRIMAL DRAINAGE SYSTEM



P = Puncta
c = canaliculi

Q. On closing eyes → arrangement of puncta
↓
UP is medial to LP.

WATERING

Due to overproduc" → LACRIMATION

overflow → EPIPHORA.

* whenever drainage system blocked ⟷ Epiphora / Discharge.

Inv -

1) Regurgitation Test -
pressing on medial canthus, when water + pus regurgitate, test is +ve.

2) Syringing -

→ If regurgitation is from opposite punctc
↳ indicate blockage in common canaliculc & forward

— If regurgitation is from same punctc
↳ punctc itself is blocked

→ partial obstruction can be opened by syringing

3) Dacrocystography
Inject dye in tear
↓
Radiography

4) Dacryoscintillography -
Radioactive dye is used.

DACRYOCYSTITIS

Inflammation of lacrimal sac.

- CONGENITAL
- ACQUIRED
  - ACUTE
  - CHRONIC

CONGENITAL DACRYOCYSTITIS

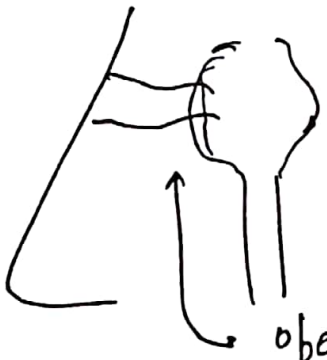
ETI- due to non-canalisation of NLD.

C/F - epiphora
Discharge

Rx - < 6 months → Massaging ē antebiotec eye drops (CRIEGLERS MASSAGE)

6-18 months → Best result - is by Probing.

>18 month → Best result is by DCR



Dacryocystorhinostomy

opening is made in Middle Q. meatus.

Q. DCR → from 4yr onwards. → 70yr

↓

>70yr - atrophy of nasal mucosa

Q. When does tear Production starts?

6 weeks. → (Reflex teer production.)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

ACQUIRED DACRYOCYSTITIS

ACUTE

C/F. → Epiphora
→ Discharge
→ Acute Inflammation

Rx - control Inflammation ī antibiotics / anti-~~allergy~~ inflammatory.
↓
DCR

Q. Sequelae → Lacrimal fistula
↓
Rx = DCR.

Q M/c. Etiological agent → Staph. aureus.

CHRONIC

♀ > ♂

Q. M/c Etiological agent - Staph. aureus > Strepto. pneumoniae

C/F- Epiphora
D/S

Rx - DCR.

Sequelae → Mucocele formation.
↓ infected
Pyocele formation
↓
Lacrimal fibrosis

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Rx of Lacrimal fibrosis → Dacryocystectomy

Q. M/c ocular feature of MUMPS?
⇒ Dacryocystoadenitis.

Q. M/c ocular feature of MEASLES?
⇒ Vit. A Deficiency

Q. SNOW BLINDNESS/ PHOTOOPHTHALMIA ?
→ Injury by UV B rays.
→ Reflection from snow

C/F- corneal epithelial necrosis

Rx- Pad + Bandage ī antibiotic ointment

Q. PHOTO - RETINITIS ?
→ Injury by Infra-red rays
→ Directly looking at Solar eclipse ī unaided eye
→ C/F- Macular Burn.
↓
Macular scar.

No effective Rx.

CAUSES OF NYCTALOPIA

1> Vit A Deficiency

2> Retinitis Pigmentosa

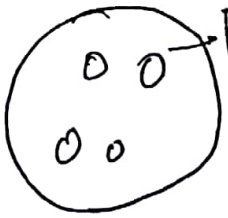
3> High Myopia (>6D)

4) Late stage of POAG.

5) **Oguchi's Disease**
   - ↳ Congenital stationary Nt. Blindness
     - Pale fundus
     - Mizou's phenomenon
       - ↳ Sitting 1 hour in dark
         - No night Blindness
         - Fundus is (N)
         - Occurs due to overstimulation of rods

6) Choroideremia } choroidal dystrophy
7) Gyrate atrophy }
   - ↳ due to Def" of Ornithine aminotransferase or transcarbamoylase

Fundus exam" → atrophic patches on choroid



Rx → Arginine free diet

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

CAUSES OF HAMARLOPIA (Day Blindness)

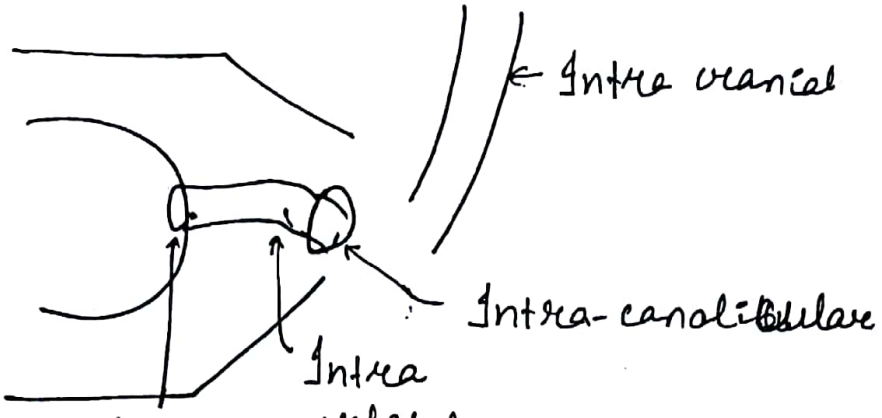
1> Central corneal opacity

2> " lenticular "

3> Congenital absence of cones

4>

NEURO- OPHTHALMOLOGY



(shortest) (1mm)

(Longest Part) (2.5 - 3cm)

Q. Structures passing through optic canal

Q. Sup. div. III Nasociliary n/v Abducent n/v Inf Div. of IIIrd

N/V s → L Lacrimal
F Frontal
T Trochlear

LR 6 SO 4 → LPS m/s

SR → by sup. div. of III rd n/v

MR, IR, IO → by Inf. div of III rd n/v

OPTIC NEURITIS

[Optic n/v Disease]

Defn- Pathological condn of optic n/v where n/v impulse transmission is hampered

C/F :-

1) ↓ visual acquity
2) Visual field Defects
   - Central Scotoma
3) Afferent Pupillary Defect – 1st Sign
   (Something away from (N) pupillary rear
4) ↓ Color ~~Brightness~~
5) ↓ Brightness

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

CLASSIFICATION

ANATOMICALLY

- PAPILLITIS
  - Blurred disc margin
- RETRO-BULBAR NEURITIS
  - Fundus - (N)
  - Pathognomic feature
    - RAPD
      - Diagnosed by swinging flash light test
      - Marcus-Gunn Pupil
    - Pain on elevation.
      - sup. rectus has connect ⊂ myelin sheath of optic n/v
      - on elevation → m/s stretched → cause pain.
- NEURO-RETINITIS
  - Papilla
  - Macular star (deposition of hard exudates)

ETIOLOGICAL

1) Inflammatory
2) Degenerative
3) Autoimmune
4) Hereditary
5) Ischaemic

AIIMS

Most likely Δ in the pt who presents ⊂ painful u/l dimness of vision ⊂ h/o of persistence of after image = Retrobulbar neuritis

ETIOLOGICAL

1) INFLAMMATORY –
All causes of post uveitis.

2) DEGENERATIVE –

Multiple Sclerosis

Toxic amblyopia Q

Cause
1) Tobacco
2) Ethambutol
3) Chloroquine
4) Ethyl alcohol
5) Methyl alcohol

TOBACCO

Bs – Blind spot

Macula

Centro-caecal Q.
Scotoma

METHYL ALCOHOL

Directly damages ganglion cell.
hence more dangerous.

Ocular effects of chloroquine

- Post. Subcapsular cataract
- Optic neuritis
- Bull's eye Maculopathy
- Vortex keratopathy

whorl-like / v-shaped

Cornea verticillata } other name

* Other causes of Vortex Keratopathy -

1) chloroquine
2) Amiodarone
3) Tamoxifen
4) Indomethacin
5) Fabry's Disease
6) Chlorpromazine ✓ all except.

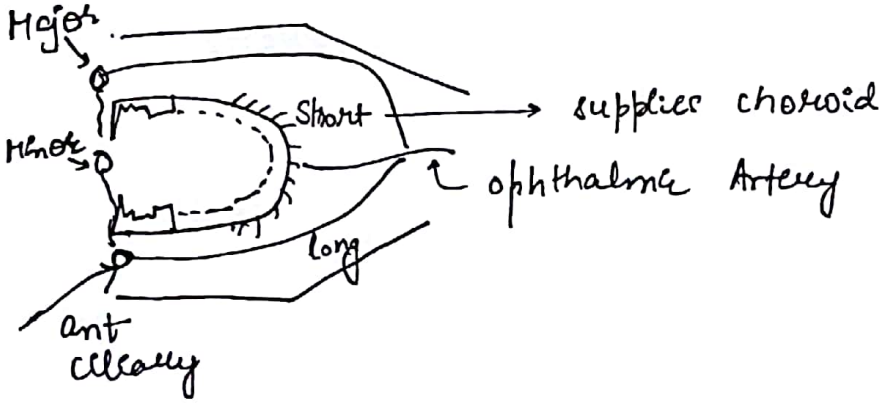
[CAT In Fab Colour]

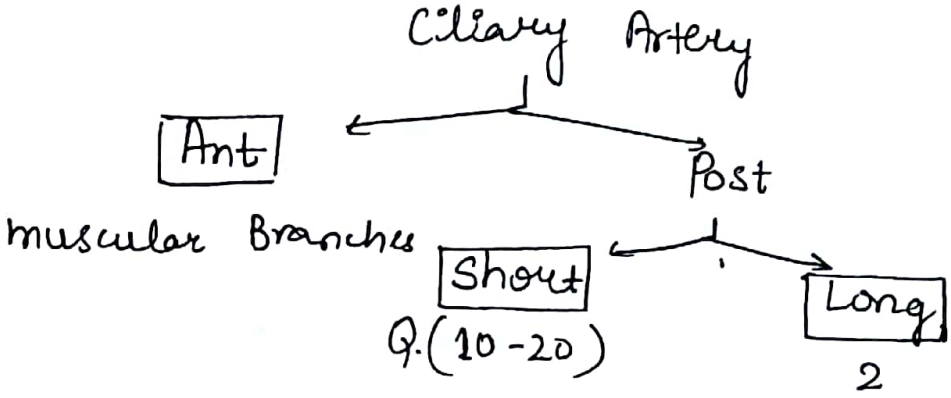
3) AUTOIMMUNE OPTIC NEURITIS -

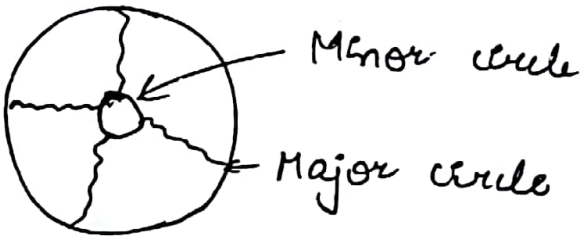
optic neuritis in all connective tissue Disorder

4) ISCHAEMIC ON -

AION → Ant Ischaemic optic neuropathy







Inner 6th Layer of Retina ⇒ supplied by Central Retinal artery

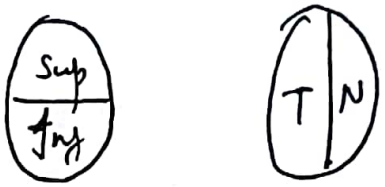
Outer 4 Layer of Retina ⇒ supplied by short post-ciliary artery

A. Ant. Ischaemic Optic Neuritis

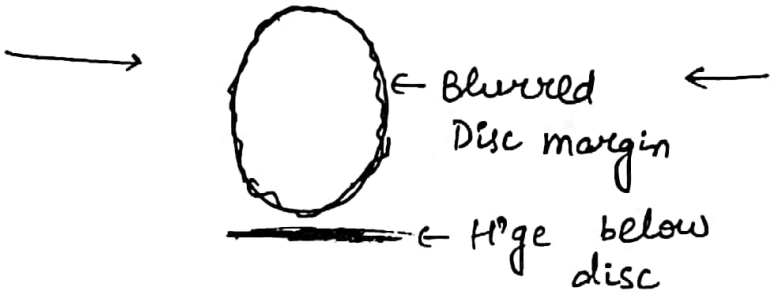
Due to blockage of short Post. Ciliary artery

ARTERITIC	NON-arteritic
Etio - Giant cell arteritis	Etio - (×)
	Major R/F = HTN ↓ (Nocturnal Hypotension)

ARTERITIC	NON-ARTERITIC
1) Sudden painful D/V Visual acquity ↓↓↓	1) Sudden painless D/V Visual acquity ↓
2) Amaurosis fugax transient loss of vision	2) Altitudinal field Defect



O/E



℞ I.V. steroids for 4-5day

↓

Oral steroids

5) HEREDITARY OPTIC NEURITIS/ LEBER's Hereditary optic neuretic

Mutation in maternal mitochondrial DNA

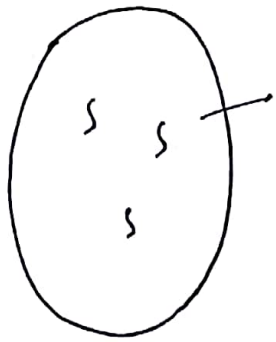
C/F - (R) Optic N. —followed by→ (L) O.N. in other eye.

optic atrophy ⟶ optic atrophy.

NO APD

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

O/E.



→ Telangectatic vessels on disc

No effective Rx.

PAPILLOEDEMA

Oedema around disc.

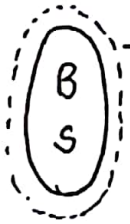
C/F- 1) visual acquity (N)

2) Pupillary Reac^{n} (N)

3) Colour (N)

4) Brightness (N)

5) Visual Field Defect-



→ Q. enlargement of Blind spot

BS - Blind spot

1st sign of papillodema → Venous dilatation

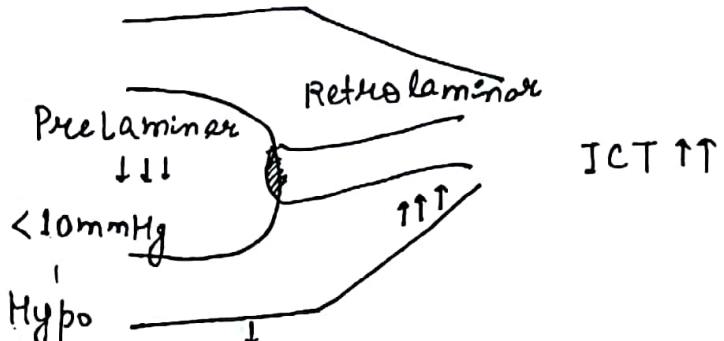
→ Blurred disc margin.

Rx- Rx the cause

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

CAUSES -

PATHOPHYSIOLOGY



↓

Disturbance of pressure gradient across Lamina cribrosa

↓

Stasis of axoplasmic flow

↓

swelling of axons

↓

Pressure on veins

↓

Leakage

ETIOLOGIES

(I) INTRAOCULAR CAUSE

Any cause of Hypotony

- Trauma
- Surgery
- Chr. uveitis → Ciliary shutdown.

(II) INTRAORBITAL CAUSE

↑↑ Pressure in orbit

- Inflammation
- Tumour
- Thyroid disease

(III) INTRACRANIAL CAUSE.

↑ ICT

- Tumour
- Encephalitis
- Abscess
- Benign HTN
- Pseudotumour cerebri

↓

↑ ICT → B/L papilloedema

CT scan / MRI (N)

CSF (N)

⇒ Imbalance of formation, Reabsorption of CSF

Causes

1) OBesity
2) Vit A toxicity
3) OCPs
4) Tetracycline

(IV) SYSTEMIC CAUSE-

- MALIGNANT HTN
- SEVERE ANAEMIA

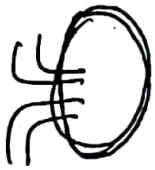
OPTIC ATROPHY

→ All n/v fibres are damaged

→ Pt - Blind

→ TAPD (Total afferent Pupillary Defect)

CLASSIFICATION

1°	2°	Consequetive	Glaucomatous
Cause Brain	optic n/v	Retina	Glaucoma
			
Clear disc margin	Blurred disc margin	clear margin	Cupping nasal shifting
Chalky white	Dirty white	Waxy disc	
Multiple sclerosis Neurosyphilis	Papillitis Papilloedema	Retinitis Pigmentosa Diffuse choroidretinitis	Glaucoma

(N) PUPILLARY REACTIONS

▷ LIGHT REFLEX-

Light → Constrict^{n} of Pupil

→ Direct

→ Consensual

2) NEAR REFLEX / ACCOMODATION REFLEX :-

Convergence + Miosis → Accomodation.

3) PSYCHOSENSORY REFLEX :-

Anxiety ⟶ Dilatation of Pupil

↳ Dilator Pupillae → Sympathetic

↳ Iris sphincter → Parasympathetic

Ab (N) PUPILLARY REACTIONS

1) RAPD

↳ Retrobulbar Neuritis

↳ By swinging flashlight Test

↳ also called Marcus Gunn Pupil

2) TAPD – PR (−)

↳ Optic atrophy

3) Argyl Robertson Pupil

Light - Near Dissociation.

Accomodation Reflex +nt, Lt Reflex (−)

due to Lesion in "Pretectal Nucleus"

Neurosyphillis.

4) HOLMES - ADIE / TONIC PUPIL :-

C/F - 1) Sluggish Light Reflex
2) " Accomodation Reflex
3) " Tendon Reflex.

Q. Position of Pupil → "MID - DILATED"
Vermiform movement of iris seen.

5) HORNER SYNDROME

Lesion of "sympathetic chain."

C/F → 1) Ptosis
2) ↳ mild

LPS → III rd n/v
Muller → sympathetic
↓
2mm of lid elevated

2) Miosis
↳ due to uninhibited action of iris sphincter

3) Enophthalmos
↳ due to ptosis. , apparent enophthalmos.

4) Anhydrosis
↳ loss of sweating

5) Loss of cilio-spinal reflex
↳ Pinching @ nape causes dilatation of pupil

Best described by → ① Ptosis + ② Miosis

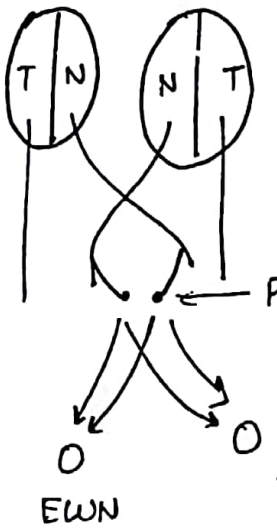
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Q. Horner's → (B) Congenital & Acquired

Congenital → Heterochromia Iridis.

PUPILLARY LIGHT REFLEX PATHWAY

AFFERENT



Lesion → (ARP)

- Pretectal nucleus
- Edinger Westphal nucleus

} explains consensual light reflex

EFFERENT

III rd N/v

↓

Inf. Div

↓

N/v to Inf. oblique (Q)

↓

HOLMES ADIE Pupil Lesion

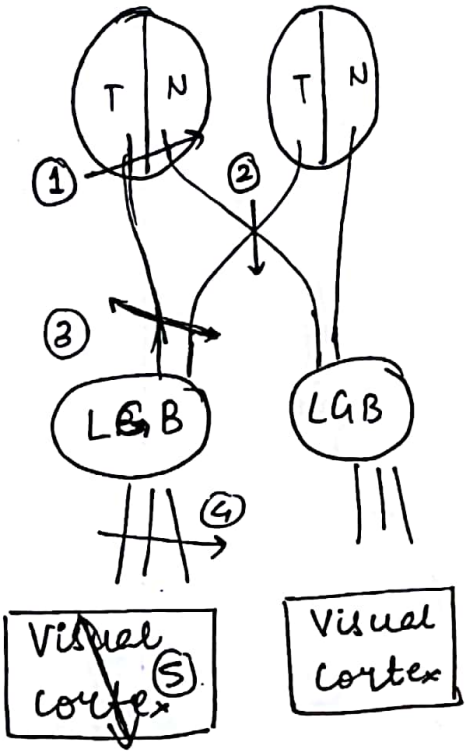
- Ciliary Ganglion
- ↓
- Short ciliary N/v
- ↓
- Iris sphincter

* 2 Internal m/s supplied by III rd n/v

1) Iris sphincter

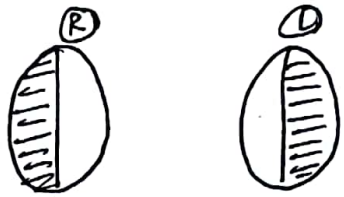
2) Ciliary m/s

LESIONS OF VISUAL PATHWAY



① Ipsilateral Blindness

②



Bitemporal Hemianopia / Heteronymous

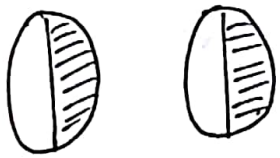
③

Incongruous Homonymous Hemianopia

↓

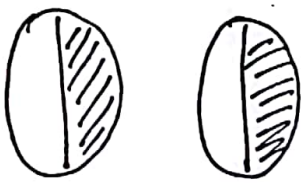
Scotoma not in continuity

④



Incongruens. / congruous. Homonymous Hemianopia

⑤



Congruens Homonymous Hemianopia

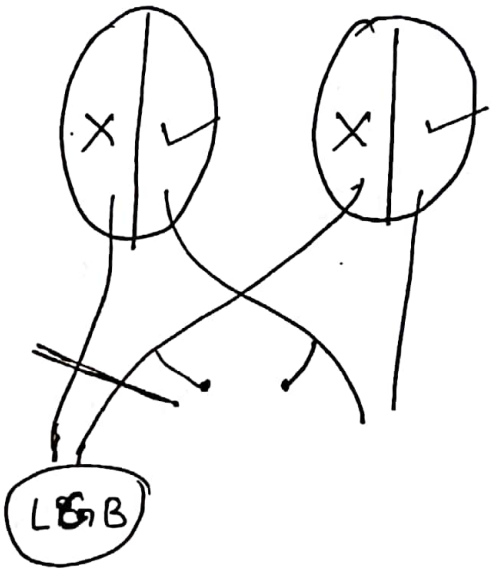
only Lesions ⑤ are Heteronymous = CHIASMAL

Chiasma is affected in Pituitary Adenomas
Craniopharyngiomas
Aneurysm circle of Willis.

WERNICKE'S HEMIANOPIC PUPIL :-

feature of optic tract Lesion.

Radiation Lesion :
Cortical Blindness
Pupillary Reac" are (N)



OPTC RADIATION

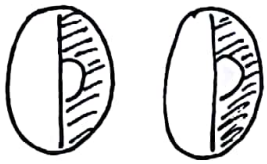
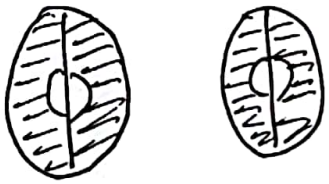
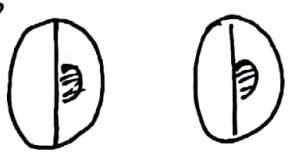
Temporal lobe → Inferior fibres (MEYERS LOOP) → ← sup. quadrantopia [Pie-in Sky]

fibres passing through.

Parietal Lobe → Superior fibres (BAUMS LOOP) → Inf. quadrantopia [Pie in floor]

VISUAL CORTEX

Supplied by

- Post. cerebral Artery
  - 
  - Macular sparing Hemianopia
  - (B) side PCA gone
  - 
  - Keyhole / vision Tunnel
- Middle cerebral Artery
  - Supplies Macular area
  - 
  - Total macular H.H. seen when there is direct trauma to macular area
  - Not seen in vascular blockage as (B) arteries supply macula

- 1^{0}
  - 17, .
- 2^{0}
  - 18, 19
  - Visual association areas.

I

II

III

IV → Thickest Layer. $a, b, C_{\alpha}, C_{\beta}$

V

VI

Q. Max. optic Radiation fibres terminate in Layer IV of visual cortex.

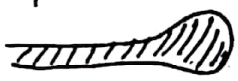
LATERAL GENICULATE BODY

I, II — Magnocellular

III, IV, V, VI — Parvocellular.

Q
1, 4, 6 → C/L supply
2, 3, 5 - I/L supply

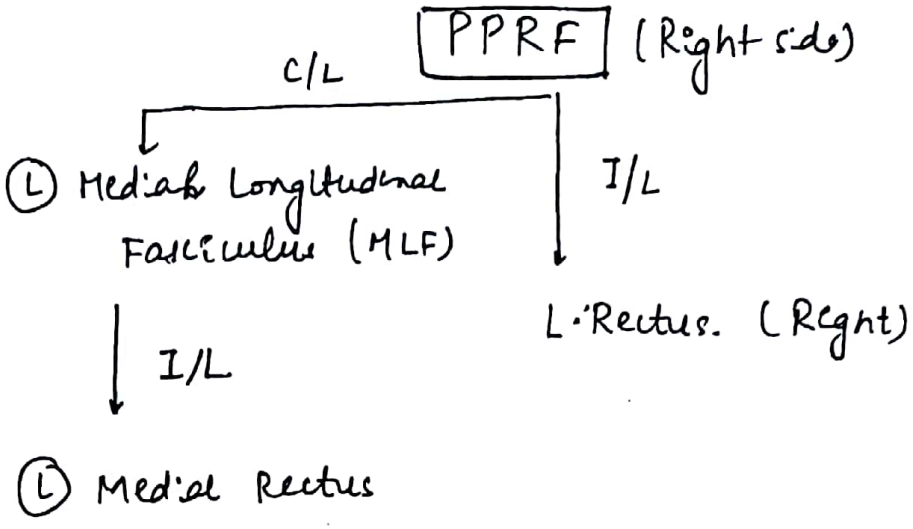
Q
AIIMS Q
Keyhole visual field Defect



HORIZONTAL GAZE CENTRE

YOLK M/s → C/L Synergists.
M/s of Diff eye → ~~sat~~ synergising action

Horizontal Gaze centre → PONS. - PPRF
(Paramedian Pontine Reticular Formation)

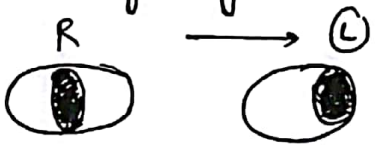


? Any Lesion of MLF → Internuclear ophthalmoplegia (INO)

INO

1) Defective I/L adduction (Medial Rectus won't work due to Lesion of MLF)

2) C/L abducting eye shows ataxic nystagmus



Lesion of (R) side

IIIrd NERVE PALSY

1) Down + Out + Intorted

Depressed + Abducted

2) Defective / Restricted ocular movement

3) Ptosis

4) Fixed & dilated Pupil

5) Accomodation — absent

EXTERNAL OPHTHALMOPLEGIA
↓
only EOM. involved

INTERNAL OPHTHALMOPLEGIA
↓
only internal m/s
↑
Internal ciliary Sphincter

TOTAL O.
↓
(B) are involved
(Ext + Int)

Q. WEBER's SYNDROME

III rd N/V Paly + C/L Hemiplegia

Q. BENEDICKTS SYNDROME

III rd N/V Paly + C/L Hemitremors

Q MIYARD - GUBLER SYNDROME

6th N/V Paly + C/L Hemiplegia

Q FOSTER - KENNEDY SYNDROME

→ IL optic atrophy
→ CL Papilloedema

Frontal lobe Tx & olfactory groove Tumours

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

NYSTAGMUS

Involuntary To & Fro Movement of Eye

- ANATOMICALLY
  - PENDULUM
  - JERKY
  - MIXED
- ETIOLOGICALLY
  - PHYSIOLOGICAL
  - PATHOLOGICAL
    - Sensory Deprivation.
    - Motor Imbalance

PHYSIOLOGICAL

1) Extremes of Gaze

2) Oculovestibular Reflex (COWS)

3) Optokinetic Nystagmus (OKN)

- Saccadic — Fast abrupt movement to reflex object on fovea
- Pursuit — Slow following movement

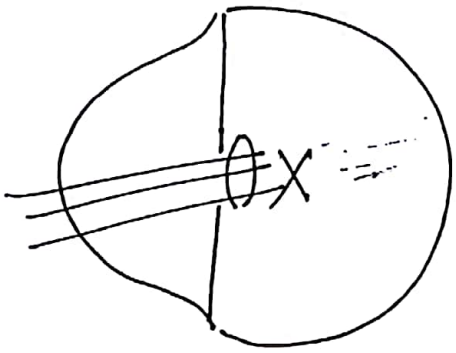
Ⓠ Defective optokinetic Nystagmus
↳ Lesion → Parietal Lobe

Q Optokinetic Drum Test -

objective Test to catch malingering Functional Blindness

PATHOLOGICAL

(I) SENSORY DEPRIVATION



Foveal reflex develop by 5-6 month

Opaque media in 5-6 months of age can lead to nystagmus

↓

Pendular

(II) MOTOR IMBALANCE

Q 1) ATAXIC NYSTAGMUS → INO

2) LATENT " → Infantile Esotropia

↓

Convergent squint < 1 yr of age

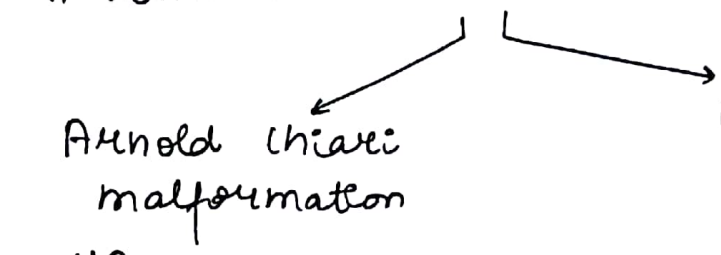
Manifest by Cover-Uncover test

3) SPASMUS NUTANS

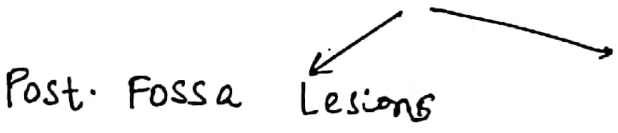
Nystagmus + Head Nodding

Pendular

4) DOWN BEAT NYSTAGMUS



5) UP BEAT NYSTAGMUS



6) SEE-SAW NYSTAGMUS

Seen in chiasmal Lesions. (Bitemporal Hemianopia)

All are jerky except spasmus nutans

* PASS-POINTING NYSTAGMUS

Nystagmoid movement

feature of cerebellar lesion

- MINER's NYSTAGMUS

Rotatory

ORBIT

Q 30cc

Q shape – QUADRILATERAL / PYRAMIDAL

Q weakest wall – MEDIAL WALL
↓
due to cribriform plate of ethmoid sinu
"Lamina papyracea"

Q. BLOW OUT # –
Floor # due to blunt trauma.
M/c site = Medial to Inf. orbital ~~e~~ fissure
(Posteromedial part)

PROPTOSIS

Protrusion of Eyeball –
Lateral orbital margin ⟶ apex of cornea
> 21 mm.

or difference btwen 2 eyes > 2mm

EXOPHTHALMOS – for thyroid disease

EXOPHTHALMOMETER – used for measurement of exophthalmos

Commonest → Hertel's exophthalmometer

In children → Leudde's exophthalmometer

CLASSIFICATION

- UL / BL
- Painful / Painless
- Axial / Non Axial
  - Straight line
  - Different direction

THYROID OPHTHALMOPATHY / GRAVE'S EYE DISEASE /

→ Autoimmune disease

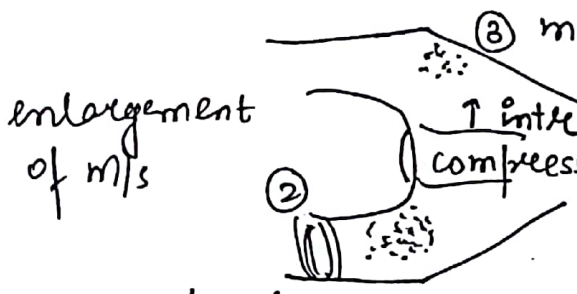
→ ♀

→ Q. Pt. can be Euthyroid / Hypothyroid / Hyperthyroid

C/F -

1) Ptosis
2) Optic Neuropathy
3) MYOPATHY
4) Soft tissue signs
5) LID Signs

PATHOPHYSIOLOGY -



↳ APD
↳ ↓ visual acquity
↳ ↓ Colour
↳ ↓ Brightness

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

R_x =

1) Systemic steroids

2) Radiotherapy → ante-inflammatory role of radio

3) Severe → **Decompression Sx**

↳ Involves breaking orbital wall

Q. sequence of wall to be broken

↓ Medial
↓ Inferior
↓ Lateral

MYOPATHY

Restrictive Myopathy

C/F → Diplopia
→ Squint

R_x - squint surgery

For an underacting m/s ⇒ Resection done
For overacting m/s ⇒ Recession

1st m/s → Inf. Rectus

Last m/s → Inf oblique

Part of m/s involved – Belly

Q. 1st Defective movement → Elevation
as the inf. rectus is fibrosed, it doesn't allow elevation.

FORCED DUCTION TEST-

To differentiate between

Paralytic pathology
↓
Sup. oblique can be elevated by forcep

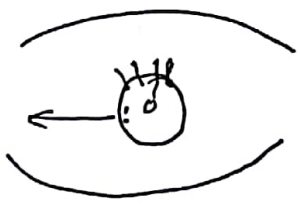
Restrictive pathology
↓
can't be elevated due to fibrosis.

SOFT TISSUE SIGN

1) edema around eyes

2) chemosis
↳ conj

3) Sup. Limbic Keratoconjunctivitis. Q



Rx = 1) Adrenaline E/D

2) Acetylcysteine E/D
↳ to dissolve mucus

LID SIGNS

(N) LOCATION - Upper lid 2mm below limbus
Lower lid touches limbus

Lid signs are due to overaction of LPS m/s

1) DALRYMPLE SIGN → Lid Retraction

2) VON GRAEFE → Lid Lag.

3) KOCHER'S SIGN → staring LOOK.
(extreme lid retraction)

4) STELLWAG SIGN → ↓ frequency of Blinking

R_x - Recession of LPS (overactive m/s t/t by recession)

Q. medical Rx of Lid Lag - GUENETHIDINE E/D.

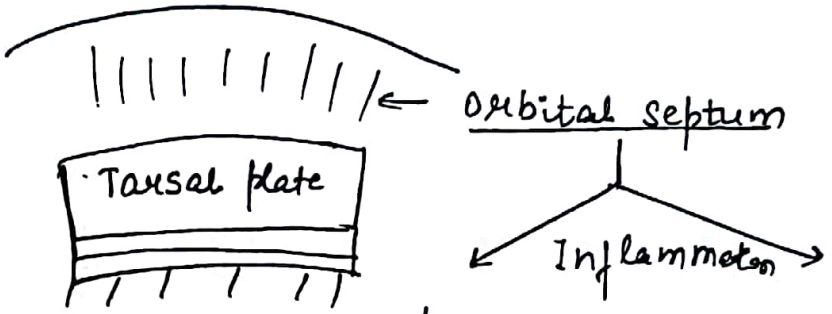
* SEQUENCE OF Sx Done In THYROID -

D Decompression
↓
S squint
↓
L Lid surgery

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

ORBITAL CELLULITIS

ANATOMY



C/F of ORBITAL CELLULITIS

1) U/L
2) Painful Proptosis
3) Restricted eye movement (Due to proptosis)
   ↳ 3, 4, 6 n/v not involved
4) Fever + malaise

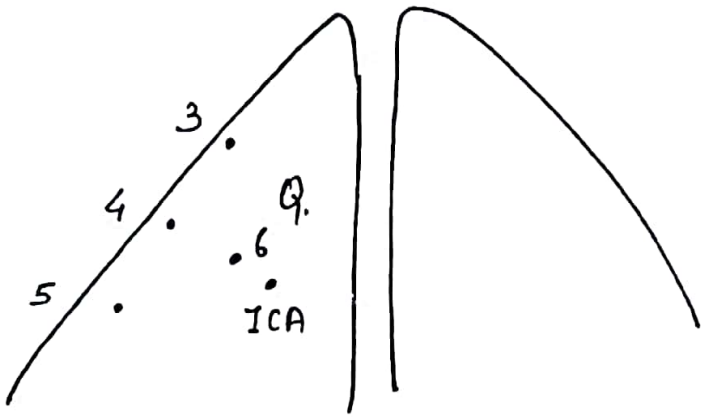
℞

Q. Ocular EMERGENCY → Becoz of risk of causing cavernous sinus thrombosis

→ Admit pt
→ start c I/V Antibiotics < aerobic, anaerobic
→ I/V anti-inflammatory

CAVERNOUS SINUS THROMBOSIS

ANATOMY



C/F -

QQ1) 1st sign → 6th n/v palsy

2) 3, 4, 6 are involved → causing total restriction of eye movement

3) Absent → L. Reflex

4) Absent → Acc. Reflex.

5) 5th → Absent Blink Reflex

6) B/L Painful Proptosis

7) B/L Papilloedema

8) Mastoid Tenderness.

9) Ptosis all except Q.

Rx 1) IV antibiotics < aerobic / anaerobic

2) IV anti-inflammatory

Prognosis - Poor

LACRIMAL GLAND TUMOUR.

NON - AXIAL

BENIGN

Benign mixed Tx / Pleomorphic adenoma
↑ H/C Tx

MALIGNANT

1) Pleomorphic Adeno carcinoma
2) Mucoepidermoid
3) Adenoid-cystic
↳ H/C malignancy
Most dangerous malignancy
↓
due to perineural invasion.

PULSATING PROPTOSIS

⇒ CAUSES :-

1) Carotico-cavernous fistula (CC). ← H/C
2) # Roof
3) NF-1

] Intracerebral pulsations are transmitted

INTERMITTENT PROPTOSIS

changes ∝ head posture

Cause - Orbital Varices QQ

ONE - LINERS -

QQ. M/C Intra ocular malignancy

Children → RETINOBLASTOMA

Adults → 1) CHOROIDAL MALIGNANT MELANOMA
2) METASTASIS

Q M/C Intra orbital Malignancy

Children → RHABDOMYOSARCOMA

Adults → NON - HODGKIN's LYMPHOMA
B cell type

Q. M/C Intra-orbital Tx of adults = CAVERNOUS HEMANGIOMA

Capsulated, so easily resected

OPTIC N/V GLIOMA = ASTROCYTOMA

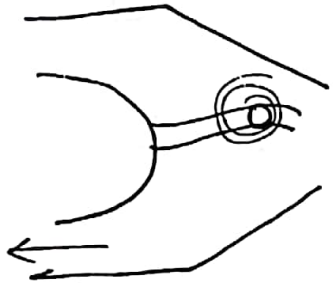
all Non-neuronal cell of nervous system → Glial cells

EXAMPLES -

1) Oligodendrocytes
2) Astrocytes
3) Neuroglial
4) Microglial etc

C/F

1) Disease of childhood
2) More common in ♀
3) U/L
4) very slow growing Tx
5) M/C → NF-1 > 2 ♀♀.



when size of Tm ↑

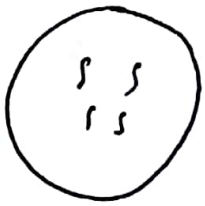
Proptosis is a Late feature

Initial signs → optic n/v disease

M/C pathological type - Pilocytic astrocytoma

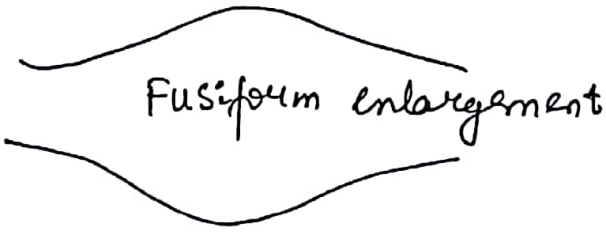
↓

hair like



Inv :-

1) MRI
2) CT Scan



Rx -

1) Observation
2) Radiotherapy
3) Surgery

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

RETINOBLASTOMA

From Neuroectodermal cells → Retinoblasts.

C/F

1) M/c age of presentation - (< 3 yrs)
   Commonest → 18 mnths

2) M/c mode of presentation - LEUCOCORIA
   (white eye reflex)
   Amaurotic Cat's Eye Reflex

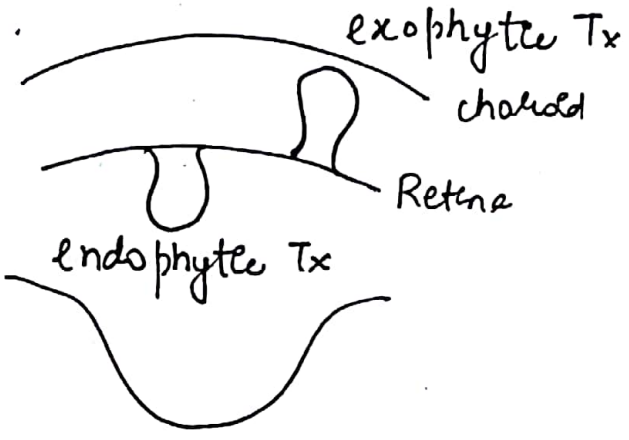
3) 2nd M/c mode of presentation = STRABISMUS

4) Glaucoma

5) Pseudohypopyon → Tx cells in ant. chamber

6) Pseudo uveitis

7) Orbital cellulitis



D/D -

PSEUDOGLIOMAS (① → ⑩)

1> Congenital Cataract – M/c cause of Leucocoria

2> Cyclitic membrane

3> Fungal endophthalmitis

4) Central choroiditis – Toxocariasis

5> Central coloboma – Sclera shine white at central part not formed

6> PHPV
↳ persistent hyperplastic 1° vitreous

7) ROP
↳ Retinopathy of prematurity

8) Coat's Disease

9) Retinal Dysplasia

10) Central Retinal Detachment

Q. Differentiating Pt. Bet^n RB & Pseudoglioma?
Retinoblastoma → IOP ↑
Pseudo glioma → (N)

Q Benign counterpart of RB → RETINOCYTOMA

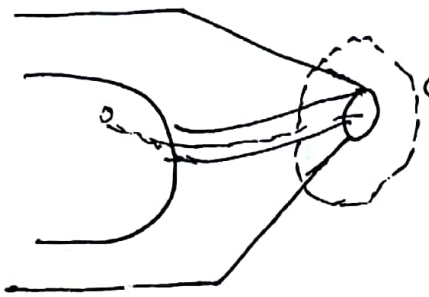
Inv -

Q. 1> 1st Inv → USG (B) scan

2) CT scan – for intracranial extension

3) MRI - for Pinealomas → IOC

4) X-Ray - Rhese view
- optic foramen.



← enlargement of optic foramen

H/c mode of spread - through optic n/v Q AIIMS

5) Estimation of enzymes in aqueous humour
↑↑↑ in RB

LDH	PGI	NSE
(Lactose Dehydrogenase)	(Phospho gluco isomerase)	(neuron-specific enolase)

PATHOLOGY :-

GROSS -

- Necrosis
- calcification Q

MICROSCOPIC -

- Differentiad
  1) HOMER-WRIGHT
  2) FLEXNER. WINTERSTEINER
  3) FLEURETTES
- Un-differentiated

GENETICS

1) QQ. M/c mutation = 13q

2) THilateral RB
= B/L RB + Pinealoma

KNUDSONS TWO-HIT HYPOTHESIS

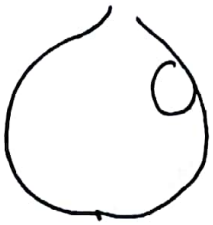
Somatic + Somatic → Sporadic / Non-Hereditary (94%)

Somatic + Germ cell → Hereditary (6%)
- → B/L
- → multicentric
- → associated ± other non-ocular malignancies

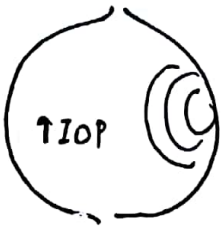
M/c → Osteosarcoma

STAGING

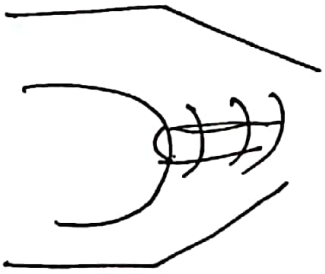
(I) QUIESCENT



(II) GLAUCOMATOUS



(III) STAGE EXTRAOCULAR EXTENSION



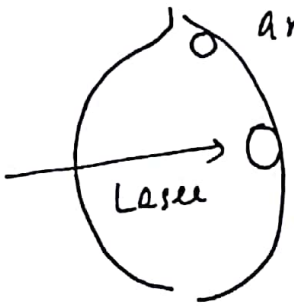
(IV) DISTANT METASTASIS

Rx –

1) Laser Photo coagulation
2) Cryotherapy

→ Can be used if $T_x \leq 3$ mm in height
→ Damage blood supply of T_x

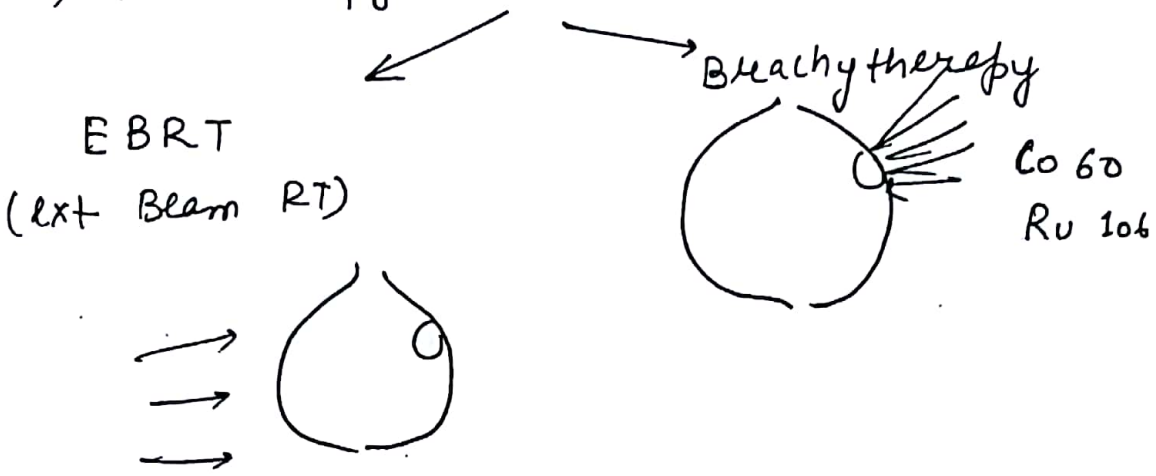
3)



ant lesions → Cryo

central lesions
↳ Laser

3) Radiotherapy

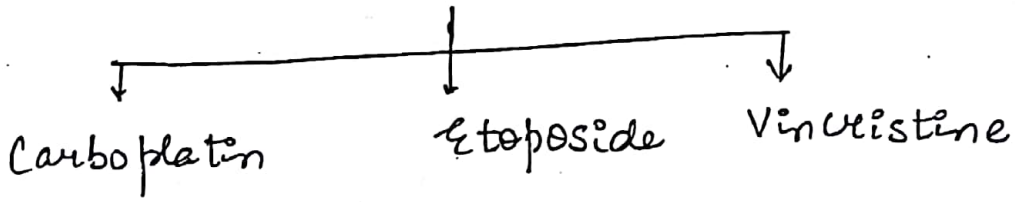


4) Thermotherapy

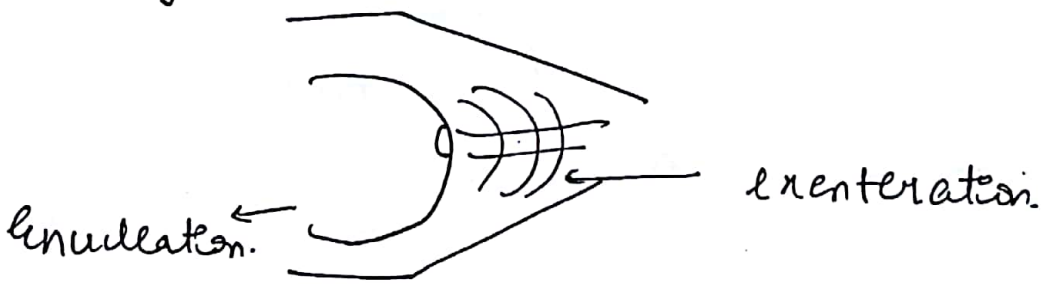
↳ thermal effect of diode is used to damage tumour.

5) Chemotherapy

Neoadjuvent role → ↓ size of Tx



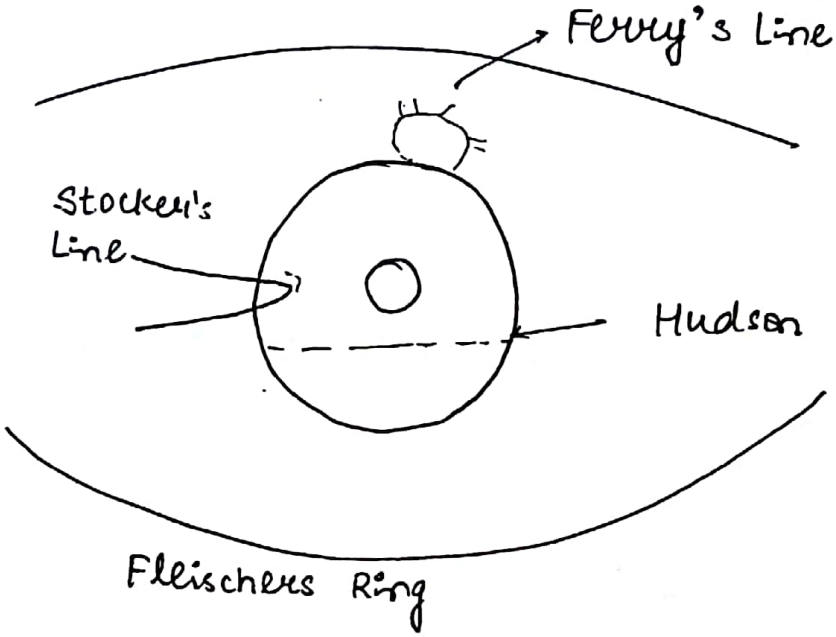
6) Surgery



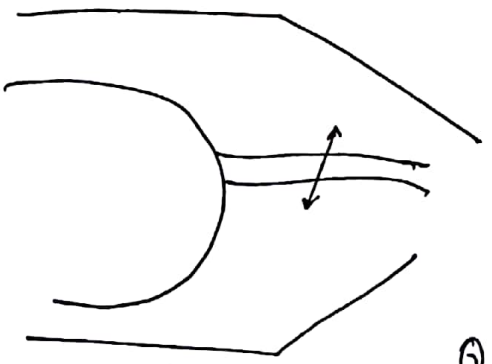
SURGERIES TO REMOVE EYE

EXTRA - NOTE.

IRON DEPOSITION



ENUCLEATION



Enucleation = Removal of eyeball & max part of optic n/v

Q 10mm → 15mm (part removed)

↓

Q C̄ in 10day / same sitting

Put Orbital Implant

↓ 6-8 wks Q

Prosthetic Eye

EXENTERATION

→ Removal of all orbital contents

* Indication-

1> Tx

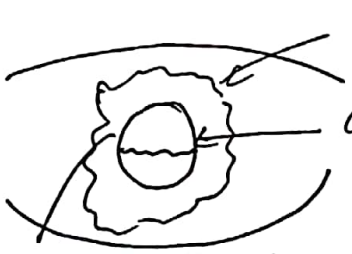
2> Mucormycosis

Lids are cut

↓

Grafting for cosmetic reasons

EVISCERATION



Scoop out the contents

Stitch the remaining sclera

↓

If sclera is also inflammed → remove max part of sclera, leave a full a sclera

↓

Full Excision Q

Indication - Panophthalmitis

Artificial eye → prosthesis

PANOPHTHALMITIS & ENDOPHTHALMITIS

D/D - endophthalmitis

PAN	ENDO
Restricted ocular movement	No restriction
Other C/F - → D/v → No fundal glow → ~~Glow~~ Pain.	Inflammation of inner coat of eye → Retina, vitreous

Other features are same

Rx = Intravitreal Antibiotic inj"

↓

Ceftazidime → Gram-ve

Vancomycin → Gram. +ve

Dexamethasone - very small dose to control inflammation

Antibiotic C/I Intra-vitreally -

Gentamicin ↔ Amikacin

↘ ↙

Maculotoxic

Antifungal → Intravitreally Given

↙ Amphotericin B

→ Voriconazole

BLOW-OUT

Floor # due to Blunt Trauma

* Mechanism → BUCKLING effect

* C/F →

1) Periocular ecchymosis → BLACK EYE / PANDA EYE

> RACCON EYE → B/L
> seen # Base of skull

2) ↓ sensation of affected cheek
↳ Damage to infra-orbital n/v.

3) Enophthalmos

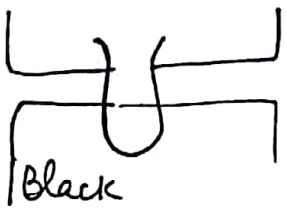
4) Diplopia

5) Subcutaneous Emphysema
(if medial wall broken)

* Inv :-

1) X-Ray → Water's View / PNS

2) CT Scan →



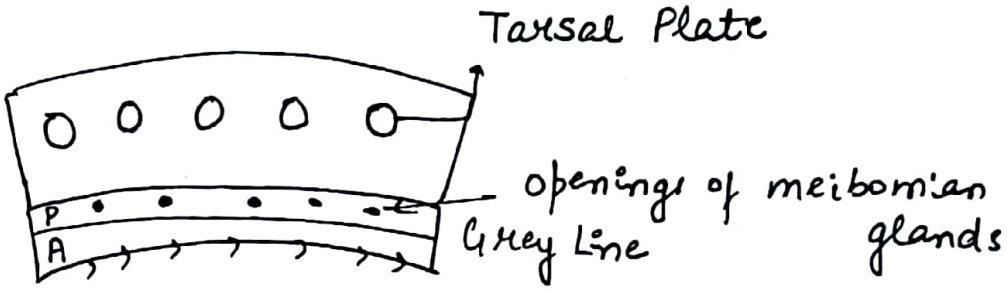
White opacity against Black Background
= TEAR DROP SIGN

* Rx — Antibiotics + Anti-inflammatory × 10 days

- Enophthalmos / Deplopia improve
- No improvement in enophthalmos / Deplopia (M/s entrapment) → Surgery

LIDS

ANATOMY



1. TRICHIASIS → misdirection of eyelashes.

2 POLIOSIS → Greying of eyelashes

3. MADAROSIS → Loss of eyelash → CAUSE: Chronic Blepharitis
" " eyebrows

CAUSES
Leprosy
Myxoedema

4. BLEPHARITIS –

Inflammation of Lid margin

- ANTERIOR
  - SQUAMOUS → Dandruff → Antibiotic + steroid → Lubricating E/D
  - ULCERATIVE → ulcers below the scale (Staph. Infec") → Antibiotic oint.
- POSTERIOR → MEIBOMITIS

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

5) TYLOSIS –

Q Thickening of Lid Margin

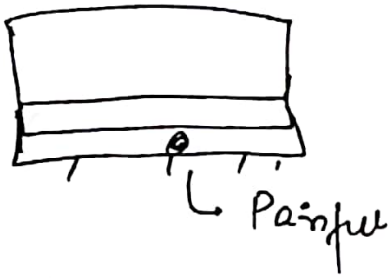
6) ECTROPION –

Outward turning of Lid Margin

7) ENTROPION –

Inward turning of Lid Margin

8) HORDEOLUM EXTERNUM / STYE



→ Staph. Infection of 1) Hair follicle of 2) Gland of Zeis / 3) Gland of Moll

R_x = 1) Hot Fomentation

2) Epilation

3) Oral anti inflammatory

4) Antibiotic ointment

9) HORDEOLUM INTERNUM

Acute inflammation of Meibomian Glands.

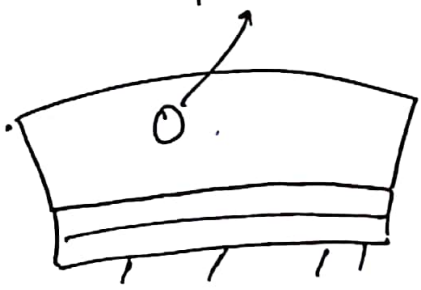
C/F - Painful swelling on lid

Rx - 1) Hot Fomentation
2) Oral antibiotics
3) Oral anti-inflammatories

10) CHALAZION -

→ Chronic Lipogranulomatous Inflammation of meibomian glands

→ Present as painless swelling



Rx = 1) Incision + Curettage
2) Intralesional Injec" of Triamcinolone acetate

Q. Recurrent Chalazion →

↙ M/c cause
Uncorrected mild refractive error

→ Q. Sebaceous cell carcinoma
↓
M/c site = upper lid.

Q. M/c malignant Tm of Lid = BASAL CELL CARCINOMA
↓
M/c site = Lower Lid
↓
Inner canthus

117 PTOSIS

Drooping of lid.

TYPES

- NEUROGENIC
  - 1) III rd n/v palsy
  - 2) Horner's syndrome
  - 3) Synkinetic ptosis
    - Marcus Gunn Jaw-winking phenomenon
      - Aberrent connec" bet" LPS x Lateral pterygoid M/s (III M N/V & 5th n/v)
- MYOGENIC
- APONEUROTIC (M/C)
  - Dehiscence
    - Post-op
    - Involutional
      - old age
- MECHANICAL
  - 1) Lid Tm
  - 2) multiple chalazeon
  - 3) conjunctival scarring

MYOGENIC

- CONGENITAL
  - SIMPLE
    - Ptosis
  - BLEPHAROPHIMOSIS SYNDROME
    - 1) narrow palpebral fissure
    - 2) ptosis
    - 3) Cong. Entropion of lower lid.
- ACQUIRED
  - 1) Myasthenia Gravis
  - 2) Lambert Eaton Syndrome
  - 3) Ocular myopathies.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

4) Telecanthus (soft tenue
IPD - (N))

5) Epicanthus inversus -
↳ extrafold of skin on medial canthus is **Epicanthus.**
When arise from Lower Lid, it is called **Inversus**

Rx of Ptosis -

LPS RESECTION
↓
Func" of LPs
↓
Upper Lid excertion (ULE)

~~From Lou~~
Distance from Lowermost to uppermost position of Lid after blocking Frontalis m/s

(N) = ≥ 12 mm

Min. req. for resection
↳ 4-5 mm

↓ SKIN route
Everbusch operation

↓ Conjunctival route
Blaskovics

MULLERS RESECTION
Fasanella-SERVAT Operation.

SLING OPERATION
Upper lid connected ī frontalis m/s
Fascia Lata
↳ Ideal material

PURKINJE IMAGES

Images formed on refracting surface of eye

I	II	III	IV
Ant. surface of cornea	Post. surface of cornea	Ant. surface of Lens	Post. surface of Lens

Q. Images absent in aphakia = III, IV

Q. ⊆ Image in Inverted = IV

Q. Pseudophakia → all 4 Purkinje images are +nt

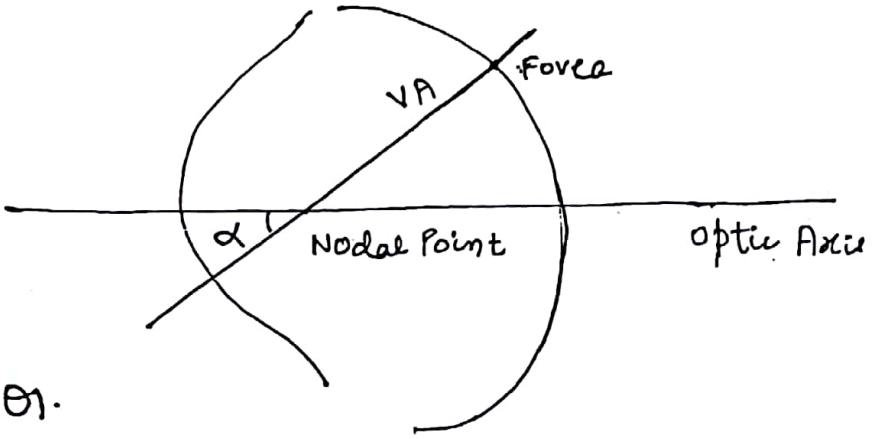
VISUAL ANGLES

α angle

optic axis + visual Axis at nodal Point

K angle

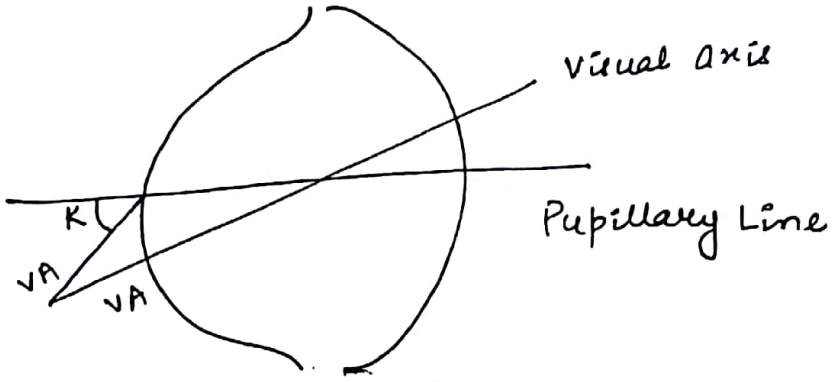
Pupillary Line + visual Axis at cornea



AIIMS Qn.

[The angular spacing betⁿ bars of Cor E in snellen's chart in 1min for 6/6 letter

Largest letter when viewed from a distance of 6 meter, subtend an angle of 50 minutes in eye ; bars of letter subtend 10 min]



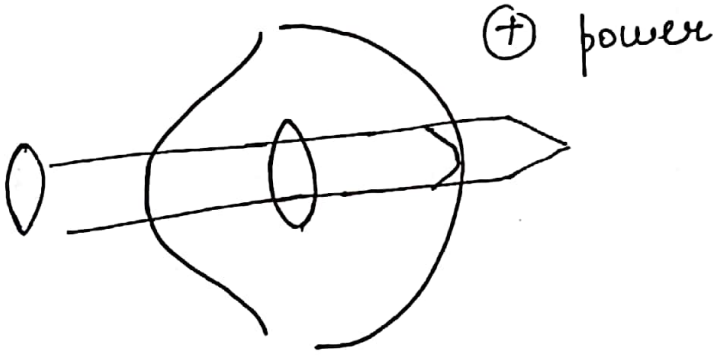
REFRACTIVE ERRORS

HYPERMETROPIA

1> Total Refractive Power is less than Required

2> Small Eye

3> Light rays focussed behind Retina

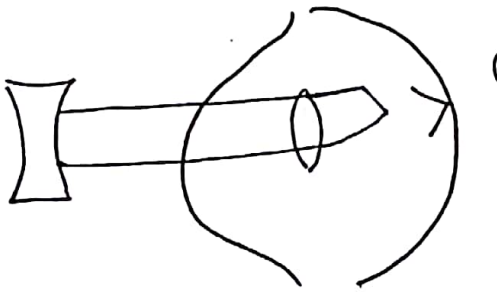


MYOPIA

1> Total Refractive Power is more than required

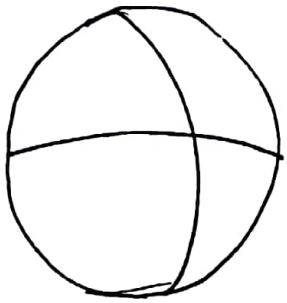
2> Large Eyes

3) Light rays focussed in front



ASTIGMATISM

Difference of refractive power between 2 principal axis



ANISOMETROPIA

Difference of refractive power between 2 eyes of >2.5 D.

ANISEKONIA

Difference of Image size between 2 eyes

5% is physiological + this helps us in depth perception.

But anything more than that is aniseKonia

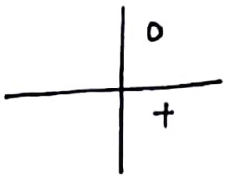
It is measured by EIKONOMETRE

R_x = ISEKONIC GLASSES

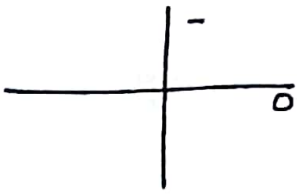
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

CLASSIFICATION OF ASTIGMATISM

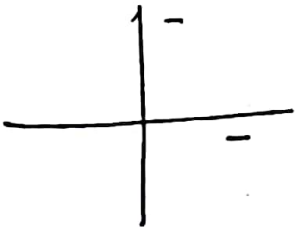
I)



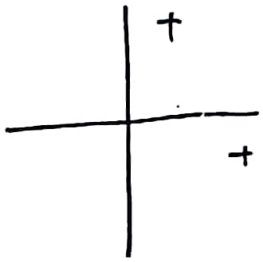
Simple HYPERMETROPIC



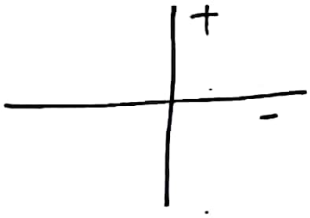
SIMPLE MYOPIC



COMPOUND MYOPIC

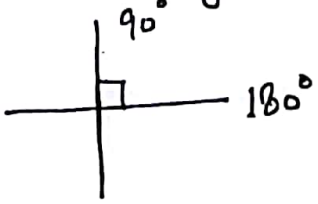


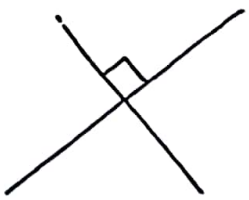
COMPOUND HYPERMETROPIC



MIXED ASTIGMATISM.

II) According to Axis

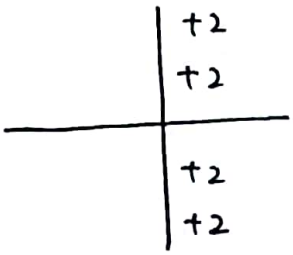




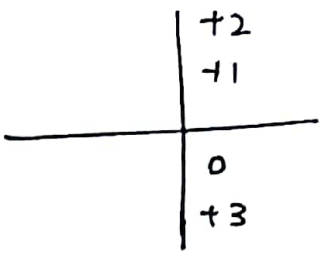
OBLIQUE ASTIGMATISM

BIOBLIQUE ACTIGMATISM

III)



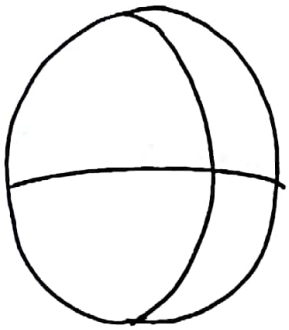
REGULAR
ASTIGMATISM



IRREGULAR
ASTIGMATISM

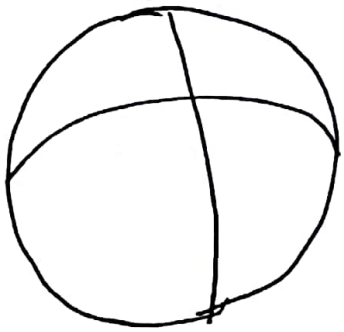
Keratoconus

IV) WITH THE RULE

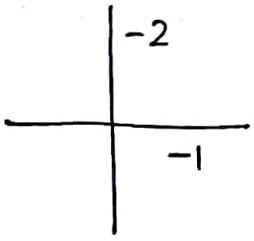


vertical more curved

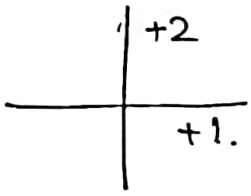
AGAINST THE RULE



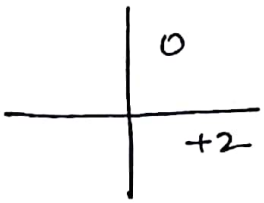
Horizontal more curved



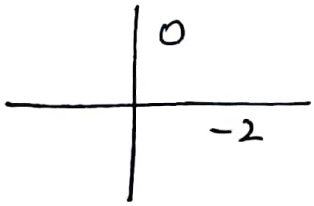
- means eye is myopic
↓
vertical more curved
↓
Hence ∴ the Rule



+ means eye is hyperimetropic
↓
vertical less curved
↓
against the rule



← Hypermetropia



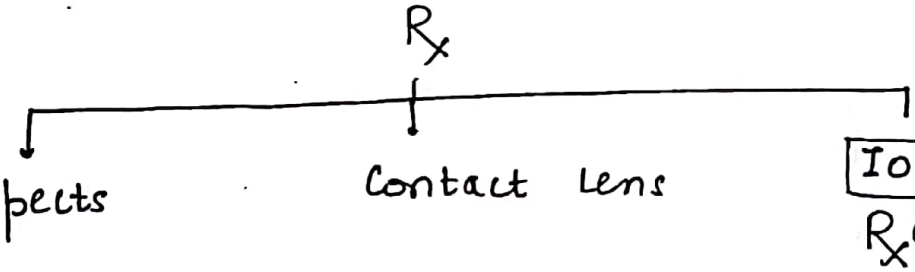
← Myopia

vertical more curved
↓
ō the Rule

vertical less curved
↓
Against the Rule

APHAKIA

HIGH HYPERMETROPIA.



Q. Choice of Site of IOL implantation = Capsular Bag > Post. Chamber

Q only mydriatic ī no cycloplegic action = Phenyl - ephrine

Q. Choice of cycloplegia in children = Atropine ointment (1%)
TDS x 3 days

Check for atropine fever
↳ stop the drug

SPECTS → +10 ⟶ +14 D

DISADVANTAGE -

1) Magnification ~ 30%

We can't correct unioculor aphakea ĉ spectes due to high anisekonia leading to diplopia

2) High Spherical aberration

Spherical aberration means refrac" from periphery is more than centres of lens.

↓

So, everything is PARABOLA

↓

PIN-CUSHION EFFECT

3) High Prismatic effect

It leads to ROVING-RING SCOTOMA

↓

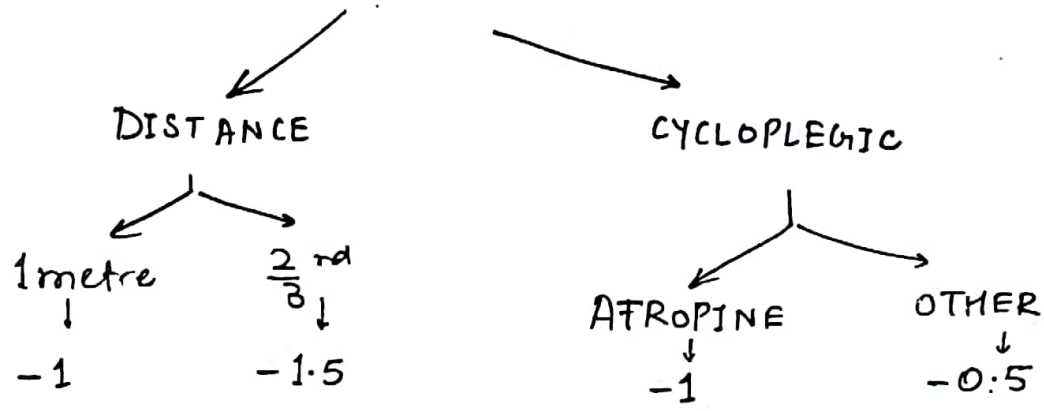
Q. JACK IN BOX PHENOMENON

(things nearby go out of vision due to narrow field of vision)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

RETINOSCOPY

CORRECTION FACTOR



Add correct factor to reading of retinoscopy

eg.

If $\frac{+3}{+4}$, Dist. $\frac{2}{3}$rd, cycloplegic other than atropine

$\frac{+3\ -2}{+4\ -2}$ - $\frac{+1}{+2}$

At 1m. **Movement Significance**

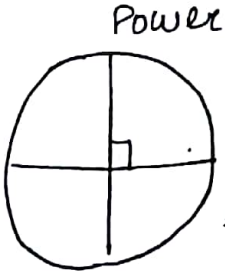
With → Hypermetropia / Emmetropia / M < 1

Against → Myopia > 1

No movement → Myopia = 1

eg.

Prescription
+1
+2



⇒ So, axis mentioned opp.

+1D spherical + 1D ~~cyclo~~ cylinder at 90°.

+2D spherical - 1D cylinder at 180°.

[spherical ~~gol~~ glasses give power to both axis.
So, by adding cylinder, we neutralize power].

+3
+3

⇒ +3D spherical

+1
0

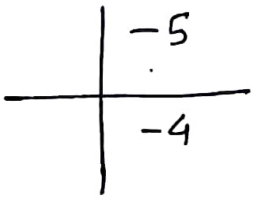
⇒ +1D ~~cyl~~ cylinder at 180°
-1D ~~at~~ cylinder at 90°

-1
-1

⇒ -1D spherical

+1
+2

⇒ +1D spherical +1D cylinder at 90°.
+2D spherical -1D cylinder at 180°.



-4D spherical -1D cylinder at 180°

-5D spherical +1D cylinder at 90°.

CONTACT LENS

- SOFT
- SEMI-SOFT or RIGID GAS PERMEABLE (RGP)

Q Hydroxyethyl Methacrylate (HEMA)

1> Silicone
2> Flouro-silicone

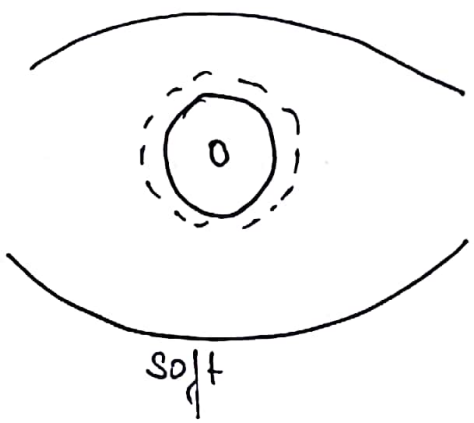
M/C infection after contact Lens = Pseudomonas

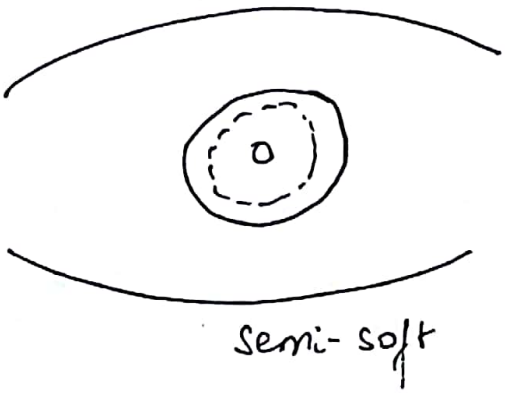
Soft contact lens used are more prone to. Acanthamoeba keratitis

TORIC LENS - Contact Lens i cylindrical correc" for astigmatism

- SOFT
- SEMI-SOFT

Q. C type of CL lens used in keratoconus = RGP





Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Higher the water content
Better is O_2 transmibility

AMBLYOPIA

Partial Loss of vision ∴ no organic cause
also called LAZY EYE.

Vision < 6/6

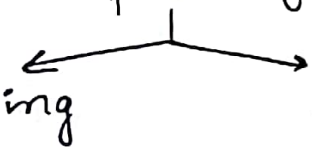
PATHOLOGY Lies in LGB

C/F-
1) visual Acquity < 6/6
2) ↓sed contrast sensitivity

Q 3) Sunglass effect -
Brightness is less in effected eye

Q 4) Crowding phenomenon
skipping of nearby letters
A B CD

RxOC - QQ
1) Occlusion of (N) eye (4-6 hours/day)



↓
PENALISATION

BINOCULAR SINGLE VISION / FUNCTION

Difficulty of Brain to fuse 2 Retinal Images as 1

Q. Foveal Reflex formation = 5-6 months

Q BSV = 5-6 years.

Q. GRADES OF BSV

(I) Simultaneous Perception

(II) Fusion

(III) Stereopsis [DEPTH perception]

VISUAL PERCEPTION

- LIGHT SENSE
- FORM SENSE
  - Q visual acquity is a measure of Form sense
- CONTRAST SENSE
- COLOUR SENSE.

DIPLOPIA Q

Double Vision.

(I) HORIZONTAL / VERTICAL / TORSIONAL

(II) UNIOCULAR / BINOCULAR

- UNIOCULAR → M/cc → Subluxation of Lens
- BINOCULAR → M/cc → Paralytic squint

UNIOCULAR

CAUSES

1) Incipient / Intumescent Cataract

2) Polycoria

3)

BINOCULAR

CAUSE

1) Thyroid ophthalmopathy

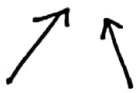
2) Blow out #

(III) CROSSED & UNCROSSED

UNCROSSED

False Image toward squinted eye

seen in convergent squint / Esotropia



Lateral Rectus Palsy
↓
convergent squint

CROSSED

False Image opposite squinted eye

Seen in Divergent squint / Exotropia

ACTION OF MUSCLES

- HORIZONTAL
  - LR → ABduction
  - MR → ADduction
- VERTICAL
  - IS — SUPERIORS ARE INTORTERS
  - RAD — RECTI ARE ADDUCTORS

	SR	IR	SO	IO
1° Action	Elevation	Depression	Intortion	Extortion
2° Action	Intortion	Extortions	Depression	Elevation.
3° Action	ADduc"	Adduc"	ABduc"	ABduc"

YOLK M/S

Contralateral Synergists

- Q
  - (R) Inf Rectus
  - ↓
  - Yolk M/s → (L) Sup. Oblique
- Q.
  - Dextroelevation

In outward deviated eye Action of elevation & Depression is of Recti.

- (R) Sup. Rectus
- (L) Inf oblique

Levo depression -

Ⓛ Inf Rectus

Ⓡ Sup oblique

HERINGS LAW

There is equal innervation in yoke M/s

SHERINGTONS LAW

Equal / Reciprocal innervation in against + antagonist M/s

same. equal + Reciprocal

STRABISMUS

Misalignment of eyeball.

- LATENT SQUINT (PHORIAS)
  - squint Δ by cover/uncover test
    - ESOPHORIA
    - EXOPHORIA
    - HYPERPHORIA
- MANIFEST SQUINT (TROPIAS)
  - CONCOMITANT
    - 1° Deviation = 2° Deviation
      - 1° Deviation: Deviation of squinted eye is 1° Deviation
      - 2° Deviation: Deviation of (N) eye behind the cover is 2° Deviation
  - INCONCOMITANT or PARALYTIC
    - 2° Deviation > 1° Deviation due to HERING'S LAW

CONCOMITANT SQUINT

- ESOTROPIA
- EXOTROPIA
- ISOTROPIA

ESOTRIA

- INFANTILE
- ACCOMODATIVE → Due to activation of accomodation reflex
- NON-ACCOMODATIVE

INFANTILE ESOTROPIA

1) Manifests in 6 months
2) Angle of deviation is Large ~ 30 prism Diopters
3) Latent Nystagmus
   manifested by cover ~~test~~ Uncover test
4) Refractive error is (N) for age

ACCOMODATIVE ESOTROPIA [Due to stimulation of accomodation]

REFRACTIVE

High Hypermetropia that is uncorrected
↓
Exerts excessive accomodation to compensate
↓
Eyes converge

(N) $\frac{AC}{A}$

NON-REFRACTIVE

- High $\frac{AC}{A}$ Ratio
- Refraction (N)
- No deviation for Distance

MIXED TYPE

Hyperemetropia + High $\frac{AC}{A}$ ratio

NON - ACCOMODATIVE

- STRESS INDUCED
- SENSORY DEPRIVATION In children
- DIVERGENCE INSUFFICIENCY
- Sx INCORRECTION

EXOTROPIA

- CONGENITAL → very rare
- 1° → From 2 yrs of age
  - CONSTANT
  - INTER MITTENT
- 2° → Sensory Deprivation of in adults
- CONSEQUETIVE → Sx overcorrecⁿ of esotropia

PARALYTIC SQUINT

1> Diplopia

2> Confusion

3> Deviation
   2° > 1° [due to Hering's Law].

4> Restricted ocular movement

5> Compensatory head Posture.

IVth N/V PALSY [Sup. oblique Paralysed]

FEATURES -

1) Hypertropia
2) Exycloterision
3) Vertical Diplopia worst on looking Down.
4) Limited depression in adduc^{n}
5) Compensatory Head Posture → Head tilt on opposite side Q.

BIELCHOWSKY'S SIGN Q

↳ Left Hypertropia

↓

Tilt the head toward (L) shoulder

↓

To Look straight eye has to intort

↓

Superior are intorters

↓

If S.O. Paly,
there is over working of S.R

↓

↑ in Hypertropia

Hence, so Paly confirmed.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

VIth N/v PALSY [LR-6]

1> convergent esotropia

2> Defective AB duc" of affected side

3> ⓠ Horizontal Diplopia - worst in affected side

4> Face turned towards Paralytic side.

MANAGEMENT OF SQUINT

1> HIRSCHBERG TEST :-

1 mm of Deviation of Light reflex = 7°

⇓

15 DD

Pupillary Border = 18° - 20°

At Limbus = 45°

2> KRIMSKY'S TEST/ PRISM BAR TEST-

Measure exact amount of squint in prism diopter

Prism Bar

3> COVER - UNCOVER TEST

4> ALTERNATE COVER TEST

PARALYTIC SQUINT

↳ wait for 5 - 6 months to improve

↓ If doesn't improve

Squint Sx

Underacting → Resection.

Overacting → Recession

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

CONCOMITANT SQUINT-

I> Refraction

↓

II> Check for amblyopia

Occlusion (if needed)

↓

Orthoptic exercises (if needed)

[Strengthening the convergence]

↓ - if nothing works

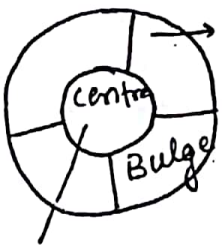
Squint Sx

REFRACTIVE SURGERIES

- INCISIONAL
- LASER-ASSISTED (Lamellar)
- NEWER PROCEDURES

INCISIONAL

1> RADIAL KERATOTOMY



→ Radial cuts @ ē diamond at Periphery

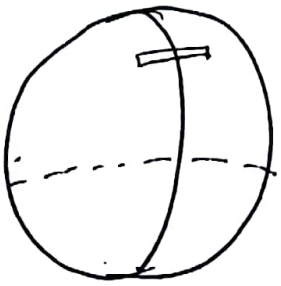
Myopic → Best results are 5D ē in

Centre flattening is to be done

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

2> ARCUATE KERATOTOMY / T-CUTS

Used to Rx astigmatism



⊥r cut on steeper axis

↓

that axis flattens on healing

↓

compensatory curving on opposite axis

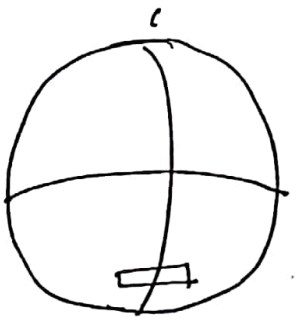
↓

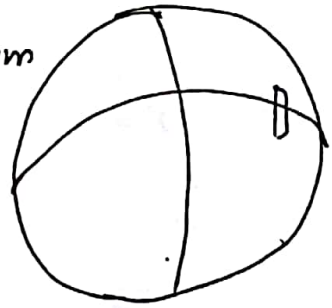
Rx astigmatism by "COUPLING EFFECT"

If cataract

↓

astigmatism





With the rule

Against the rule

LAMELLAR / LASER ASSISTED

KERATOMILEUSIS - Changing corneal curvature

Laser used is EXCIMER ~~Ag F~~ (Argon F)

λ = 193 nm

PRE-REQUISITES :-

1> Pachymetry reading (N)

2> Age > 18yrs

3> Stable refractive error since last 6 months

4> Ant. Seg (N)

5> Fundus (N)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

WORK- UP

1) Refraction
2) Pachymetry
3) Corneal Topography

1> PRK [PHOTO REFRACTIVE KERATECTOMY]

Remove the epithelium (painful)
↓
Apply Laser [dealing c superficial stroma]
↓
Bandage

DISADVANTAGE
- Painful
- Long Rehabilitation Time

2) LASIK [LASER IN SITU KERATOMILEUSIS]

Raise a flap → by micro keratome
└ by Femto laser
↓
Apply LASER [Deeper Stroma]
↓
Put the flap back

3> EPI-LASIK / LASEK [Laser Sub-epithelial Keratomileusis]

Raising epithelial flap
↓
Apply Laser [Sup. stroma]
↓
Put the flap back

} Done for Nebular opacity

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

S|E-

1) Dry Eye
2) Regression of No.
3) Sand of Sahara Syndrome
   ↳ infilteration of inflammatory cells b/w bed & flap.
4) Epithelial Ingrowth Bet" Bed & Flap
5) Infec" bet" Bed & flap
6) Fibrous ingrowth Bet" Bed & Flap.

NEWER PROCEDURE

1) SMILE Procedure → Femto laser.
   [Small Incision Lenticule Extraction]

   Procedure - Focus Femtolaser on stroma
   ↓
   cut the lenticule
   ↓
   Remove the lenticule through a small Incision

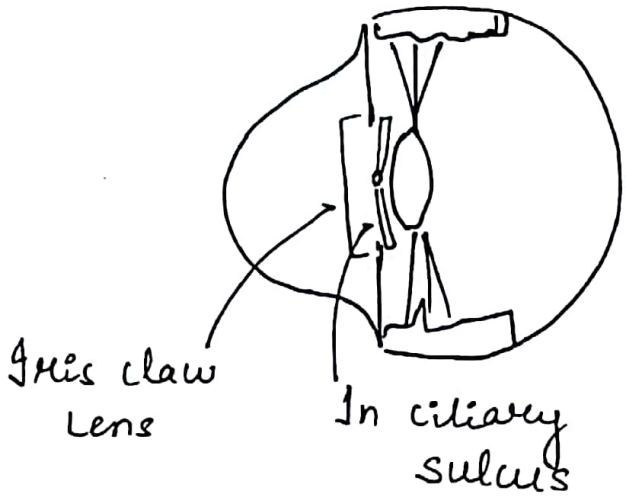
2) CLEAR LENS EXTRACTION-

Non-cataractous
To Rx → High Myopia

Retinal Detachment may occur if post capsule

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

3) PHAKIK IOL IMPLANTATION-



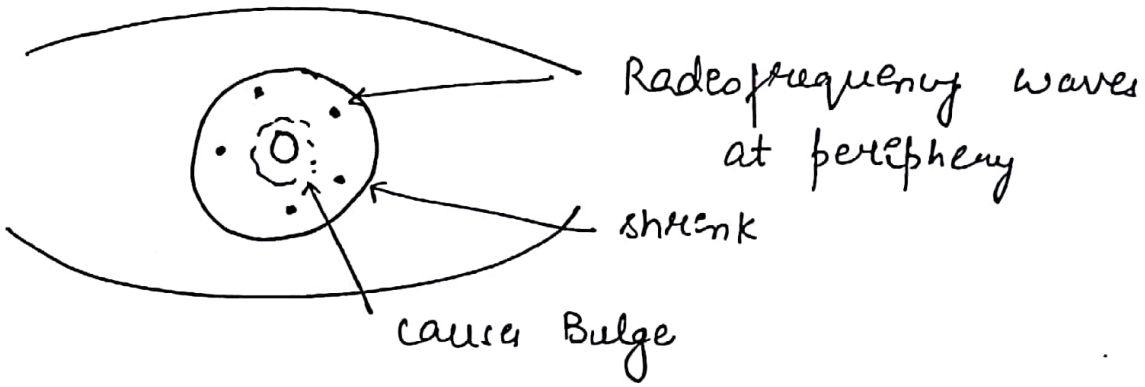
Cataract may develop if IOL touches Lens.

4) CONDUCTIVE KERATOPLASTY

Done in Presbyopia.

Ideal Pt-

- Emmetropic (N)
  - 2-2.5 D



Based on Monocular Vision

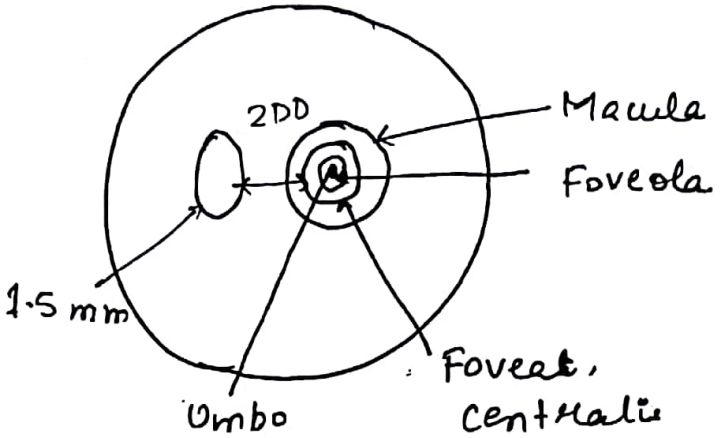
So, untreated eye used for far

treated eye used for near

RETINA

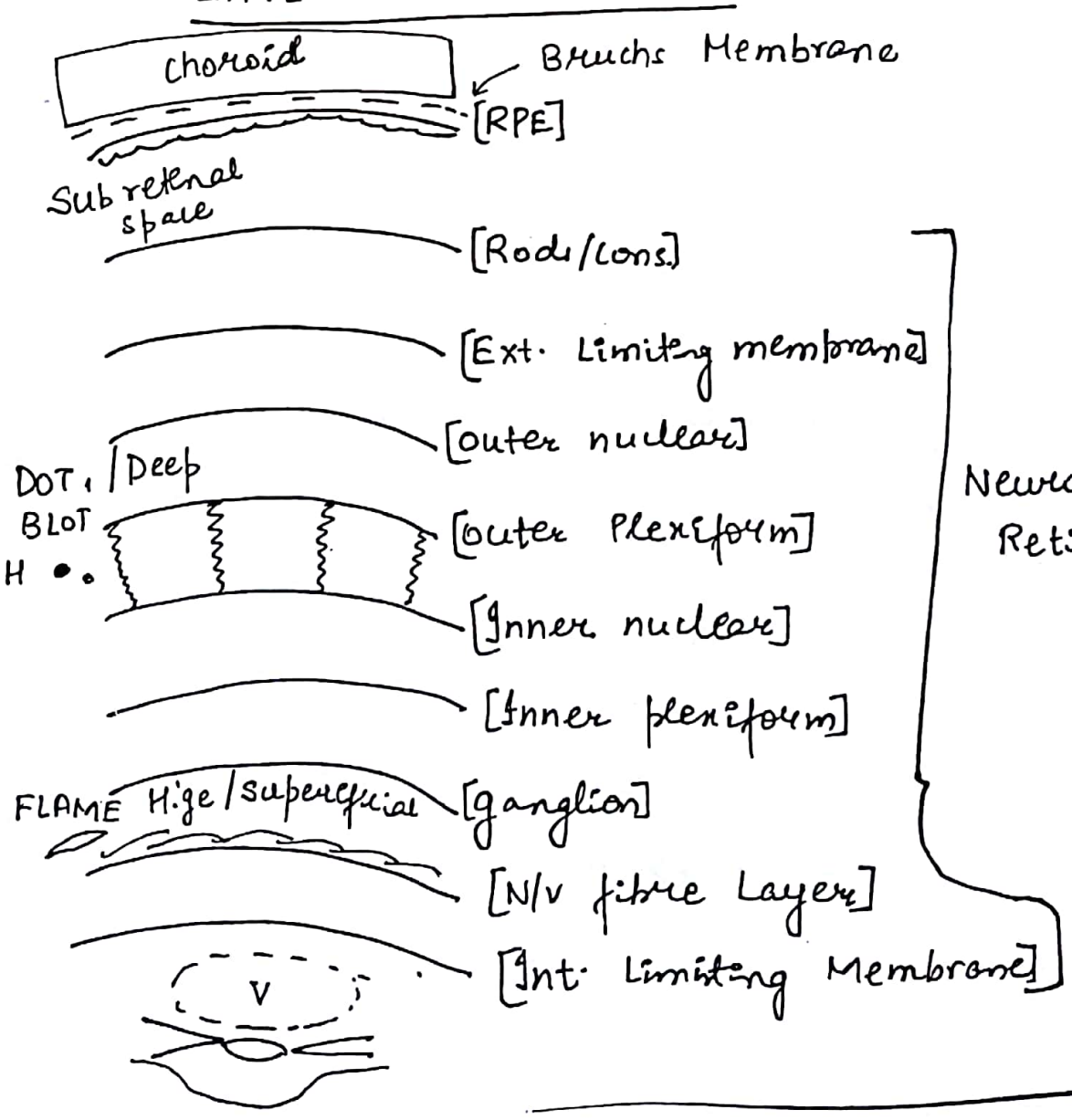
Most SENSITIVE → FOVEOLA

THINNEST → ORRA SERRATA (0.1mm)



AMBLYOSCOPE / SYNAPTOPHORE
↳ Image.

LAYERS OF RETINA



HARD EXUDATES → [Lipids]

SOFT EXUDATES → [Axonal Debris]

* SEQUENCE OF EVENTS IN RETINA [RETINITIS PROLIFERANS]

HYPOXIA

↓

↑sed capillary Permeability

↓

Leakage

↓

Oedema | Exudates | H'ge

↑↑↑ HYPOXIA

↓

Release of chemotactic factors

↓

Neovascularisation — NVD – at Disc; NVE → anywhere else

↓

Vitreous H'ge | Tractional RD | Neovascular Glaucoma

* ROLE OF PAN RETINAL PHOTOCOAGULATION —

Convert Hypoxia to Anoxia

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

CHEMOTACTIC FACTORS

1> VEGF (VASCULAR ENDOTHELIAL GROWTH FACTOR)

2> PDGF (PLATELET DERIVE " ")

3) ILF (INSULIN LIKE " ")

4) bFGF (basic FIBROBLAST " ")

5) TNF-α (TUMOUR NECROSIS FACTOR)

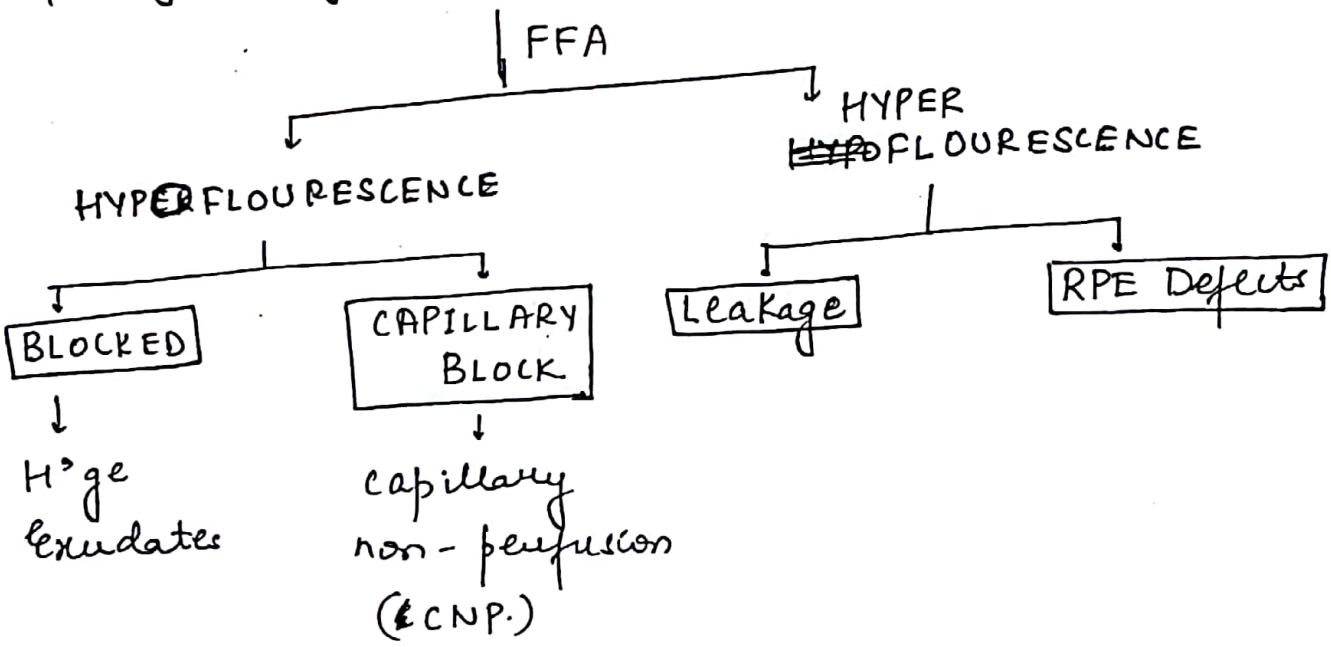
6) TGF α/β (TRANSFORMING GROWTH FACTOR)

Q. I.L. , Interferons are not related to angiogenesis → They are related to Inflammation

INVESTIGATION

1> FUNDUS FLOURESCENE ANGIOGRAPHY (FFA)

Q. Inject dye in Antecubital vein



Q. **ICG ANGIOGRAPHY**

[Indocyanine Green.] – 98% bound to Plasma Protein.

specially used to study CHOROID.

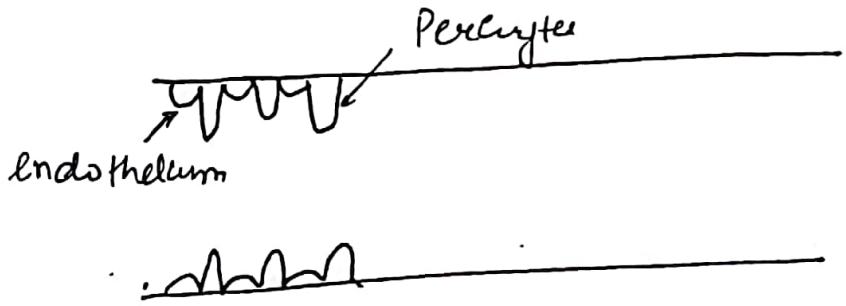
stays for longer time

Q. ICG → particularly used for occult choroidal neovascularisation

DIABETIC RETINOPATHY

Pathogenesis – Retinitis Proliferans.

PATHOLOGICAL CHANGES AT CAPILLARY –



1> Loss of Pericytes Q.

C/F-

STAGES

BACKGROUND (BDR) | PRE-PROLIFERATIVE | PROLIFERATIVE

1) Earliest feature
↳ Micro-aneurysm
↓
Inner nuclear Layer

BDR +

2> Hge, oedema, exudates

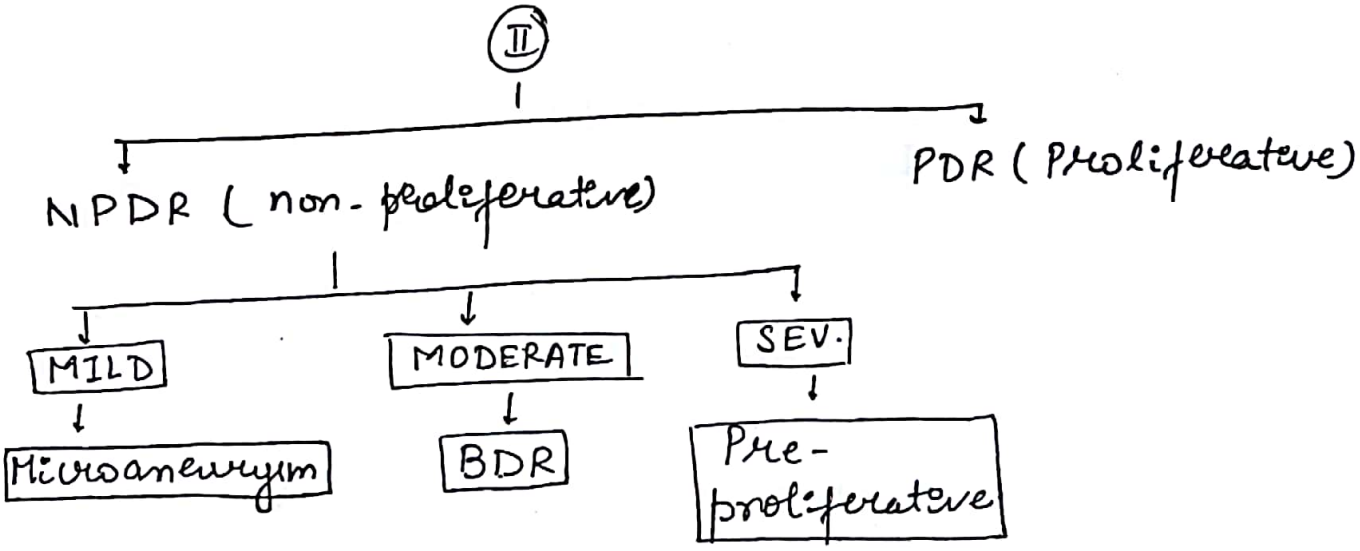
PRE-PROLIFERATIVE

BDR
+
1> ↑↑↑ Cotton-Wool spots
2> Large Blot H°ge [venous Infarcts]
3> Looping & Beading of capillary

4> IRMA (Intra-Retinal Microvascular Ab(N)).
↓
capillary shunt vessels

PROLIFERATIVE

Pre-proliferative
+
Neovascularisation → NVD, NVE



Rx- 1) Glycemic control

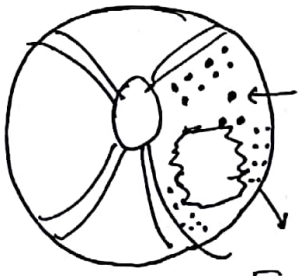
2)

NPDR → check for CSMO [Clinically significant Macular oedema]

CSMO: edema, Hard exudates [< 500 µm from centre of fovea]

↓

FFA



Focal Photocoagulation

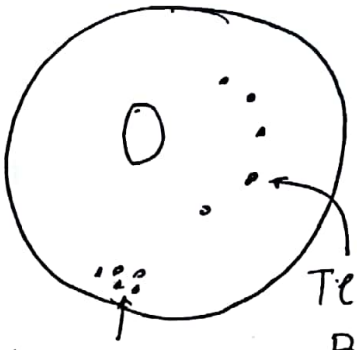
Grid Photocoagulation

[2 rows along blood vessel

Few burns on temporal side]

PDR → PRP Laser

avoid macular area



Temporal Barrage

Q Start Laser from inferior quadrant

Q. 2000 - 2500 Burns are given

Q. Most Imp factor for occurrence of Retinopathy in a diabetic patient- ⇒ DURATION (25-30 yrs)

Q. 2nd most Imp. factor ⇒ GLYCEMIC CONTROL.

Q. 1st Fundus exam" when ?

Type I → After 5 years

Type II → Immediately

Q. Frequency of follow-up

I → 1 yearly follow up

II →

Q Frequency of follow-up in ♀

↓

3 monthly follow up

(N) $\frac{\text{Artery}}{\text{Vein}} = \frac{2}{3}$.

HTN RETINOPATHY

changes in retina due to long standing HTN

KEITH-WAGNER GRADING

(I) Generalised attenuation of artery

(II) (I) + Focal Spasm

(III) II + H'ge + Exudates

(IV) III + Papilloedema

Q. Pt of PIH presents ∴ Hypertensive Retinopathy
(♀ Induced HTN)

CENTRAL RETINAL VEIN OCCLUSION (CRVO)

RISK FACTORS

1) HTN
2) Small eye (Hypermetropia)
   ↳ small Lamina cribrose
3) ↑ IOP
4) Blood viscosity Syndrome → Polycythemia / Leukemia

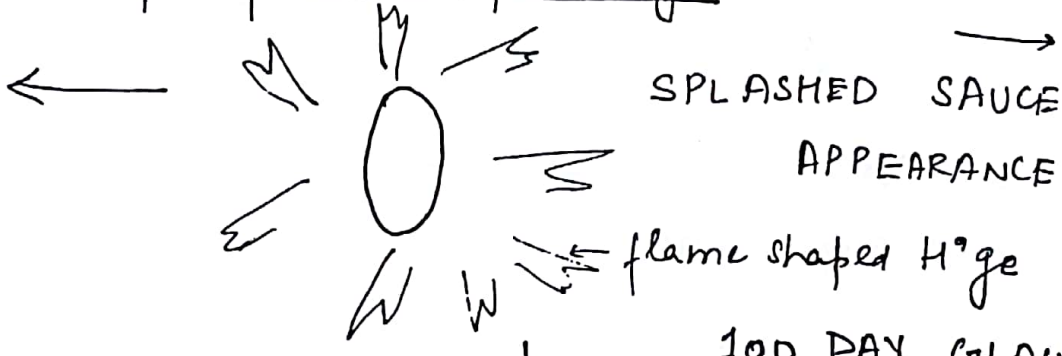
PATHOGENESIS

NON-ISCHAEMIC	ISCHAEMIC
↓	↓
Only Leakage	Retinitis Proliferans

C/F

	NON-ISCHAEMIC	ISCHAEMIC
1)	Visual Acquity ↓	VA ↓↓↓
2)	Cotton wool spot	CWS ↑↑↑
3)	Pupillary RXN - (N)	RAPD
4)	O/E	

Multiple flame shaped H°ge



100 DAY GLAUCOMA
or 90 DAY

INVESTIGATION-

1> FFA

- Non-Ischaemic → Leakages
- Ischaemic → Leak + Block (CNP)

Rx-

- NON-ISCHEMIC → IVTA (Intravitreal Triamcinolone Acetate)
- ISCHEMIC → PRP

Monitor IOP

CENTRAL RETINAL ARTERY OCCLUSION (CRAO)

↳ embolism occurs.

* RISK FACTOR-

A> 1) Heart Disease

2> Carotid artery Disease

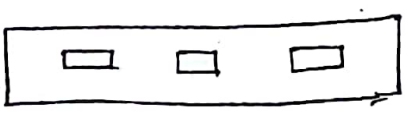
B> Mucormycosis Q

AIIMS QQ

Cherry Red Spot + Hollenhorst plaque are seen in-Both CRAO + BRAO.
But CRAO > BRAO.

* C/F-

1) Sudden painless loss of vision
2) Severe oedema → white retina
3) Marked attenuation of artery → thread like arteries
4) Interrupted blood column in brain



Cattle Track appearance of blood flow (VEINS)

5) cherry red spot

D/D of CHERRY RED SPOT

1> Berlin's oldema - Q AIIMS

2> CRAO ✓

3> Depositions ✓

a> Taysach's

b> Neiman Pick

c> Gaucher's

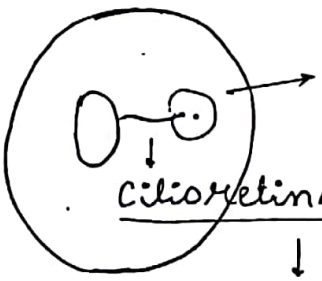
d> GM-1 Gangliosidosis etc all except

GM1 Gangliosidosis

I ⓧ

II ↓ cherry red spot

Q Pt. suffered from CRAO But not Blind ?



→ Tubular vision / Tunnel vision.

Ciliaretinal artery

↓

Branch of short post. ciliary artery

Rx -

AIM of Rx → Dislodge to emboli

↓

Sudden ↓↓ of IOP

↙ I.V. ACETAZOLAMIDE

↘ OCULAR MASSAGE

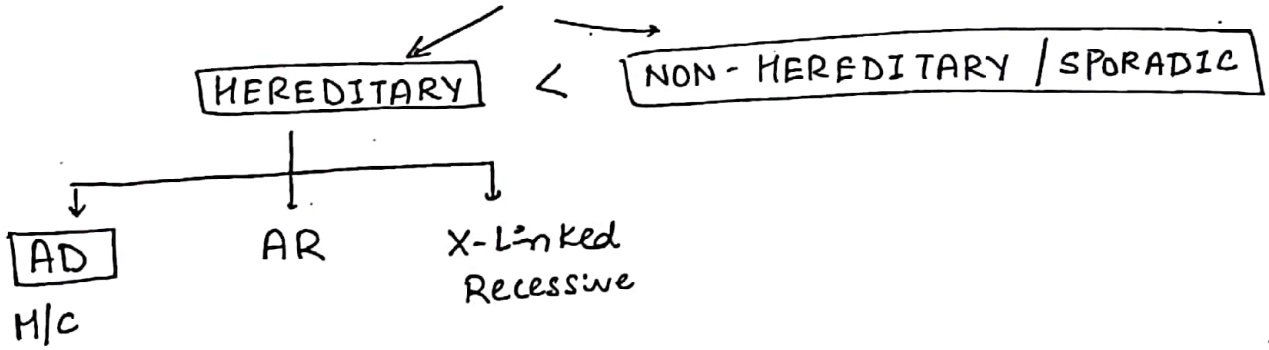
CAUSES OF TUNNEL VISION

1> B/L OCCIPITAL LOBE LESION
2> CRAO = Cilioretinal artery
3> Late stage of RETINITIS PIGMENTOSA
4> QUININE TOXICITY

RETINITIS PIGMENTOSA

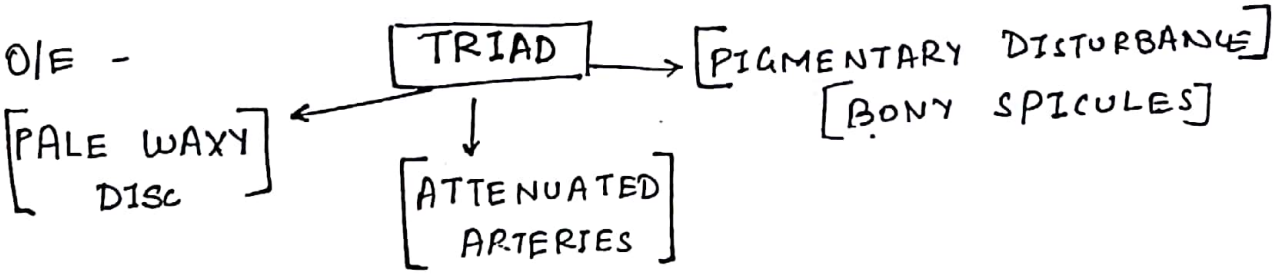
1> Dystrophy of [Rods] & Cones (Photoreceptor cell)
↓
primarily affected

2> Genetic Disease & can be



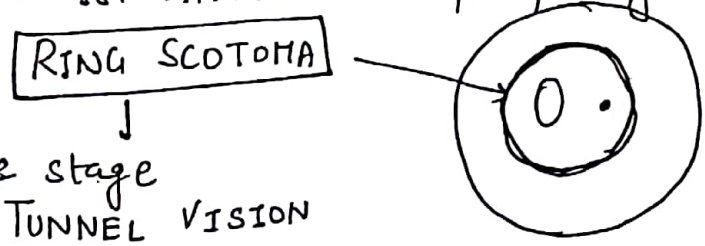
3> C/F → Nyctalopia

4> O/E -



5) INV

a> Perimetry → 1st involves mid periphery

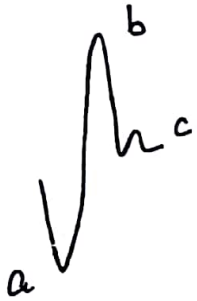


b> **ERG (Electro Retino Gram)**

It tells the activity of outer 2 layer of Retina

Rods & Cones — outer nuclear → Bipolar cells + Muller cells

Q.



a = Rods & cones

b = bipolar & muller cells

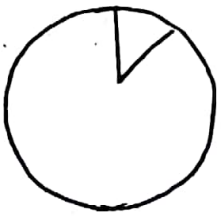
c = RPE.

In Retinitis Pigmentosa ⇒ ↓ amplitude of a & b waves

ATYPICAL RP

1> SECTORAL RP

Better Prognosis than a typical case

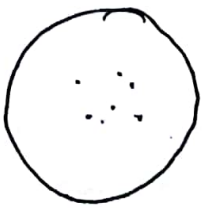


2> PERICENTRIC RP / INVERSE RP

starts from centre

3> RP SINE PIGMENTO

NO Bony Spicule



SALT & PEPPAR Fundus

4) RP ALBESCENS

White spots

SYSTEMIC ASSOCIATION

1) Q. USHERS SYNDROME – M/C
RP + Deafness
Rx = no effective Rx
Vit A for rods
Vit E as an anti-oxidant

2) BEST Disease / BEST VITELLYFORM DYSTROPHY
→ AD
→ childhood disease
→ Dystrophy of RPE
→ O/E – Macula – egg yolk Appearance
Q EOG – Ab (N)

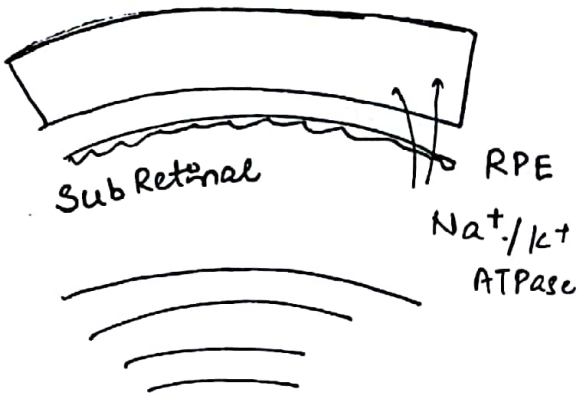
ELECTRO-OCULO-GRAM

Measures standing potential of eye.

Q. ARDEN RATIO = $\frac{\text{Light Peak}}{\text{Dark Trough}}$ $\geq$ 1.85. (N)

In BEST DISEASE = < @ 1.5

CENTRAL SEROUS RETINOPATHY (CSR)



PATHOGENESIS

Weakening of Na^+/K^+ ATPase Pump of central Retinal Pig. Epithelium

↓

Collection of fluid in Sub-Retinal Space

↓

Causing shallow Retinal Detachment

↓

CSR

C/F -

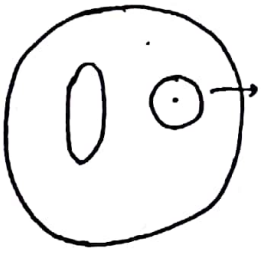
Q1> young ♂

Q2> Self-Limiting

3> Disturbance of vision

- Metamorphopsia (Distortion of image)
- Micropsia (small)

4> O/E



Ring Reflex = Ring of light encircling detached Retina

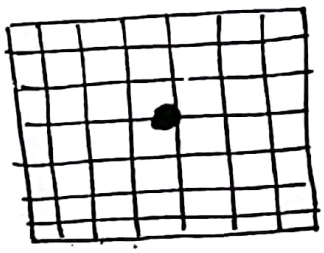
5> Inv :- (I) FFA QQ

Ink-Blot appearance

Smoke-stack appearance

(II) AMSLER-GRID TEST

→ Piece of paper ē a central dot
→ Pt can tell if any disturbance of vision.



6> R_x – not Required steroids c/I ⇒ aggravate CSR.

CYSTOID MACULAR OEDEMA

CAUSES

I> INFLAMMATORY-
all causes of Intermediate & Posterior Uveitis

II> VASCULAR CAUSE-

III> DEGENERATIVE
Retinitis Pigmentosa

IV> IRVINE GASS SYNDROME
CME after cataract S_x as a post-op complication

C/F-

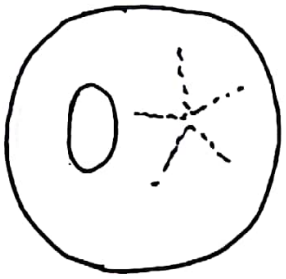
1> Diminution of vision

2> O/E → Dull or absent foveal Reflex

3>

Inv-

1> FFA



→ FLOWER-PETAL PATTERN QQ

↓

outer plexiform is layer is Radially present ~~at~~ ⇒ HENLE's Layer

↓

So, leakage is Radial

Rx-

1) Oral Acetazolamide *

2) Topical NSAIDs-

Indomethacin.

PUTSCHER's RETINOPATHY

ETIOLOGY

Q. 1> Pancreatitis → acute

Other causes-

-Head Trauma

-Chest ,,

PATHO

Air/ Fat embolism

multiple cotton wool spot

R_x- no effective R_x.

BULL'S EYE MACULOPATHY

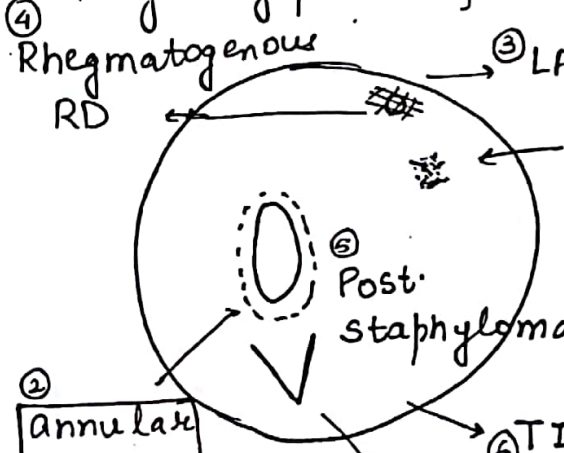
Alternate areas of **hyper** · **hypo** pigmentation

ETIO-

1) Chloroquine
2) Hydroxychloroquine
3) Cone Dystrophy
4) Batten Mayo Syndrome / Battens Disease
   ↓
   cerebro-macular degeneration.

PATHOLOGICAL MYOPIA

Any Myopia ± fundus changes



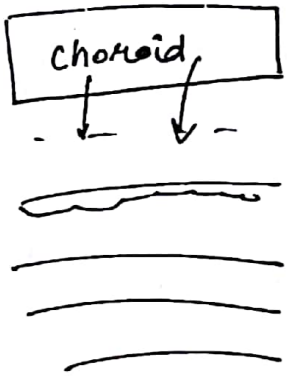
few fibres are shortened

RETINAL DETACHMENT

Separation of RPE from Neurosensory Retena

TYPES

H/C
1> TRD (Tractional RD)
2> RRD (Rhegmatogenous RD)
3> ERD (Exudative RD)



RHEGMATOGENOUS RD

TYPE

HOLE → After Degeneration → LATTICE DEG. / SNAIL-TRACK DEG.

TEAR → Traction
H/C- Post. Vitreous Detachment

C/F :-

1> D/V
2> Visual field Defects
3> Floaters → opacities in vitreous cavity
4> Photopsia → flash of light seen by pt. due to traction on Rods / Cones

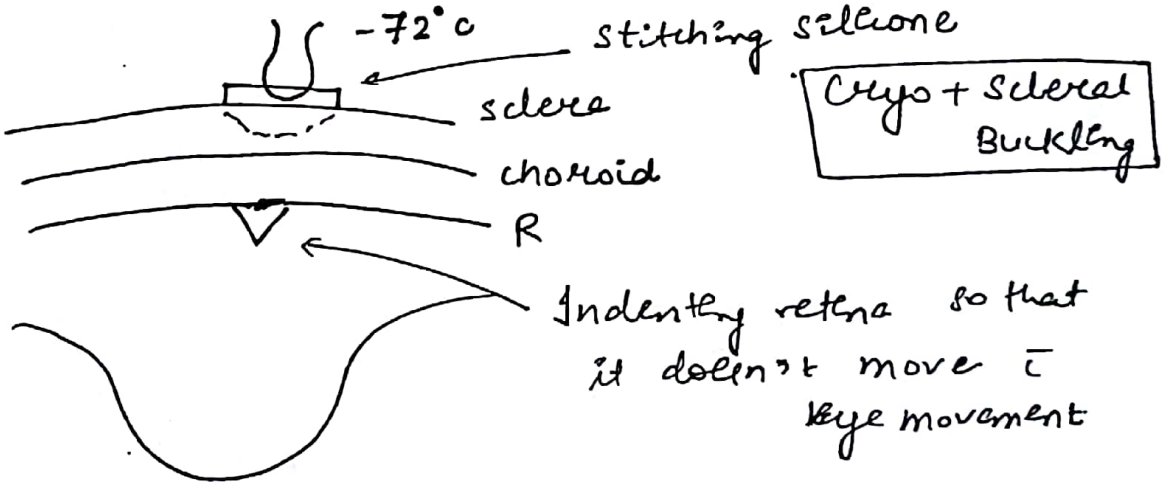
Look grey due to detachment

℞-

① TRD → 1) PRP
2) Sx

② ERD → ℞ the cause

③ RRD → Close the break



RETINOPATHY OF PRE-MATURITY (ROP)

PATHO

Free Radical Injury to developing blood vessel

↓

Hypoxia

↓

Retinitis Proliferans

C/F -

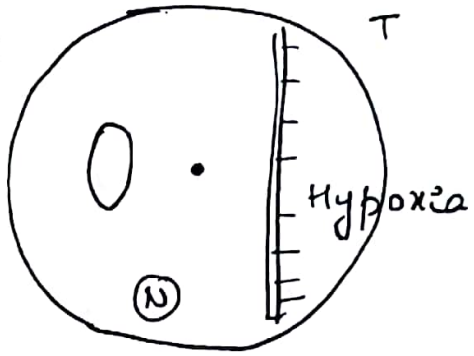
STAGE 1 → Demarcation Line

STAGE 2 → Ridge formation

STAGE 3 → Neovascularisation

STAGE 4 → Subtotal RD

STAGE 5 → Total RD



Rx OF ROP -

Q. Laser Photo-coagulation of Hypoxic Pts.

PROPHYLAXIS -

1) Vit E Therapy

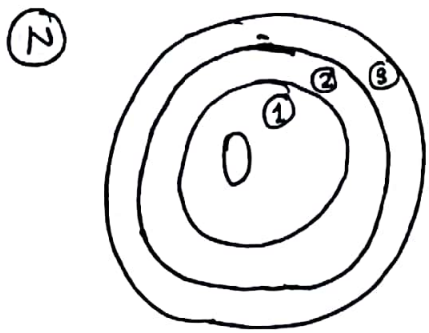
Q. C factor is more Imp for occurence of ROP?
⇒ Prematurity

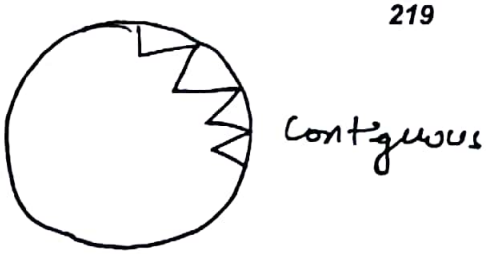
Q. Ideal Time of screening for ROP?
Add 4 weeks to Post natal age (31-33 wks)
Later.

THRESHOLD RETINOPATHY → other name of ROP.

CRITERIA -

STAGE	ZONE	EXTENT	PLUS DISEASE
III & Above	1,2	5 contigous or 8 non-contiguous clock hours	Tortuosity of artery & Vein





AGE RELATED MACULAR DEGENERATION (ARMD)

→ Choroidal Disease

→ Degenerative changes at macula in old age
↳ irreversible loss of vision

- M/C **DRY** (80-85%) (Non-Exudative)
  - 1> DRUSENS
  - 2> Geographical atrophy
  - No effective Rx
- **WET** (Exudative)
  - 1> RPE Detachment
  - 2> Choroidal / Subretinal neovascularization

Rx

- SUBFOVEAL (Below) → (I) Intravitreal Inj of Anti-VEGF
  - Bevacizumab → Avastin
  - Ranibizumab → Lucentis
- JUXTAFOVEAL (Beside) → (II) Laser photocoagulation
- EXTRA FOVEAL (away from) → (III) Laser photocoagulation

Q ② Photo dynamic Therapy
↓
Verteporfin
+
Diode y

} Hypopigmentation or whitening of the area occurs immediately after PDT

③ TTT (Trans- Pupillary Thermotherapy)
↓
Thermal effect is used to damage the membrane

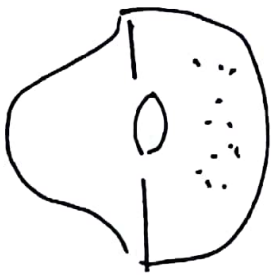
VITREOUS

1°	2°	3°
↓	↓	↓
Hyaloid Tissue (formed during embryonic life)	Q Hyaluronic Acid + Type II collagen (Adults)	Q Zonules of Zinn / Suspensory Ligaments
↓		
MESODERM	NEURO- ECTODERM	

Q Strongest attachment to ▼ retina
↳ At Vitreous Base
(ora serrata)

Q. C is more in vetreous?
Ascorbate
V:P = 9:1

FLOATERS



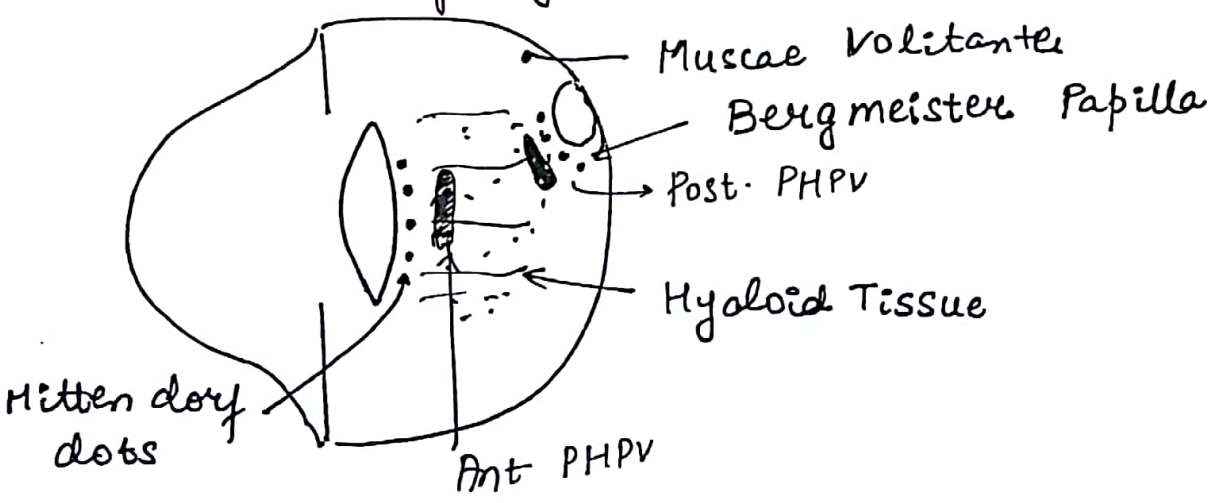
Opacities in Vitreous

1) Inflammatory cells
2) Pigments
3) H'gic clots
4) Synchisis Scentillans
   └ Cholesterol Bodies
5) Asteroid Bodies
   ↳ asteroid hyalosis

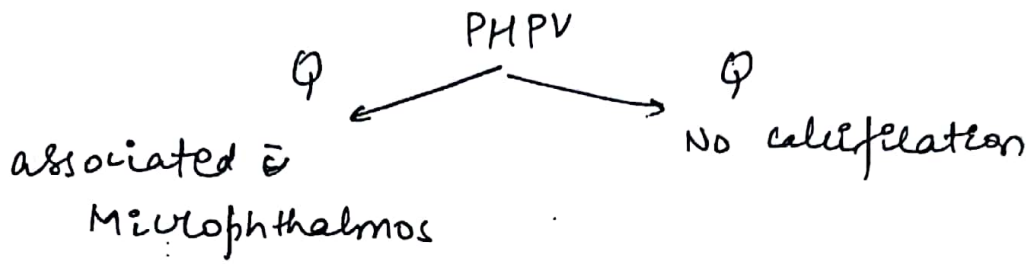
↓

Q
a) Disease of old age
b) ♂
c) ~~Bo~~ VA (N)
d) Ca + Lipids
e) A/c DM, HTN, high cholesterol,
f) ~~Hypermetropia~~
g) Not associated c myopia

6) MUSCAE VOLITANTES-
Remnants of Hyaloid Tissue



Ant PHPV → Better Prog than Post. PHPV.



COMMUNITY OPHTHALMOLOGY

Q M/cc of Blindness in India = CATARACT

Q M/cc of Preventable Blindness = 1) CATARACT
2) Trachoma

Q M/cc of childhood Blindness in India Vit A Def

Q 2nd M/cc of Blindness = Refractive Error (RE)

Q M/cc of ocular Morbidity = RE

Q M/cc of Blindness in world = Cataract

Q. M/cc of Blindness in developed countries = Glaucoma
↓
ARMD

Q Define Blindness → WHO
NPCB
Legal

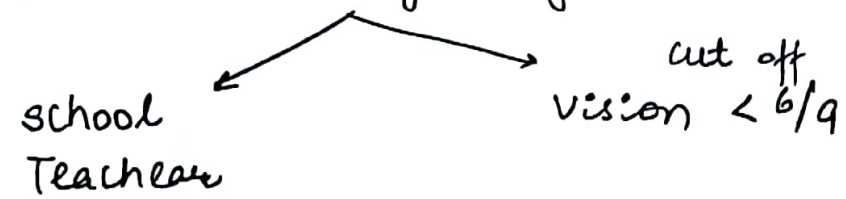
Best corrected visual acquity in Better eye $< 3/60$ (BCVA)
Or
visual field (Better eye)

Q. BCVA $< 6/60$. NPCB Def^n
< Better eye

Q Prevalence of Blindness in India = 0.56%
(>50yrs = 1.1%

Q. Incidence of Cataract In India = 62.6%

Q School Screening Programme



VISION - 2020

Q

Ophthalmologist : Population 1 : 50,000

Q.

2° service centre : Population 1 : 5 lakh

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

PSM

Handwritten Note

MBBS Help

http://mbbshelp.com

http://www.youtube.com/mbbshelp

http://www.facebook.com/mbbshelp.com

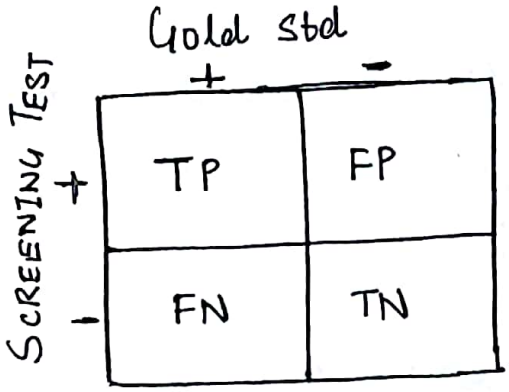
Name: _____

Subject: **PSM**

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

SCREENING

5/6/18



2x 2 Table

2 columns x 2 Rows.

DEGREE OF FREEDOM -

factors on a variable depends

$[C-1][R-1]$

eg. 3x4 Table = 6.

FN is more DANGEROUS than FP.

$$\text{SENSITIVITY} = \frac{TP}{TP + FN}$$

$$\text{SPECIFICITY} = \frac{TN}{TN + FP}$$

$$PPV = \frac{TP}{TP + FP}$$

$$NPV = \frac{TN}{TN + FN}$$

→ For a test to be screening Tests, Sensitivity should be High.

→ More sensitivity = Less False Negative

→ Person Labelled as Diseased on the basis of Gold std

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

→ Sensitivity & Specificity are Column Parallels

→ PPV & NPV are Row Parallels

$S_N \approx TP$ $S_p \approx TN$

Probability

PPV = have Disease NPV = Don't have Disease

PRACTICAL APPROACH TO QUESTIONS OF SCREENING

1> Draw 2×2 table & Label properly

2> Write the total population.

* If Total Population is not given then we most commonly assume it as 100

3> Write the column 1 Total

This can be obtained from 3 Sources

a> those who are +ve ī GS

b> those who are labelled as diseased

c> those who contribute to prevalence

4> Fill the 4 cells & apply the formula.

BAYE'S THEOREM

$$PPV = \frac{S_N \times Prev}{S_N \times prev + (1-S_p)(1-p)}$$

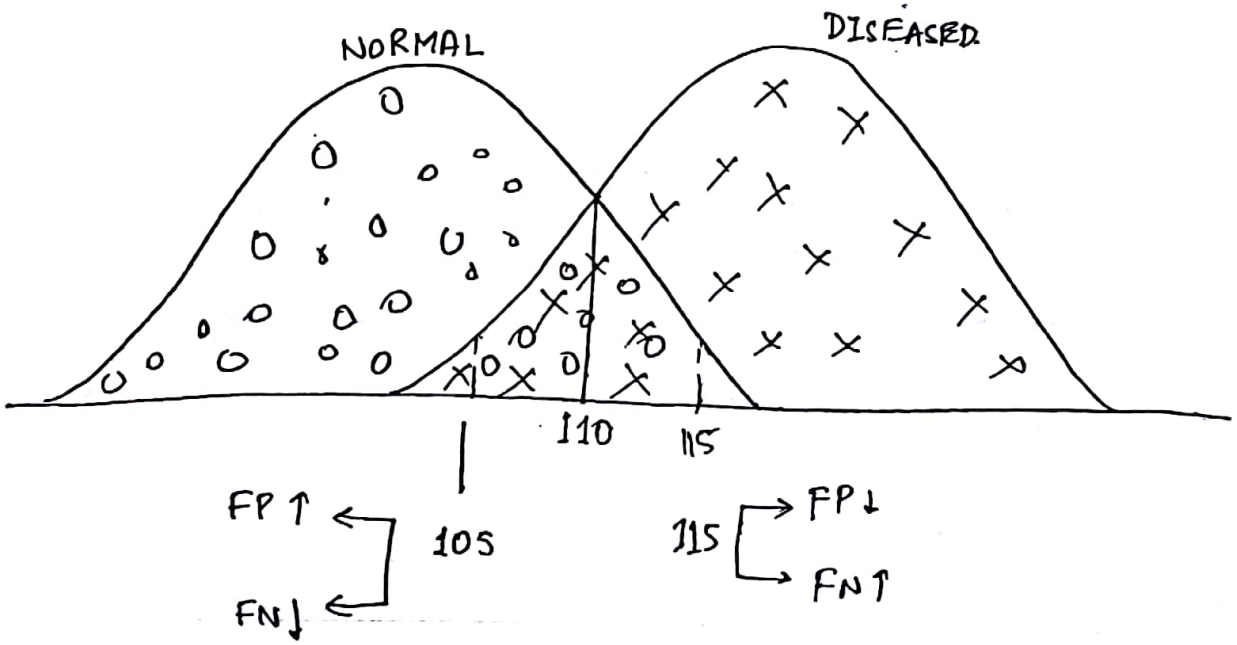
NPV = from CRS.

S.T. = screening Test

G.S. = Gold std.

G.S. \ S.T.	+	−
+	a	b
−	c	d

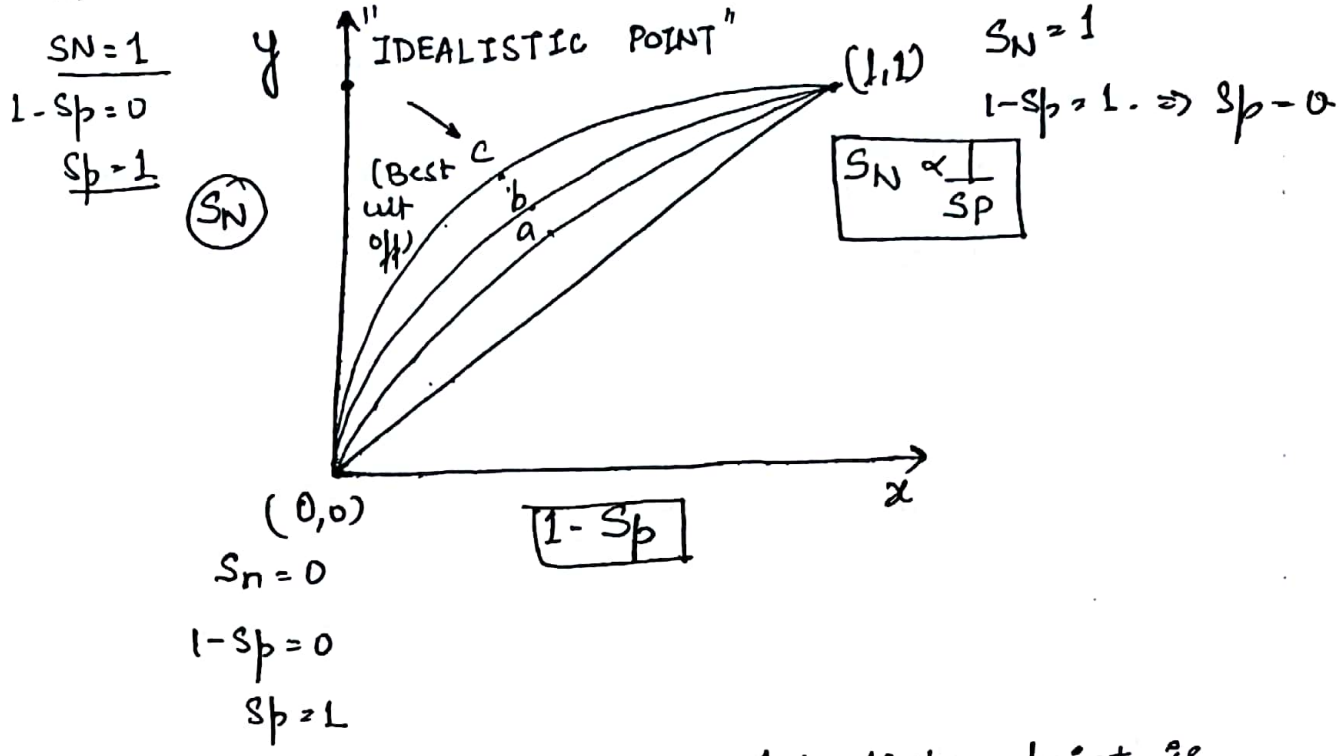
S.T. \ G.S.	+	−
+	a	c
−	b	d



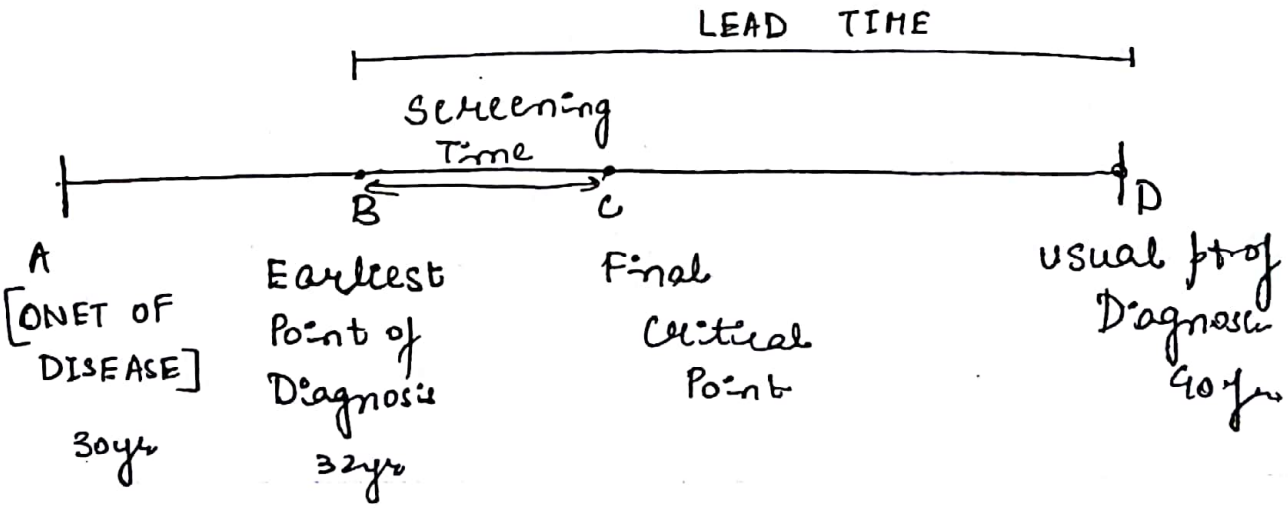
TO DECIDE BEST CUT OFF WE DRAW ROC

RECEIVER OPERATOR CURVE

AIIMS



⇒ Cut off Line Nearest to Idealistic point is "BEST CUT OFF"



Early Diagnosis [B - D]

↕ LEAD TIME

Early Rx → No improvement in Prognosis

Improvement in prognosis (B - C)

Screening Time

Ex. Rabies → No Rx

Pancreatic Cancer → Rapid progression

(LEAD TIME BIAS)

FINAL Critical Point.

↓

Last point after ∠ there is no improvement in Prognosis

ex- golden Time in stroke / CAD

PRINCIPLES OF SCREENING :- WHO

DISEASES	TESTS	Rx
- Imp. Public Health problem - Latent / asymptomatic phase must be tnt	- cost-effective Gold std must be present	cost effective Definitive Rx

Measles, Rubella, Rabies, Tetanus } No Latent / Asymptomatic Phase → No iceberg Phenomenon

↓

No Rx Screening

SCREENING DONE	Ca	NOT DONE
Ca Colon		Ca uterus
Ca Breast		Ca ovary
Ca Cervix		Ca Pancreas
Ca Prostate		Ca Testis
		Ca Brain

Null Hypothesis from Discussion Paper

p value

It refers to chance

p value of 5% or 0.05 means only < 5% of people ~~who~~ were benefitted from the therapy due to chance.

INTERPRETATIONS

1) PREDICTIVE VALUE = Diagnostic Power of a Test

Depend on-

a) Prevalence (max) Not on Incidence

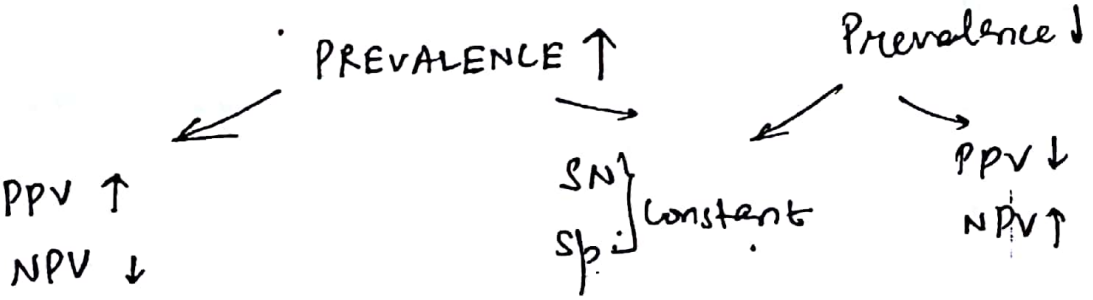
b) $S_N + S_p$

2) PRE TEST PROBABILITY ⇒ Prevalence

3) POST TEST PROBABILITY ⇒ Predictive value.

4) $S_N \propto \frac{1}{S_p}$ $PPV \propto \frac{1}{NPV}$

5.



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

(5) $SN \uparrow \rightarrow TP \uparrow \rightarrow FP \uparrow$

But reverse doesn't happen.

[FP ↑ → SN ↑ XXX MCQ Book Error
→ Prevalence]

(6) ∴ Screening is always done in High Risk Population.

TEST IN SERIES

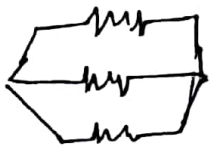
one after other

Ex. Fever + Burning micturition
↓
Urine — Routine
Microscopy
↓ +ve
Urine culture & Sst.

$SN \downarrow$ & PPV ↑ses

Sp ↑ NPV ↓

TEST IN PARALLEL



all at same time

serum
LDL → TG
IDL
VLDL → CHL

Vice-versa in parallel

$SN \uparrow \propto \frac{1}{Sp \downarrow}$ $PPV \downarrow \propto \frac{1}{NPV \uparrow}$

⑦ Concept of Likelihood Ratio & Yield is obselete now.

H.W DIFFERENCE BTW SCREENING & DIAGNOSTIC TEST

TYPES OF SCREENING

TYPES OF SCREENING

PRESCRIPTIVE

1> People screened for own's benefit

2> OBJective ⇒ case control

3> Eg:- Neonatal screening
Pap smear

PROSPECTIVE

1) People screened for other's benefit

2> Disease Control

3> Eg:- Immigrants screening
HIV screening among sex workers

SCREENING TEST

1> High Sensitivity

2> For apparently healthy

3> Based on 1 criteria

4> Relatively cheaper

5> Not sufficient basis for treatment

6> Initiative from investigation

7> Applied to groups

DIAGNOSTIC/GOLD STD TEST

1> High Specificity

2> For persons ± signs & symptoms

3> Based on signs, symptoms & Lab findings

4> Expensive

5> Sufficient basis for t/t

6> Initiative from a person ± complaint

7> Applied to individuals

TOPIC-1

6/6/18

11

MEASURE OF CENTRAL TENDENCY

MEAN (arithmetic)

Add all divided by sample size

~~Geometric~~
~~Harmonic~~

MEDIAN - Arrange in Ascending / Descending value. & middle value is selected

MODE - Most frequently occurring.

Measure of central tendency

NORMAL DISTRIBUTION	NON-NORMAL DISTRIBUTION
Mean = Median = Mode	Mean ≠ Median ≠ Mode
Preferred measure → MEAN	Preferred measure → MEDIAN

OUTLIERS - Any extreme value

Most affected → Mean

Least affected → Mode (But not preferred as no statistical test can be applied).

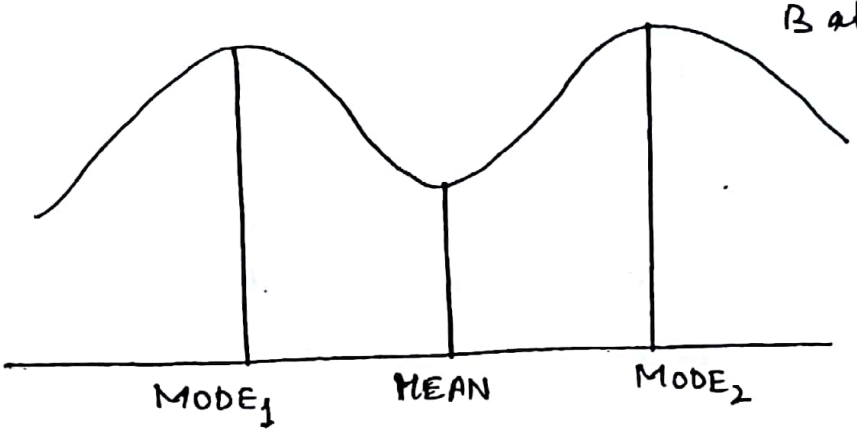
Most preferred → MEDIAN

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Q TEST-

Statistical Test used to see outliers

BIMODAL → 2 modes



Bath-Tub Distribution

MODE Summary = 3 × MEDIAN − 2 × MEAN

TOPIC-2

MEASURE OF DISPERSION / DEVIATION

FORMULAE :-

1) $SE = \frac{SD}{\sqrt{n}}$ $\qquad SE = \sqrt{\frac{pq}{n}}$.

Quantitative Data. $\qquad$ Qualitative Data

n = sample size

p = prevalence { %age / Proportion.

$q = (1-p)$ or $(100-p)$

3) $COV = \frac{SD}{mean} \times 100$

↓

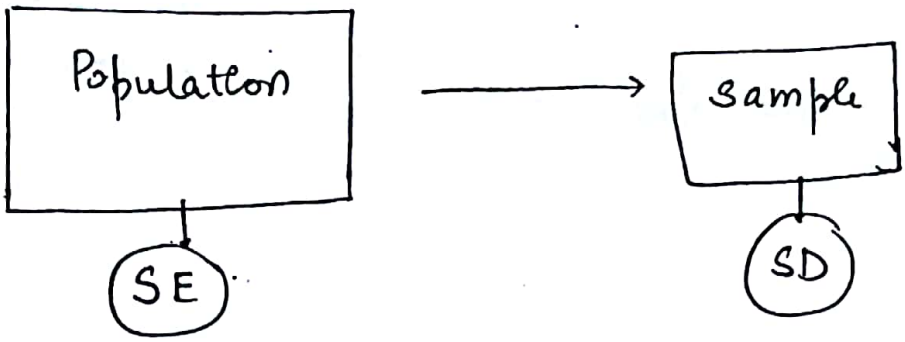
→ Coefficient of variance

→ Unit free measure to compare 2 dissimilar Variables

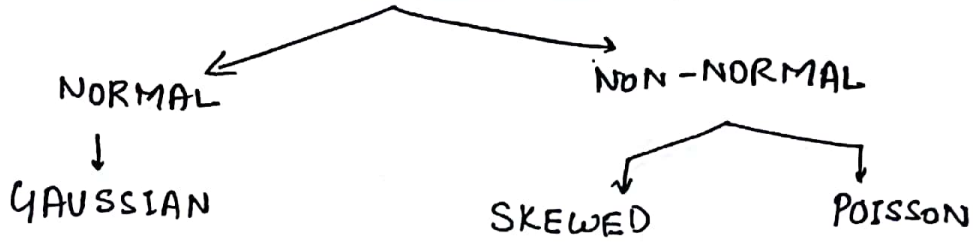
4) $Z\ score = \frac{X - Mean}{SD}$

↓

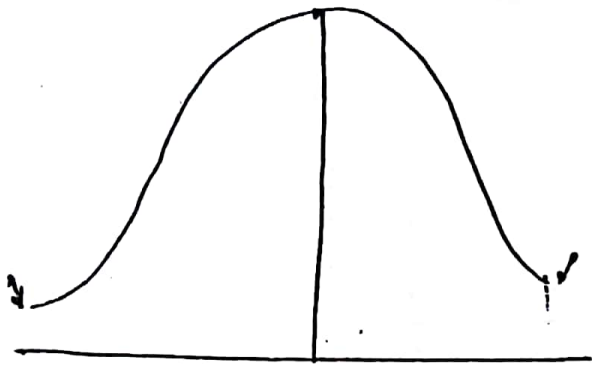
- Growth chart
- BMD of osteoporosis


Population
Sample
SE
SD

TOPIC-3 DISTRIBUTION OF DATA



GAUSSIAN

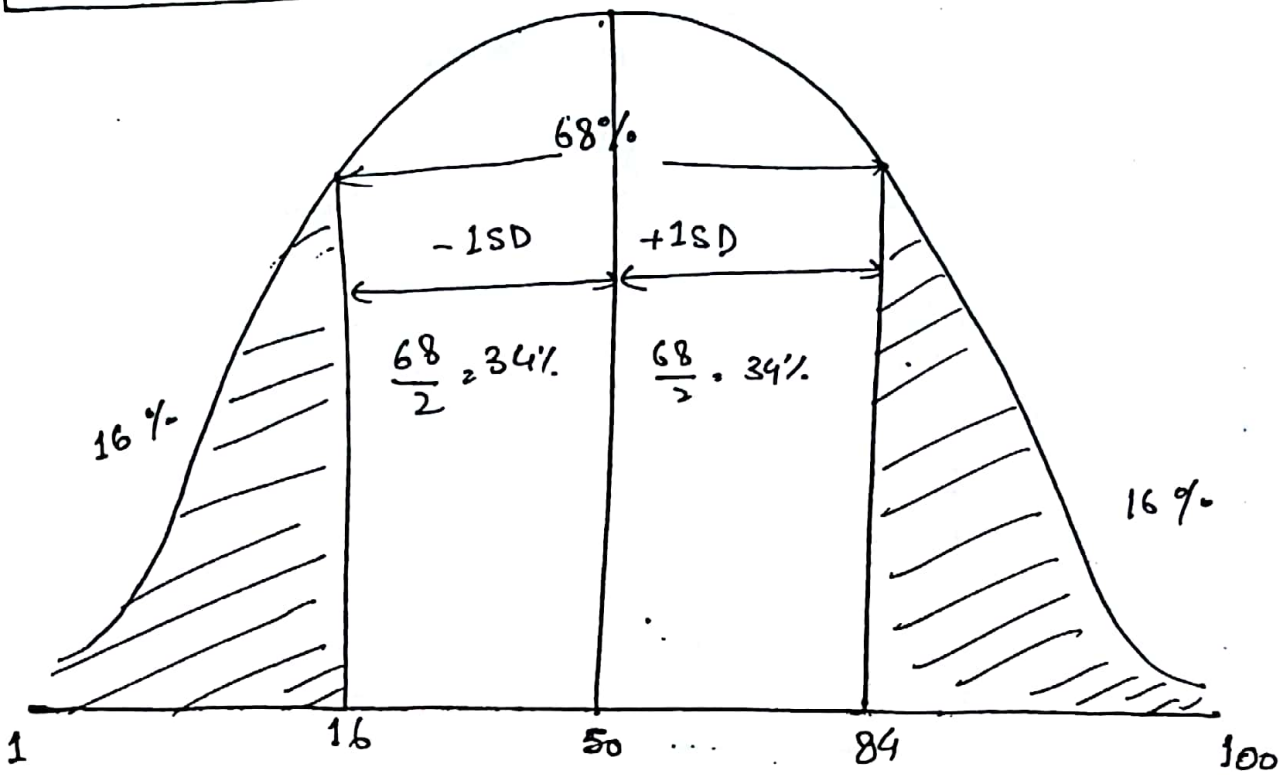


1) Bell shaped
2) B/L Symmetrical
3) Tails Touch X-Axis from $-\infty$ to $+\infty$
4) Area under curve 100% or 1
5) Mean = Median = Mode → Not the absolute values
6) S.D. = 1, Variance = $1^2 = 1$

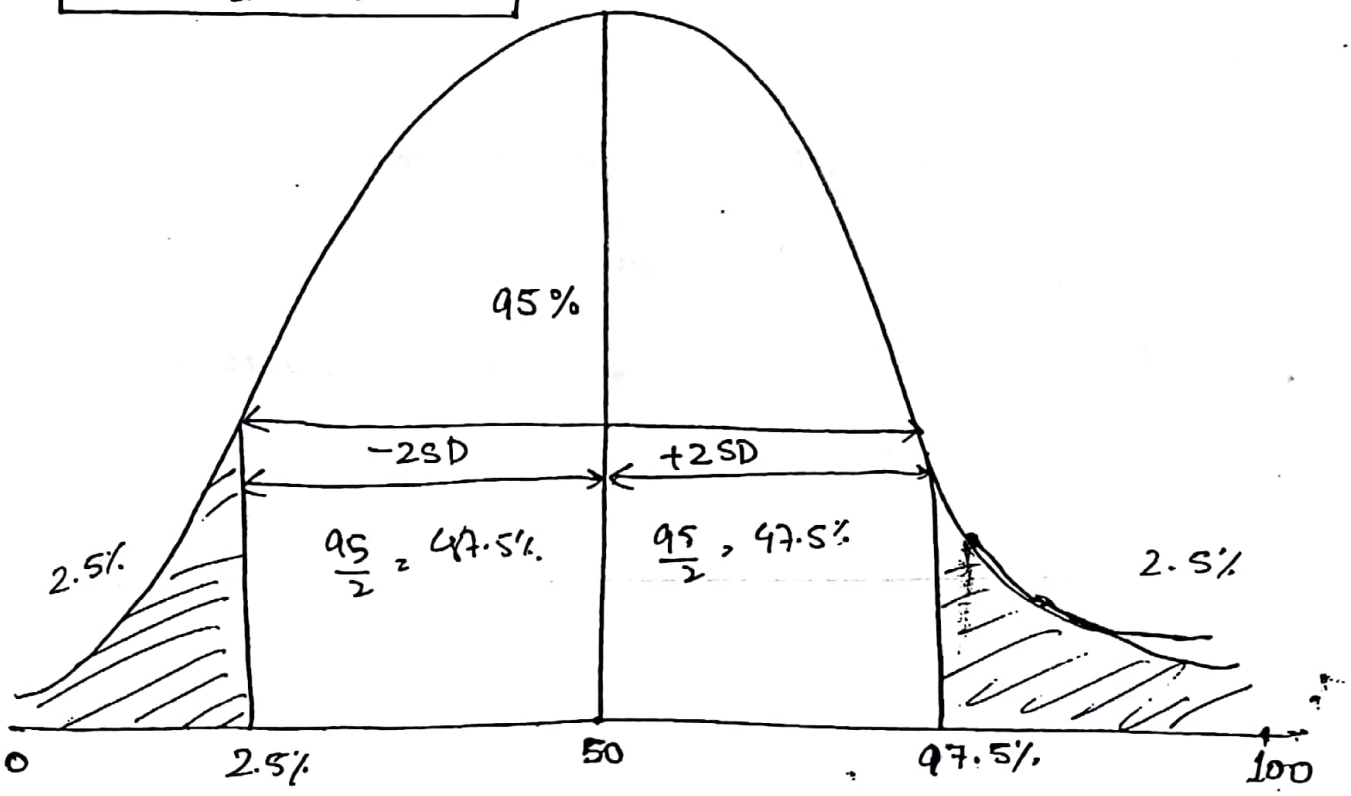
THEOREMS

Mean $\pm$ 1 S.D. = 68%
or
Median $\pm$ 2 SD = 95%
or
Mode $\pm$ 3 SD = 99%

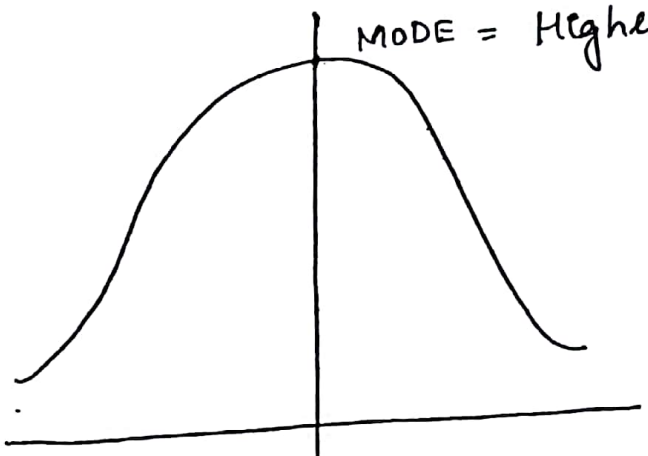
Mean ± 1SD = 68%



Mean ± 2SD = 95%

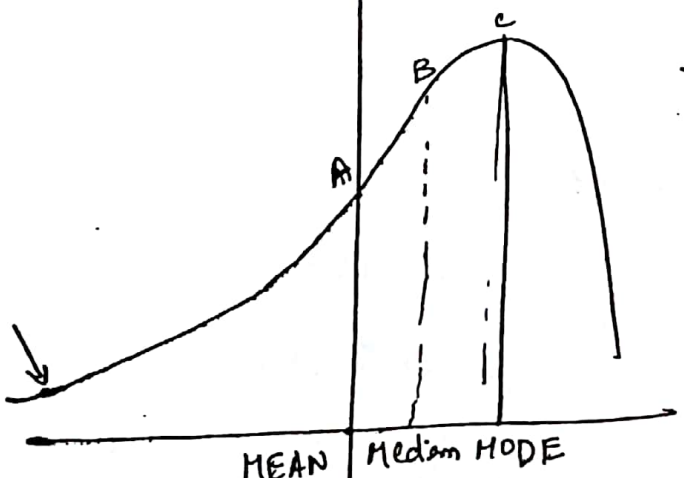


SKEWED



NORMAL

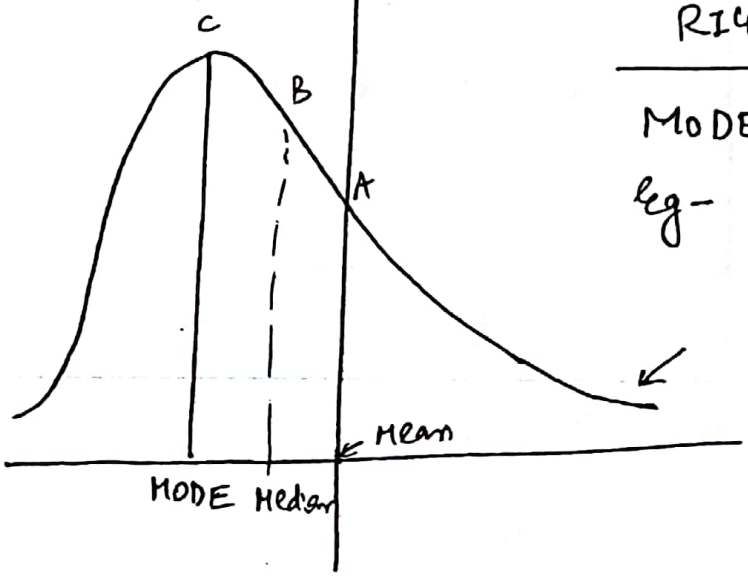
MEAN = MEDIAN = MODE



LEFT / SKEWED / -ve

MEAN < MEDIAN < MODE

eg- APGAR



RIGHT / +ve SKEWED

MODE < MEDIAN < MEAN

eg- Hb of children in slums

POISSON DISTRIBUTION

It is a probability Distribution

No Diagram/ curve

eg. → No. of email or phone calls received in a day.

→ No. of head Trauma pts. admitted in Hospital in a day

TOPIC 4A VARIABLE

(Any characteristic)

QUANTITATIVE (How much)	QUALITATIVE (How is it)

* Majority of variables can be both.

Depending upon 'How much they are measured'

wt - 120kg / 70kg / 40kg	overwt / (N) / underwt

* But some variables are purely Qualitative - like race, religion.

Gender ....

only No. ⇓ Frequency / sample size	No. + METRIC SCALE ⇓ Quantitative variable

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Q. In a class of 400 students, 220 are boys + 180 are girls.

Variable ⇒ Gender

220 + 180 are frequency of sample size

II) BINARY/DICHOTOMOUS	POLYTOMOUS
2 ANSWERS	>2 ANSWERS
Ex. Yes/No	Tall/Med/short
Rh +/-	ABO Bl. Gps.

III) DISCRETE	CONTINUOUS
↓	
Can't take In Between values	Can take in between values
Ex. No. of Siblings	Wt. - 80.2
Pulse Rate	Temp - 37.9
	Hb - 11.2
	BP

A variable can take any of these 3 classification

Eg. Wt can be Quantitative, continuous, Polytomous

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Topic 4b 7 SCALE OF MEASUREMENT

- CATEGORICAL → Qualitative Data
  - NOMINAL → Names only → Race, Religion, Gender → MODE
  - ORDINAL → Ordered Data → Severity of Disease, TNM staging, Socioeconomic status → MEDIAN
- METRIC / DIMENSIONAL → Quantitative Data
  - INTERVAL, RATIO → In stats we don't use them separately. → wt. (kg), Ht (cms) → MEAN

(1) LIKERT SCALE

(1) Type of Ordinal Scale

→ ~~Summative scale~~

(2) SUMMATIVE SCALE

Summarises human behaviour.

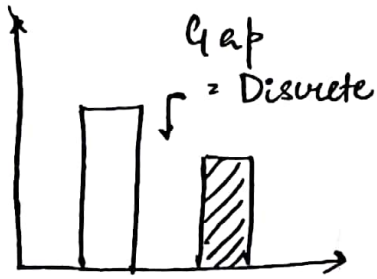
(3) Ordinal scale → median, mode ~~mean~~

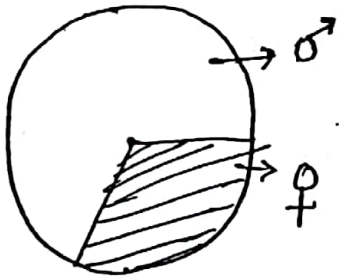
(4) Ex- Visual analogue / Pain scale

USELESS → GUTTMAN/ ADJECTIVINAL

TOPIC 5> GRAPHICAL REPRESENTATION OF DATA

QUALITATIVE	QUANTITATIVE	MISC
① BAR LINE	HISTOGRAM	PICTOGRAM
⇓	FREQ POLYGON	TREE
400 students	LINE DIAGRAM	SPOT MAP
220 Boys	CUMULATIVE FREQ	VENN
180 Girls	POLYGON / OGIVE	STEM & LEAF
② PIE	SCATTER DIAGRAM	QUARTILES





PIE

QUANTITATIVE DATA

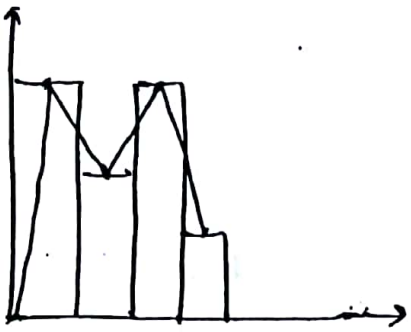
Ht (cm)	fn	cumulative frequency
140.1 - 150	150	150
150.1 - 160	100	250
160.1 - 170	130	380
170.1 - 180	20	400
	400	

FREQ TABLE

CUMULATIVE FREQ TABLE

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

FREQ TABLE



Join mid points.

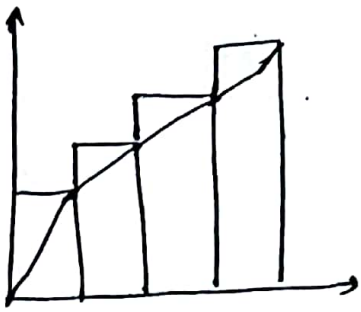
HISTOGRAM

↓

FREQ POLYGON / ~~CURVE~~ CURVE

↳ LINE DIAGRAM
(provides trend)

CUM. FREQ TABLE



Join end points.

OGIVE / CUM. FREQ POLYGON

MISCELLANEOUS DIAGRAMS

Suppose I want to explain to an illiterate Person-

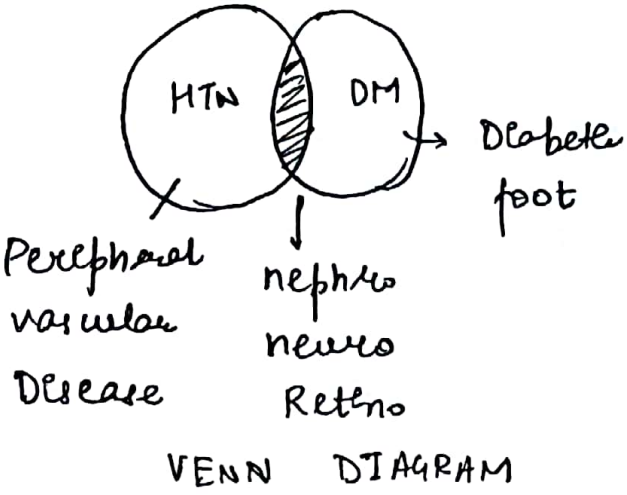
1) Complica" of DM → PICTOGRAM

2) Progression of DM → TREE

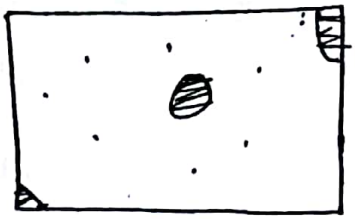
3) Complica" of DM & HTN → VENN

4) Geographical Distributon of DM in Delhi → SPOT MAP

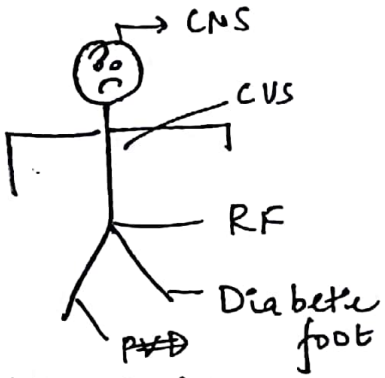
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp



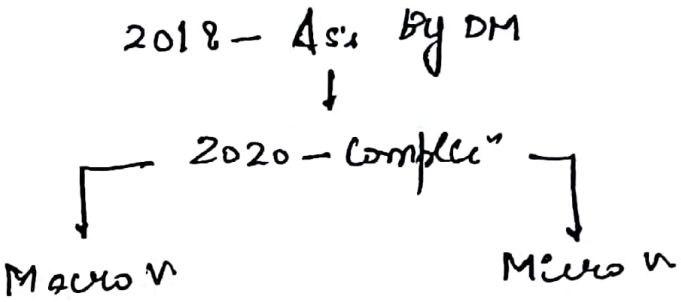
VENN DIAGRAM



SPOT MAP



PICTOGRAM

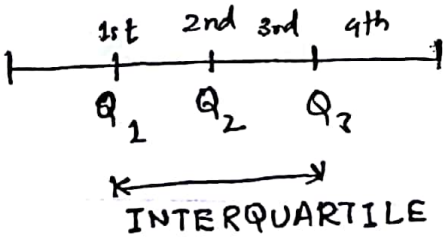


TREE

QUARTILES

NORMAL D.

EQUAL



RANGE = $Q_3 - Q_1$

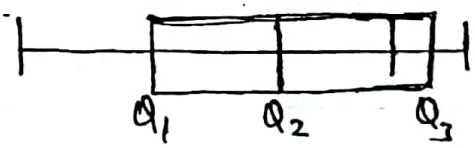
BOX & WHISKER PLOT

$Q_2 - Q_1 = Q_3 - Q_2$

ON-NORMAL D.

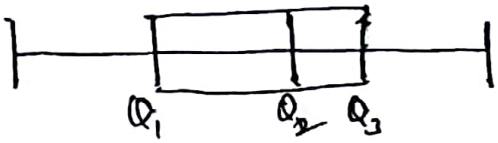
UNEQUAL

⇒ POSITIVE SKEW

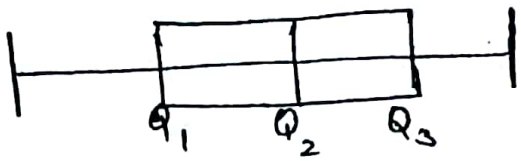


$Q_2 - Q_1 < Q_3 - Q_2$

⇒ NEGATIVE SKEW



$Q_2 - Q_1 > Q_3 - Q_2$



TOPIC-6

PROBABILITY

- DEPENDENT → ADD
  $P_{TOTAL} = P(A) + P(B)$
- INDEPENDENT → MULTIPLY
  $P_{TOTAL} = P(A) * P(B)$

TOPIC-7A.> SAMPLE SIZE

$n = \frac{4pq}{d^2}$ At 95% confidence interval for all observational studies

AIIMS

$n = \frac{z^2 pq}{d^2}$ ← d error if given, remember to get confidence ★

where $z = 1$, at 68% confidence

$z = 2$, at 95% confidence

$z = 3$ at 99% confidence

where, p = prevalence ← proportion / %

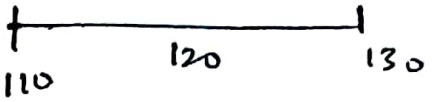
$q = (1-p)$ or $(100-p)$

d = ABSOLUTE PRECISION

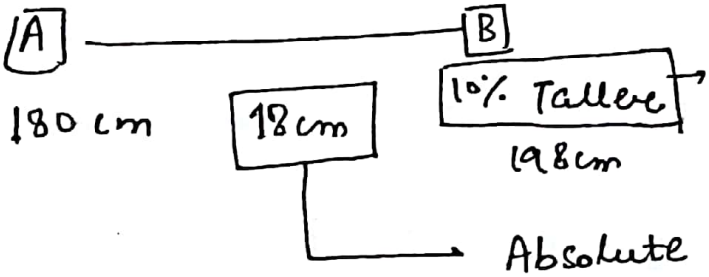
I) SBP_A = 120 mm Hg ± 10 mm Hg

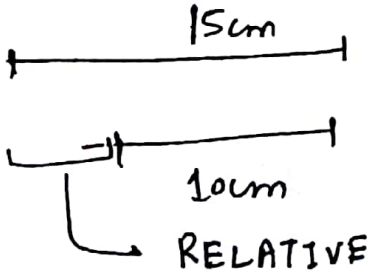
1	- 100	F	F
2	- 110	??	P
3	- 114	P	P
4	- 120	P	P
5	- 128	P	P
6	- 130	??	P
7	- 140	F	F

ABSOLUTE PRECISION



II (RELATIVE PRECISION





★ UNIT OF ABSOLUTE PRECISION IS SAME AS THAT OF VARIABLE

Eg. Prevalence variable, absolute precision will be in %.

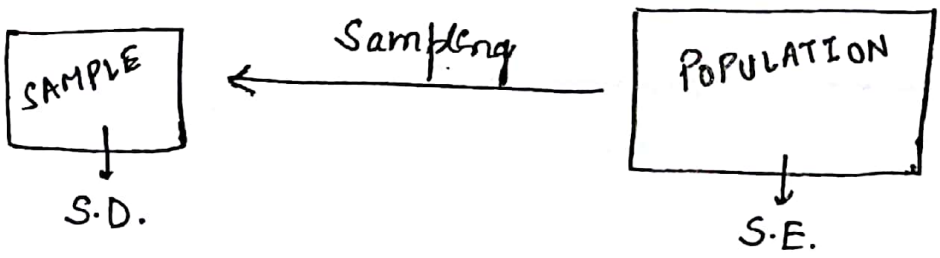
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

⇒ If no prevalence is available or
If we are doing the study for the 1st Time.
we take p = 0.5 or 50%.
↓
Being it yield maximum sample size for a given absolute Precision.

⇒ POWER effects sample size in case of "INTERVENTIONAL STUDIES"

⇒ |

TOPIC 8A) CONFIDENCE



$$S.E. = \sqrt{\frac{pq}{n}} \qquad S.E. \frac{SD}{\sqrt{n}}$$

Mean ± 1SD = 68% or	± 1s . 68%
Median ± 2SD = 95% or	± 2s 95%
Mode ± 3SD = 99% or	± 3s 99%
Prevalence	SAME THEOREM

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

⇒ Whenever Population / confidence is mentioned, We need to calculate **Standard ERROR**

CONFIDENCE

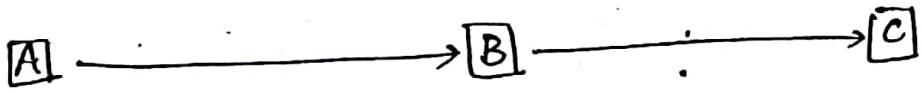
Research is done on sample & Results are generalised to the population.

95% confidence means ⇒ 95% sure dat my results will be true to the Population.

To achieve 100% confidence the entire population has to be studied

CONFIDENCE LEVEL = $1-\alpha$ or $100-\alpha$

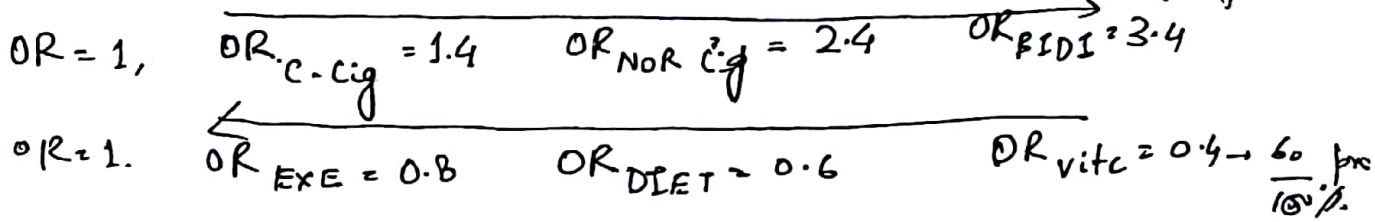
INTERPRETATION OF CONFIDENCE



A – If CI touches / Includes **NULL VALUE** It is statistically Insignificant.

- No Association — RR, OR = 1
- NO Relationship — $\rho = 0$

B – More the Distance of null value from Point Estimate, more is the statistically significant

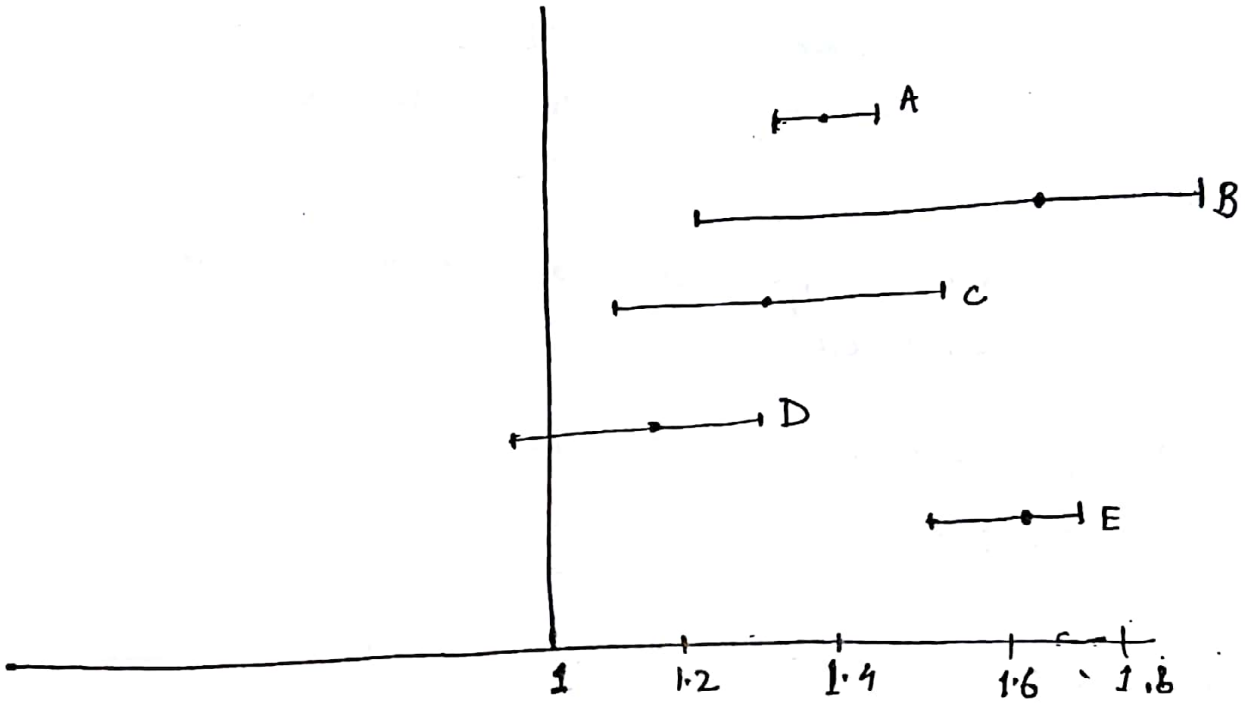


Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

C - Smaller the CI, more is the significance

Sample size LARGE.

$$\left[\downarrow SE = \frac{SD}{\sqrt{n}\uparrow} \Rightarrow \downarrow CI = \pm 2SE\right]$$



INSIG / WORST = D ← touches null value

MAXIMUM "N" = A ← minimum CI

MINIMUM "N" = B ← max. CI

BEST / MAX SIG = E. ← doesn't touch null value

Max. dist. from null value

Smaller CI:

STATISTICAL TESTS

— from Discussion paper.

SUMMARY

1> DISCRETE QUALITATIVE DATA — BAR, PIE

2> Continuous Quantitative Data → Histogram → FREQ POLYGON

Histogram → LINE DIAGRAM (Trend)

3> Relationship Scatter Diagram, Correlation, Regression

4> Progression of Disease - Tree Diagram

5> Overlapp of some features - Venn Diagram

6> Geographical Distribution - Spot Map

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

EPIDEMIOLOGY

I> Validity & Reliability from Discussion Paper

II> Bias . also from Discussion Paper.

MORBIDITY INDICATOR

INCIDENCE	PREVALENCE
~~(1) POPULATION AT RISK~~	~~(1) TOTAL POPULATION~~
(2) RATE	(2) PROPORTION
(3) CALCULATED FROM COHORT STUDIES	(3) CALCULATED FROM CROSS SECTIONAL
(4) NEW CASES/Pop^{n} AT RISK	(4) NEW + OLD CASES/ Total Population
(5) Imp. for preventive services / planning	(5) Imp for curative services & planning

INTERPRETATION:-

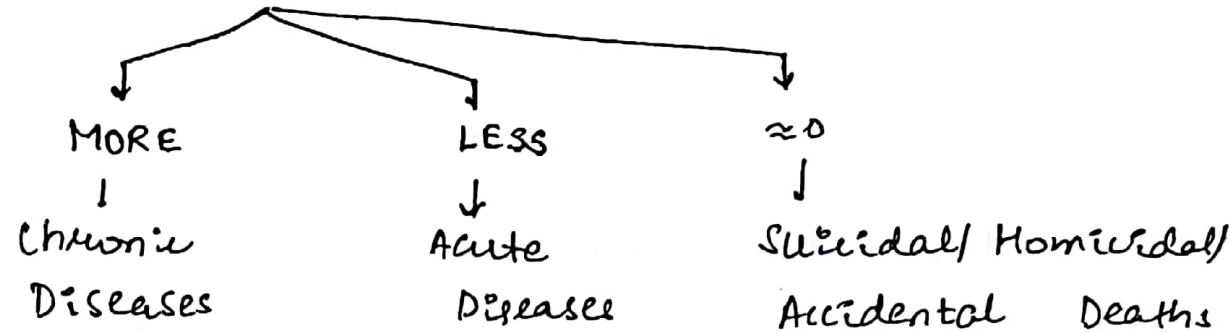
1> Prevalence is of 2 types

- POINT
  - a) Calculated from cross sectional study
- PERIOD
  - b) calculated from longitudinal study

2) If nothing is mentioned we take it as point prevalence

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

3) $\text{PREVALENCE} = \text{INCIDENCE} \times \text{DURATION}$ (PERIOD)



4) Prevention Is Better than Cure

Preventive strategies → ↓ Incidence → ↓ Prevalence

Curative strategies (100% cure) → ↓ Prevalence

5) If for a Previously Fatal Disease, a new Rx is initiated & Prevents mortality But life long morbidity Persists, Prevalence ↑

Before 1920, any person of who developed DM used to die, But after discovery of Insulin in 1920, the deaths where prevented but Insulin doesn't cure of DM But ↑ses duration.

∴ Prevalence ↑ se.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

MORTALITY INDICATORS

FORMULAE :

1) CDR = $\frac{\text{TOTAL DEATH}}{\text{TOTAL POPULATION}}$

2) SPECIFIC DEATH RATE = $\frac{\text{TOTAL NO. OF DEATHS IN SPECIFIC AGE GROUP /occupation/ Gender /Location ....}}{\text{Total Population}}$

3) PROPORTIONAL D.R. = $\frac{\text{Total No. of deaths In Specific age group /occupation/ Gender /Location...}}{\text{Total Deaths}}$

4) CASE FATALITY RATE = $\frac{\text{Total Deaths due to Particular Disease}}{\text{Total No. of cases due to same Disease}}$

MULTIPLICATION FACTOR

→ For all mortality & Morbidity Indicators

If total Population is not given, we take it as $\times 1000$.

except MMR ⟶ 1,00,000

or

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Case Fatality Rate
Survival Rate
Couple Protection Rate
2° attack Rate
} → ·100

Pearl Index → 1200

RATE	PROPORTION	RATIO
Proportion + Time component	Prevalence = Total cases / Total Population Numerator is part of denominator.	Sex Ratio = ♀/♂ Numerator is not the part of Denominator.

CFR & 'Proportional D.R.' are MISNOMER.
As no time component is taken

MMR
N = M.M.
D_1 = No. of L.B.
D_2 = No. of ♀ of reproductive age group

MM RATE → D_2

MM RATIO → D_1

IMPORTANCE OF MORTALITY INDICATORS

1) BEST INDICATOR OF DISEASE BURDEN

a) mortality Indicator → PROPORTIONAL D-R

b) morbidity Indicator → PREVALENCE

c) Health Index → HALE.

2) CFR-

a) ↑ Killing Power of disease → ↑ virulence → ↑ CFR

b) Acute Disease

c) CFR = 1 - Survival Rate

or

CFR = 100 - Survival Rate

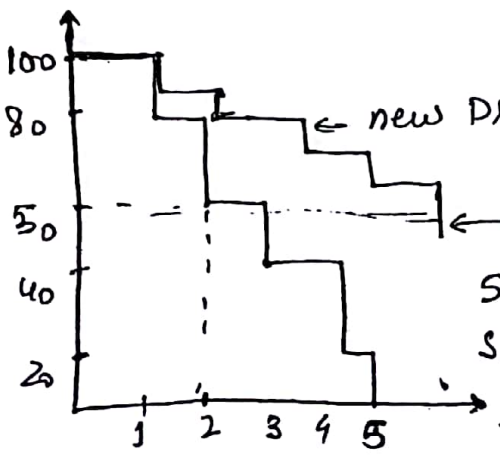
SURVIVAL RATE ⟹ cancers

a) prognosis

b) Yardstick for assesment of therapy

AIIMS KAPLAN MEIR CURVE → survival

Special Type of Regression = 'COX'S STEPLADDER PROPORTIONAL HAZARD PATTERNS



5yr survival = 0.

Median survival = 2yrs.

Max. Death occurs in 2 yr = 2 year.

3) SPECIFIC D.R..

a) 'AT RISK' Population

b) Comparison of Deaths In **same** Population

Standardised/ Adjusted D.R. ← Two Different Population

ADJUSTED/STANDARDISED

* STD- POPULATION -
  - → National Population is not the Std. Population
  - → Population where no. in each age & sex groups are known

Standardisation

DIRECT

When no. of People & No. of Deaths In each age & sex. Group In known

INDIRECT

when it is unknown

SMR [Standardised Mortality Ratio]

SMR >100 → Hazardous occupation

Standardisation removes confounding effect of Different age structures &

∴ **Age Standardisation D.R.** is **Best** to compare vital statistics of a country.

'Detail not Imp'

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

EVIDENCE BASED MEDICINE

1) DEF^{n} -

* Applying Best Available evidence gained from scientific methods to clinical Decision making
* seeks to assess quality of clinical Practice objectively (no subjectivity)

2) IMP- Gold Std. of clinical Practice

3) Father → David Sackett

4)

ICD

International Classification of Diseases - ICD Σ

① consists of 22 chapters

② Revised every 10yrs

③ Arranged in 3 volumes

ICD XI → 2018

SDG

Sustainable Development Goals.

1) 17 Goals (Goal No. 3) └ health

2) TARGETS → To Be achieving By 2030

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

GLOBAL

→ MMR < 70/1 Lakh L.B

→ NMR < 12/1000 L.B.

→ USMR < 25/1000 L.B.

↓ By 33% Premature mortality From NCD's

↓ By 50% Global Deaths & Injuries from RTA's

MATCHING AIIMS

1) DEF^n:-
Process of Selecting controls so that they are Similar to cases ~ regards to certain Variables

2) CAUTION:- OVER MATCHING
↓
Don't match for variable of Interest as won't be able to get statistical Test

3) ELIMINATION - It eliminates ∨ Confounding known

4) DONE IN - Case Control >> Cohort

CAUSATION / CASUALITY

10 FACTORS

Most Imp Study Design to study

1> CAUSALITY → Double Blind RCT

2> TEMORALITY → COHORT

~~3~~

A> TEMPORALITY - Most Imp. / Mandatory

Exposure → Disease

Smoking → Lung Ca

MBBS → MD/MS

B> DOSE RESPONSE -

Smoke 10 cigerette → Ca in 1 year

Smoke 1 cigerette → Ca in 10 year

C> REVERSABILITY -

Stop smoking → Relapse

D> BIOLOGICAL PLAUSIBILITY - Feasibility

E> SPECIFICITY -

Weakest - / Most Difficult

Only 1 Risk Factor is associated ~ 1 disease.

Not possible to prove in Non communicable Disease

F) STRENGTH ⟶ Relative Risk

G) CONSISTENCY

H) COHERENCE

I) STUDY DESIGN

J) JUDGING BY EVIDENCE

GRADING OF STUDY DESIGNS

TOP

META ANALYSIS & SYSTEMATIC REVIEW

DOUBLE BLIND RCT

COHORT

CASE CONTROL

LONGITUDINAL

CROSS - SECTIONAL

ECOLOGICAL

CASE SERIES

CASE REPORT

BOTTOM

INTERNATIONAL DEATH CERTIFICATE

Ia → ~~Underlying~~ Immediate cause of Death

Ib → Underlying cause of Death

Ic → Main underlying cause of Death

II → other cond" not directly leading to Death

I_a & I_c ⇒ MANDATORY

I & II ⇒ OPTIONAL

I_c is most Imp. as we do ICD - classification Based on it.

STUDY DESIGNS

[WHO CLASSIFICATION]

- **OBSERVATIONAL**
  - **DESCRIPTIVE**
    - ✓CASE REPORT
    - ✓CASE SERIES
    - ✓CROSS-SECTIONAL
    - ✓LONGITUDINAL
  - **ANALYTICAL**
    - ✓ECOLOGICAL
    - ✓CASE CONTROL
    - ✓COHORT
- **INTERVENTIONAL**
  - **NON-RANDOM/ QUASI**
    - EVALUATN STUDIES
    - CESSATN STUDIES
    - NATURAL EXPERIMENTS
    - PRE-POST CLINICAL TRIAL
  - **RANDOM**
    - RCT

* For all Study Design, unit of study is an individual except for Ecological Study (whose unit of study is population)

* PARK & MCQ Book consider Cross-sectional & longitudinal Study as Analytical study ∴ it wrong

DESCRIPTIVE STUDY

No Comparison No Temporality

1) CASE REPORT
Single
↓
1st study Done for any research

2) CASE SERIES
Multiple
[Ab (N) C/F/ Diagnostic/ Prognostic feature.]

3) CROSS - SECTIONAL
single
↓
Point Prevalence

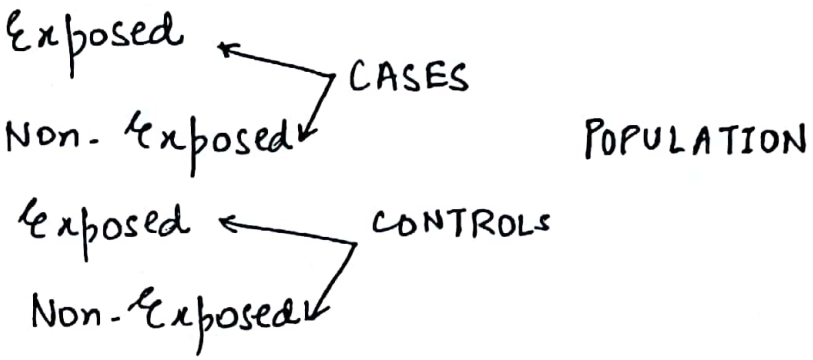
4) LONGITUDINAL
Multiple
↓
Period Prevalence

Snapshot Studies i.e. Both exposure & Disease are measured at same time

←——— Done for chronic Disease ———→

CASE CONTROL

(I)



(II)

	Exposed	Non-exposed
CASE	a	b
CONTROL	c	d

(III)

$$\text{ODD's RATIO} = \frac{ad}{bc}$$

$$\text{ODDS RATIO} = \frac{\text{ODDS of Being Exposed In Cases}}{\text{odds of Being Exposed in Controls}}$$

$$\text{ODDS} = \frac{P}{1-P} = \frac{\text{Probability that event will occur}}{\text{Probability that event will not occur}}$$

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

COHORT

(I) POPULATION → Exposed → Diseased / Non-Diseased
POPULATION → Exclusion
POPULATION → Non-Exposed → Diseased / Non-Diseased

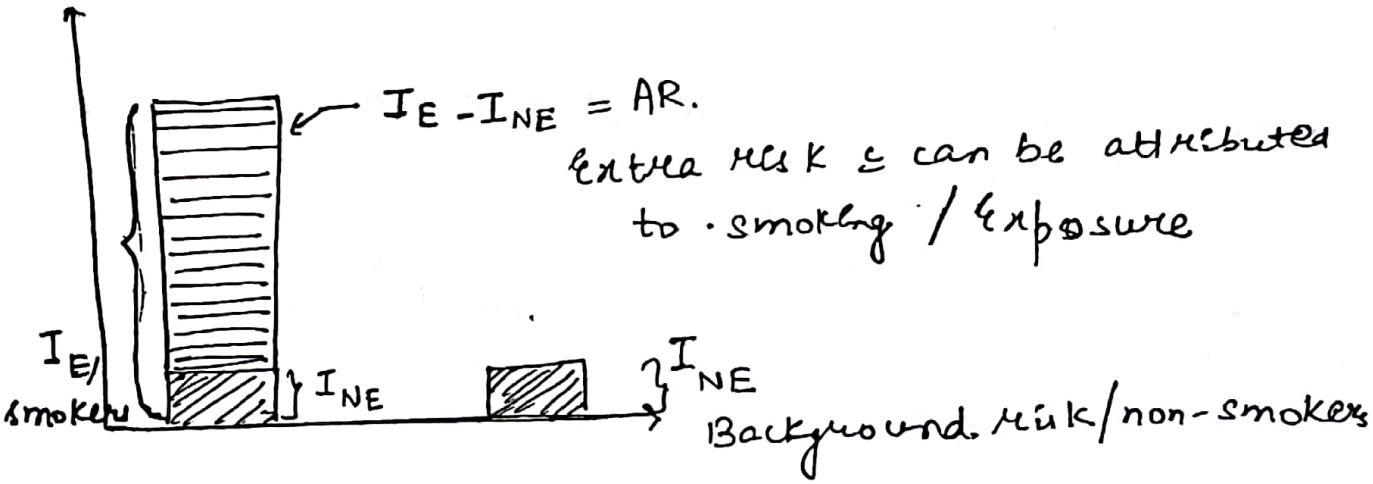
V.V.Imp

(II)

	Dis	Non-Dis
EXPOSED	a	b
NON-EXPOSED	c	d

(III) $RR = \dfrac{\frac{a}{a+b}}{\frac{c}{c+d}}$

$$\text{RELATIVE RISK} = \frac{\text{Incidence of Disease in Exposed}}{\text{Incidence of Disease in Non-Exposed}}$$



$$\text{PROPORTION AR} = \frac{I_E - I_{NE}}{I_E}$$

[AR do not have denominator]

RR = Imp. for clinicians

AR, PAR = Imp for Both

Population AR = Imp. for ~~clinicians~~ Public Health Specialists.

COMMON POINTS

INTERPRETATION OF OR ↑ OR ⇒

OR, RR	ASSOCIATION	
>1	+ve	Risk Factor
=1	NO	–
<1	–ve	Protective Factor

* In Both cohort + case-control study, multiple comparison groups can be taken For 1 case upto [4 controls] can be taken.

TYPES OF COHORT

* If nothing is mentioned in question then we take it as Prospective Cohort

- CONCURRENT
  - PROSPECTIVE
    1) At the start of study neither the exposure nor the disease has occurred. After the start of study 1st der will be exposure then der will be disease
  - AMBISPECTIVE
    ① At the start of study exposure has already occurred but disease has not yet occurred.
    ② ∴ at the start of study any person who is diseased would be excluded
- NON/CURRENT HISTORICAL/ RETROSPECTIVE

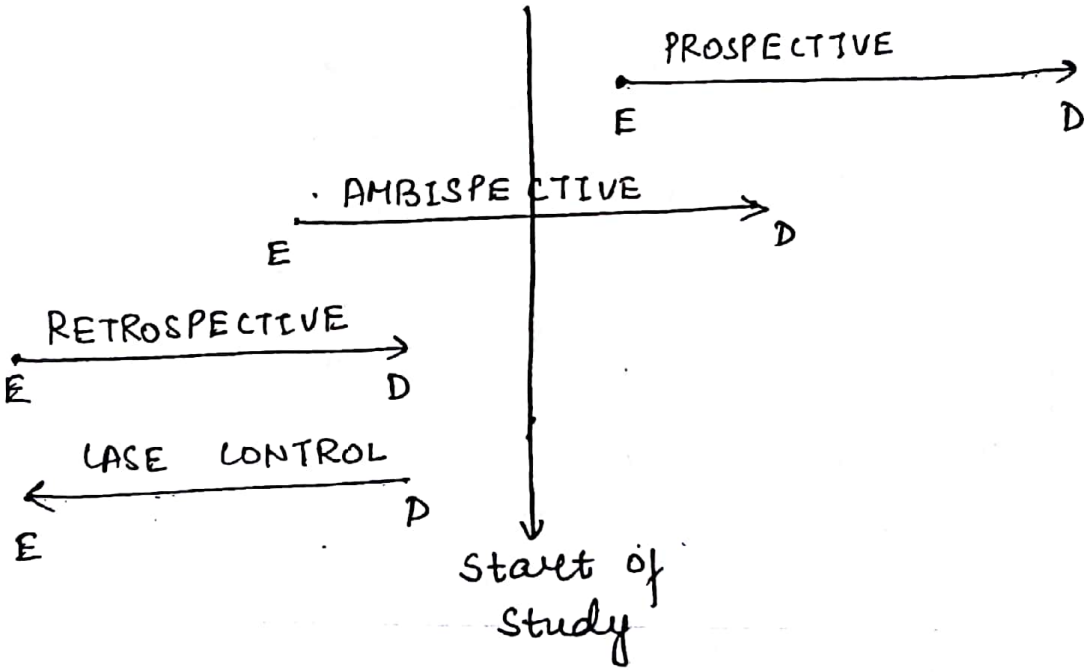
Prospective

2) ∴ if any person is exposed & or diseased at the start of study they would be excluded

HISTORICAL

① At the start of study both exposure + diseased have occurred.

② It is differentiated from Case-control study by the direction of arrow + Retrospective study is ~~Hist~~ record based whereas case-control exposure is asked.



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

ECOLOGICAL STUDY

Population is the unit of study

ECOLOGICAL FALLACY -

Generalising the findings of the population to an Individual is wrong

Example- People from Japan have ↑sed risk of Stomach cancer (ECOLOGICAL STUDY)

Any person from Japan will develop Stomach person (wrong generalisation → ECOLOGICAL FALLACY)

INTERVENTIONAL STUDIES

POPULATION → Exposed [NON-RANDOM] / Non-Exposed

[COHORT]

↑

NATURAL INTERVENTION

POPULATION (Random) → Exposed / Non-Exposed

[RCT]

↑

ARTIFICIAL INTERVENTION

DOUBLE BLINDING

» It removes Interviewer Bias

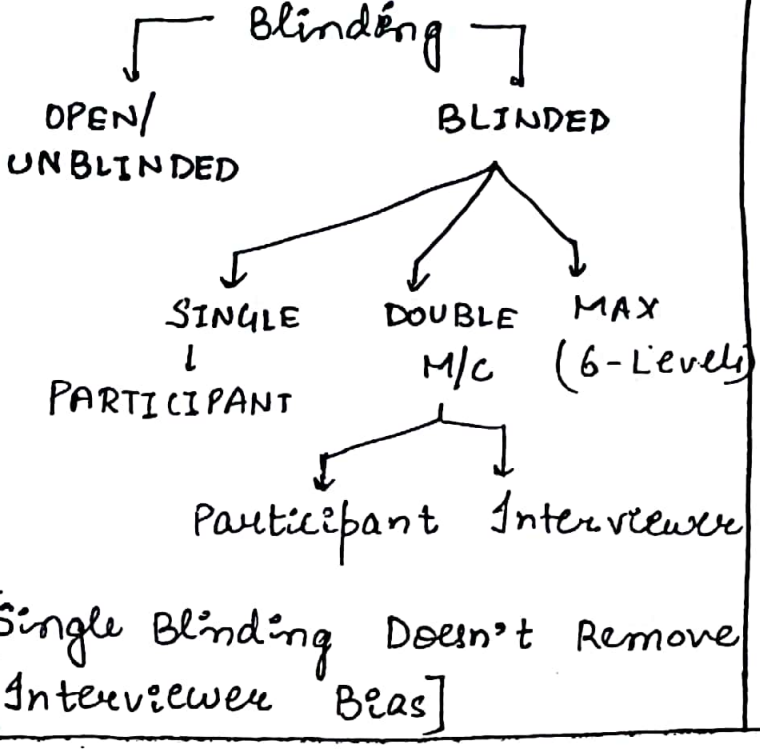
» Blinding Done Before Data collection

MATCHING

It removes SELECTION BIAS

Randomization done Before Recruitment.

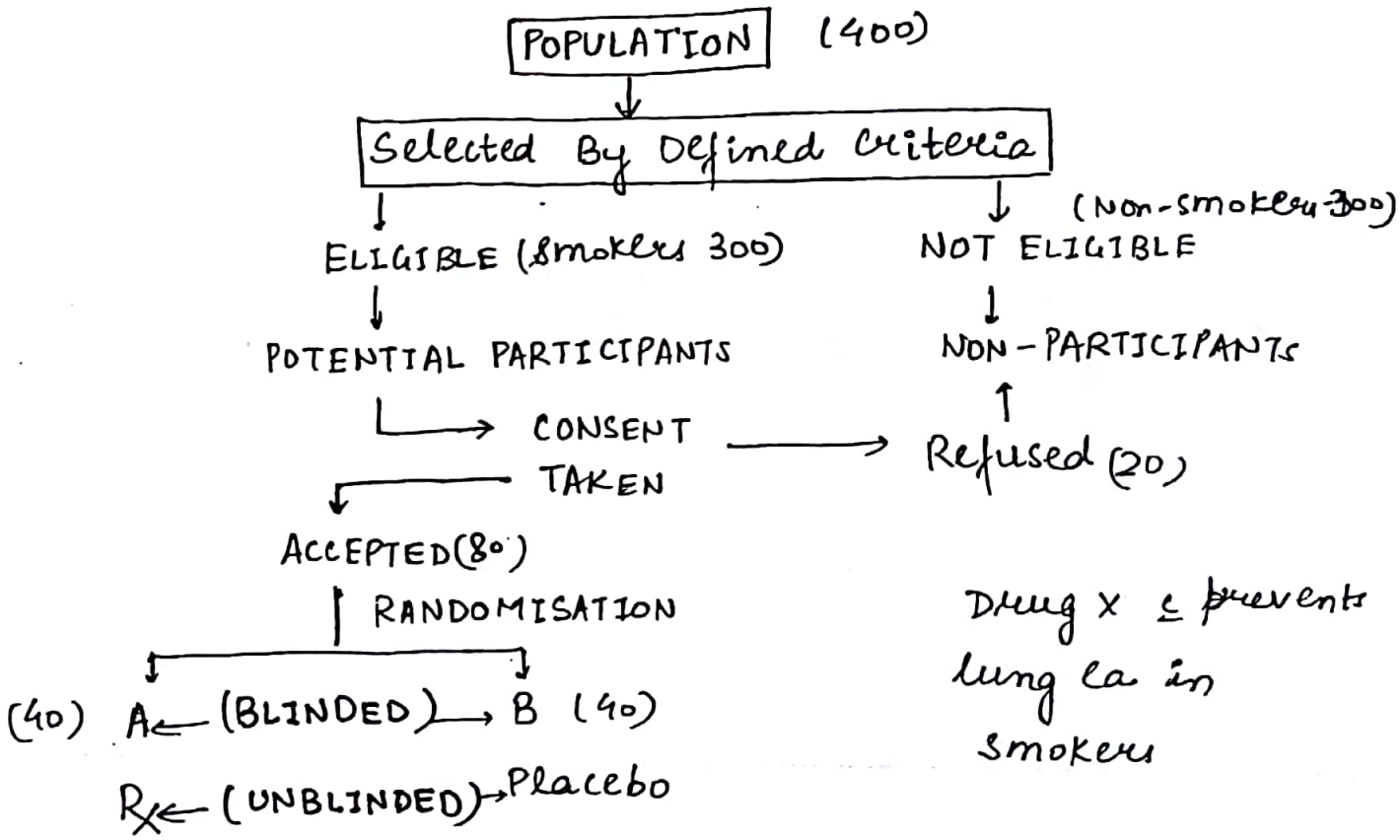
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp



*[Single Blinding Doesn't Remove Interviewer Bias]

Uses Internal Validity

Makes Groups compareable at Baseline



Drug X ↓ prevents lung ca in smokers

→ Metaanalysis & systemic reviews.

→ Nested case control.

→ Case-cohort.

→ Types of RCT.

Chapter.	Chapter Name	Imp. Topics	NEET	AIIMS 48
1)	History	Images	2	0
2)	Health . Disease	Prevention. HDI / PQLI / MPI	2	1
3)	Epidemiology	entire chapter	5	4
4)	Screening		4	3
5)	Common Disease	Basics Vaccination	4	1
6)	NCD	Cancers	1	0.
7)	Health Programme	TB, HIV, New Prog	4	1.
8)	Demography . Infertility Indicators	Demographic pyramid Fertility Indicators	2	1
9)	Obs . ped.	one liners	5	1
10)	Nutrition	MUG UP	2	0
11)	Sociology	useless	0	0
12)	Environment	Images MUG UP	3	0
13)	BMW	Guidelines	2	1
14)	occupational health.	NEW ESI guidelines.	1	0

					49
15>	Disaster	}	useless	0	0
16>	Mental Health				
17>	Genetics				
18>	Statistics		entire chapter	6	5
19>	Communication	}	Types, Delphi method.	1	0
20>	Management		Mx methods	1	0
21>	Health Care of community		community health system	2	1
22>	International health		useless	0	0

TYPES OF RCT

FACTORIAL RCT

In 1 RCT 2 Interventions are tested & are not related to each other

PLANNED CROSS-OVER RCT

100 pt Disease

50 Rx x 1 month → 50 Placebo

Washout Period x 2 months

50 Placebo x 1 month → 50 Rx

It remove the ethical issues.

Rx should not involve ↓ Sx.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

UNPLANNED CROSS OVER

~~100 cancer~~

~~Intention to Rx~~

~~50 chemo~~

~~50 Sx~~

~~Per Protocol Analysis~~

100 cancer

50 chemo

50 Sx

5 serious

10 refuse Sx

urgent Sx

10 chemo.

50 + 10 - 5 = 55

50 - 10 + 5 = 45

ANALYSIS

Intention to Rx	Per Protocol Analysis
50 Chemo	55 chemo
50 Sx	45 Sx
	(as per actual Rx)

METAANALYSIS & SYSTEMIC REVIEW

1) When multiple studies on a single topic are combined then sample size ↑ × hence power of study ↑

2) Summary statistic → I^2

3) Summary Diagram → Forest Plot

4) Limitation → a) GIGO (Garbage in : Garbage out)

b) Publication Bias → Funnel Plot

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

c) apple & orange effect - Compare dissimilar things

ADVANCED COHORT STUDY

1) Predominantly cohort (Because of forward direction)
2) Mixed study design (Cohort + Case control study)

Cohort

↓

Temporality +nt

Recall Bias is eliminated

Case control

↓

Rare Disease

whose Asstn tests are costly

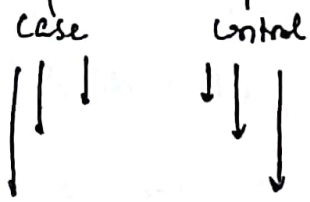
TYPES

NESTED CASE CONTROL

⇓

Control will be alloted the moment case occurs

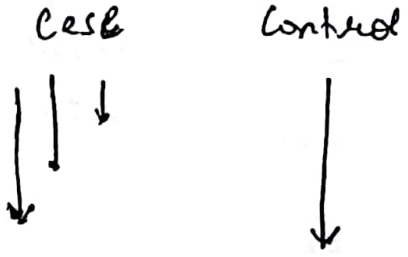
(matched for types of follow-up)



CASE COHORT

⇓

Control is alloted at end of study



Control assigned @ end

E —Causal Pathway→ D

3rd Factor

Interfere In causal Pathway → Pathology — Latent/ Pre-cancerous

Doesn't Interfere In causal Pathway → Epidemiology

E → D

3rd Factor

CONFOUDING

E → D

C

Related to Both 'E' & 'D'

1940 Rich USA Coffee Drinker → Pancreatic Cancer

Smoking

EFFECT MODIFIER

E → D

EM

Related to 'D' only

Unprotected Intercourse (EM-ve) → HIV

Circumcision

Asbestosis → Lung Ca

(EM+ve)

Smoke

METHODS OF REMOVING 3rd FACTOR –

1> Randomisation – Best
(Remove Both Known & Unknown)

2) Matching – Remove only known

3) Stratification – g. unadjusted.
or
1.9.

↓ stratification By 3rd factor

2 Groups will be formed

ĩ 3rd Factor	ĩ out 3rd factor
If Adjusted OR is same In Both Groups	Diff. in Both Groups
↓	↓
Confounder	Effect Modifier
$OR_{adj} = 1$, In Grp 1	$OR_{Adj} = 1$ In Grp 2
	$OR_{Adj} = 1.5$ in Group 1
	& $OR_{Adj} = 1.1$ In Group 2

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

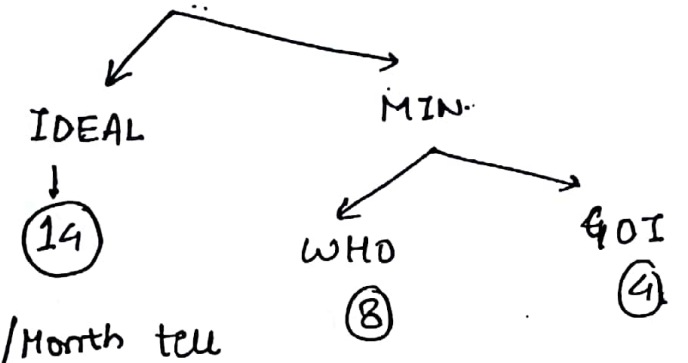
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

OBSTETRICS

ANC

I> ANC Visits



1 Visit / Month till 7 month → (7)

1 visit / every 15 day in 8th month (2)

1 visit / every week. 9th month (4)

9 month + 7 day : 1.

14

1st visit < 12 wk (early Registration)

2nd Visit 14-26 wk

3rd visit 28-34 wk

4th visit > 36 wk

PNC Visit = No schedule

HBPNC = Home Based Post Natal Care

ANM + ASHA WORKER MAKE HOME VISITS TO PROVIDE PNC CARE.

SCHEDULE

Hospital Delivery	Home Delivery
3, 7, 14, 21, 28, 42	Day 1 (extra) Rest same

ANC SERVICES UNDER RMNCHA

I) LAB INV.

SUB CENTRE	PHC + ABOVE subcentre +
a) UPT KIT	1) VDRL
b) Hb	2) HbsAg
c) Urine → albumin, Sugar	3) HIV
d) RDT (malaria)	4) Blood grouping
	5) RBS

NISHAY → UPT Kit
NIKSHAY → T.B.

NEET 2018

II) INTERVENTIONS –

1) Deworming – Albendazole is c/I. in 1st Trimester

DOC in 1st Tri → MEBENDAZOLE 100mg BD × 3 days

DOC in 2nd + 3rd Tri. → ALBENDAZOLE 400mg OD to chew stat

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

2> CALCIUM

RDA ♀ = 1200 mg/day

Calcium is given as supplement in form of $CaCO_3$ 500mg BD from Day 1 of 14th week POG. till 6months Post Delivery. (1yr).

3> TETANUS TOXOID-

a> Every ♀ in her 1st ♀ will Receive 2 doses of T.T.

- 1st Dose
- 2nd Dose

1st Dose @ point of contact

@ an interval of 4-6 weeks.

b> If ♀ had received 2 doses of T.T. at an interval of < 3yrs ⇒ SINGLE BOOSTER DOSE Given

c> If ♀ who is completely ~~UIA~~ unimmunised comes to you at ~~POG~~

POG < 36wks

⇓

Give T.T. as would be given to (N) ♀

POG > 36wks

⇓

Give 1st Dose of T.T. & explain to mother that this dose won't protect her baby from MNT (maternal neonatal Tetanus)

Newborn is given 750 IU of anti toxin within 4hrs of Birth

Give 2nd Dose after 4wks irrespective of ♀ outcome

4) IFA :- ★★

a> 100mg of Elemental Iron + 500 µg Folic Acid

b> In 300mg of FERROUS SULPHATE SALT
(% of elemental Iron = 33%)

c> Red coloured capsule / Tablet

d> To be consumed ~~c~~ LEMON WATER

e) After food

f> from Day 1 of 14th week POG till 6months post Delivery (1yr)

Hb > 11 → OD → 365

9-11 → BD → 365 x 2 = 730

CALCULATION

* NO. OF ♀ IN A YEAR -

x = Birth Rate × Population of an area (per 1000 Pop)

$y = x + \underbrace{10\%\ x}_{\text{abortion.}}$

Q. B.R = $\frac{20}{1000}$ Subcentre Popu. (5000) $y = ?$

$$y = \left[\frac{20}{1000} \times 5000\right] + \frac{10}{100}\left[\frac{20}{1000} \times 5000\right].$$

$$= 100 + 10$$

$$= 110.$$

No. of ♀ at any given point = $\frac{y}{2}$

DELIVERY

CLEANS OF SAFE DELIVERY :-

Clean Hand — Cord — cut

" Table — Tie

" Towel — Stump

" Water

MATERNAL MORTALITY

Any ♀ female during ♀ / delivery / Post-Delivery till 42 days dies due to ♀ related causes & not due to accident or trauma irrespective of period of gestation is called MATERNAL MORTALITY.

MMR

- MM RATE
- MM RATIO

Numerator = M.M.

Denominator
↓
No. of ♀ in reproductive age group

Denominator
↓
No. of Live Births

M/C type of Maternal Death is ⇒ POST PARTUM.

CAUSES

DIRECT	INDIRECT
Haemorrhage (37%) (APH + PPH)	Anaemia (55%)
Abortion	
Sepsis	
Eclampsia	
Others	

MCC of MM -

Haemorrhage

Anaemia

PPH

PROGRAMMES

1) PMSMY (Pradhan Mantri Suraksit Matritva Yojna)

9th ~~April~~ Every month → every ♀ female is provided free of cost ANC services @ all level of health system in Govt. setup where doctor is available & enrolled private health facilities

2) COLOUR CODED PROGRAMME

RED = High Risk ♀

GREEN = Normal

BLUE = PIH

YELLOW = Systemic Diseases

3) ♀ AID YOJNA SCHEME

Every ♀ female for a successful 1st ♀ would get 6000 Rps as Incentive

1000 = JSY

5000 + under this Programme

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

INFANTOMETER

Used to measure ht of Baby tell 2years

I-NIPI (V.V.I.)

(Intensified National Iron Plus Initiative)

This is under POSHAN ABHIYAAN

↓

PM's overarching scheme for Holistic Nourishment.

SLOGAN – Sahi Poshan, Desh Roshan

VISION – Anaemia mukt Bharat

6 × 6 × 6 PYRAMID

6 Intervention | 6 Beneficiaries | 6 Institutional Mech.

OBJ – To ↓ anaemia by 18% in each Beneficiary Group. by 2022

→ 6 BENEFICIARY GROUPS

6 - 59 months

15 - 19 ♀

15 - 19 ♂

♀ In reproductive age group.

♀ female

Lactating ♀.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

6 INTERVENTION

1) Prophylactic IFA supplementation
2) Deworming
3) Intensified Year Round Behaviour change
4) Communication Campaign
5) Anaemia Testing
6) Mandatory Provision of IFA fortified foods under public health programme.
like Mid-Day meal +
Anganwadi supplementary Nutrition Programme

6> Addressing Non-nutritional causes of Anaemia

Malaria ← ↓ → Flourosis
Sickle cell

DEWORMING ⇒ ALBENDAZOLE (DOC)

< 1yr - 9I

1-2yr → 200mg OD to chew stat

>2yr → 400mg OD to chew stat

NATIONAL DEWORMING DAY = 10/02
10/08

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

AGE	DOSE	COLOUR	OTHERS
6-59 mnths	20mg IRON + 100 µg Folic acid	Liquid formulation	Biweekly
5-9 yrs	45mg IRON + 400 µg folic acid	PINK colour	Weekly 1 IFA
10-19 yr	100 mg IRON + 500 µg Folic acid	Blue	Weekly 1 IFA
20-49 yrs	100mg IRON + 400 µg Folic Acid	RED	Weekly + 1 tab /day of folic acid (400 µg)
♀	100mg IRON + 500 µg Folic acid	RED	Daily from Day 1 of 14th week POG till 6 months Post ~~Natal~~ Delivery

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

WIFS

→ Weekly IFA Supplementation.

→ On every MONDAY every adolescent ♂ & ♀ going to a govt. or govt. aided school is provided ∈ Blue colour capsule

→ To all adolescent ♀ not going to school @ Anganwadi

→ Both Married & Unmarried ♀ & ♂ are covered under this programme
(Adolescent male not going to school are left out)

PAEDIATRICS

BREAST FEEDING

BF ⇒ EXCLUSIVE BREAST FEEDING

→ Baby is only on Mother's Milk ∈ may be

naturally feed

artificially feed ∈ spoon or paladai

8-10 times a day
mandatory 1 right feed for
duration of 6 months

→ ORal vaccines & medications if prescribed are allowed.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

no water or artificial feeds are allowed

⇒ LAM CRITERIA

Lactational Amenorrhoea

- ♀ undergoing exclusive breast feeding for 6 months gets advantage of ~~lactational~~ lactational amenorrhoea till 6-12 wks
- It is natural mode of contraception

⇒ BFHI (Baby Friendly Hospital Initiative)

a) By WHO + UNICEF

b) 10 Steps

- Critical Mx Procedures
  - 1 → a, b, c
  - 2
- Key clinical Practices
  - 3-10

c) Objective ⇒ succesful Breast feeding Practice

d) MFHI ⇒ mother friendly Hospital Initiative (MFHI) only in USA.

Breast Feeding wk ⇒ 1st week of August

⇒ ADVANTAGE

NEONATE

- Diarrhoea ↓
- Pneumonia ↓
- Better Dentition
- Type 2 DM in adulthood ↓
- ↑ IQ

MOTHER

- Breast Ca ↓
- Ovarian Ca ↓
- Type 2 DM
- Post Partum depression

BIRTH ~~WEIGHT~~ WEIGHT

① **LBW** < 2.5 kg

a) H/C cause = PREMATURITY

b) No. of Babies to be weighed randomly to calculate % age of LBW = 500

c) B.W. of <2.0 kg is a C/I for Hep B^{0} vaccine

d) % in India = 18.5 % (data may change)

② **VLBW** <1.5 kg

③ **ELBW** <1.0 kg

④ Avg. B.W. in India = 2.8 kg

⑤ Cut off for Prophylactic Admission into NICU = 1.8 kg

(6) KMC = Kangaroo Mother care
Supportive care to new Born <2.5 kg

GROWTH MONITORING / LONGITUDINAL FOLLOW UP STUDY

NORMAL CHILD

↓

0-1 yr - Every Month

1-2 yr = Every alternate month

2-5 yr = Every 3rd month

MALNOURISHED CHILD

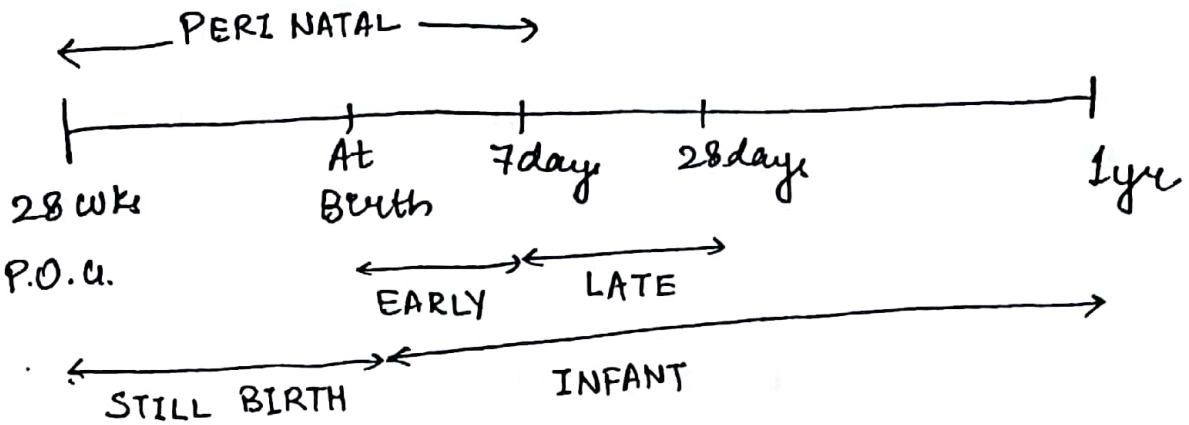
Mod. mal. = Every week

Severe mal = Admission in NRC (nutritional Rehab. centre)

↓

Free Rx for children < 5 yrs of age

PAEDIATRIC MORTALITY



DENOMINATOR

WHO ↓

No. of Live Births

GOI

↓

No. of Live Births except for "Peri-natal M.R. & Still B.R."

↓

[No. of Live Birth + Still Birth]

CAUSES

ENDOGENOUS

⇓

1) Prematurity (33%)
2) LBW (28%)
3) Infections (Torch)
4) Birth Asphyxia
5) Birth Trauma
6) Still Birth

Perinatal Mortality

Neonatal Mortality

EXOGENOUS

⇓

1) Pneumonia
2) Diarrhoea
3) Malnutrition
4) Accident
5) Child Birth
6) Under 5 mortality

IMR

(Endo > Exo)

Most Imp Indicator for Socio-economic

Status → IMR

Development → Under 5 mortality Rate

IMR

Most Imp. Indicator of ~~health status~~

a) health status of community

b) Level of living

c) Effectiveness of MCH service

d) Best Predictor of Govt. failure

e) Combined Parameter of Paediatric + Obstetric care in country

f) Sensitive Indicator of availability + utilisation of health service

CHILD SURVIVAL INDEX / RATE	=	$\frac{1000 - \text{Under 5 MR}}{10}$

CONGENITAL DISORDERS OF NEWBORN

M/C → Cong Heart Disease

2nd M/C – Cong. Deafness

3rd M/C – Neural Tube Defect

LANDMARK PROGRAMMES

IMNCI (Integrated Management of neonatal, childhood Illness)

Colour Coded

Pink	YELLOW	GREEN
Most severe	OPD Rx	Least & Home Rx
Inj^n Gentamicin		
By ANM + UR.		

Referral for Admission into Hospital

IMNCI MODULE

0–2 mnths ← | → 2mnths – 5yrs.

KEY FEATURES of INDIAN IMNCI

1) Inclusion of 0-7 days in Programme

2) Incorporation of
national Guidelines on
Malaria
Anaemia
Vit A supplementation
Immunisation schedule

3) Skill Based Training

4) Training starts @ 0-2 mnths age group.
But same amount of time is devoted
to 2mnths - 5yrs. age agency

SCHOOL HEALTH PROGRAMMES

1) HEALTH DISORDERS AMONG SCHOOL CHILDREN

Dental Defects > Goiter > Malnutrition

2) Medical Exam^{n} → To be done every 6 months

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

3) School children Eye Screening -

a) 5th - 8th class / 10-14yr age Grp

b) Teachers Perform screening (1/150 students)

c) Visual Acquity cut off PHC Reference < 6/9

ICDS
[Integrated Childhood Development Scheme]

1) Beneficiaries → irrespective of Social Status (ICDS + JSSK)

2) Aanganwadi

3) Under 'WCD' Ministry

4) INTERVENTIONS -

SHINER He

S - Supplementary nutrition

H - Health checkup

I - Immunization

Ne - Non-formal Education

R - Referral

He - Health Education.

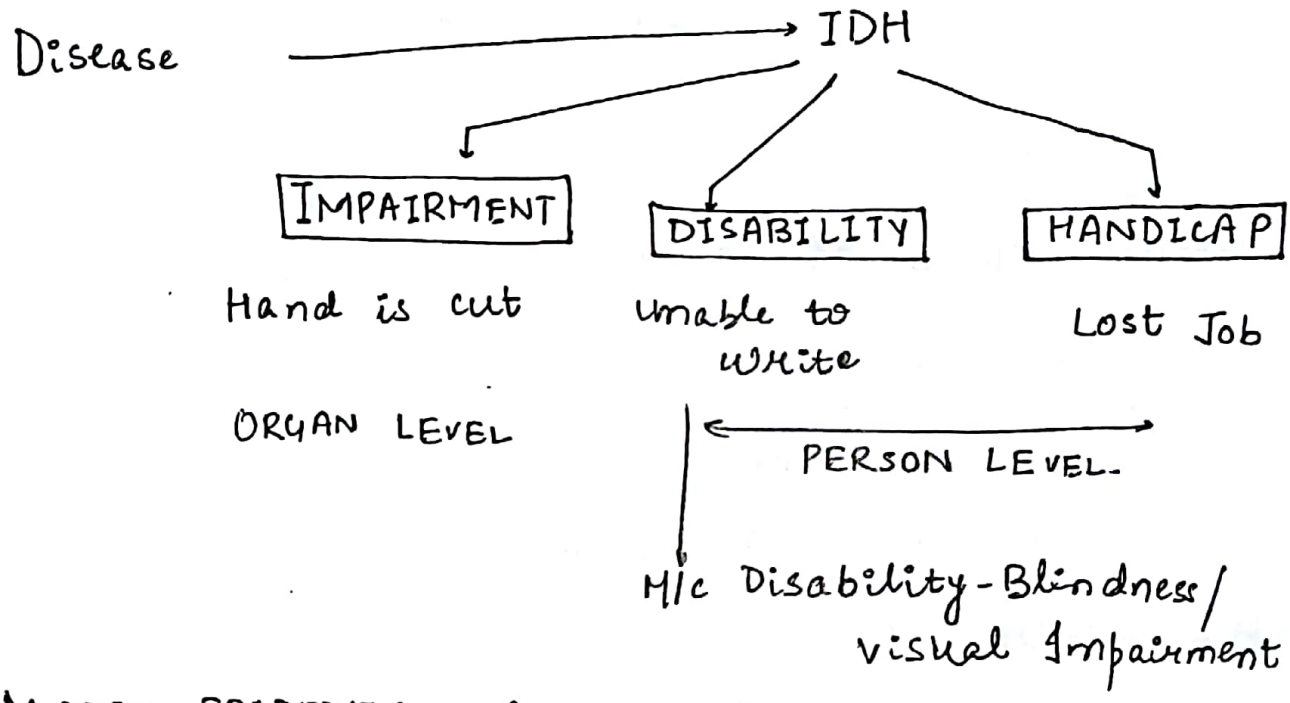
3-6 yr = SHINeR

< 3 yr = SHINER

11-18 yr ♀ - SHe

15-45 yr ♀ = He

HEALTH & DISEASES



MODERN EPIDEMIC : CORONARY ARTERY DISEASE

SILENT " — ALZHEIMER's Ds.

LITERACY-

Any person > 7yrs of age who can read, write & comprehend atleast 1 single Indian Language.

* MAX. LITERACY ⇒ TRIPURA.
* India has achieved threshold of Literacy 75%

HEALTH INDEX

SULLVIAN / DFLE → Obselete

DALY → Disability Adjusted Life Years

↳ DALY = YLL + YLD

YLD = Years of Life With Disability

YLL = Years of Life Lost due to premature mortality.

QALY- Quality Adjusted Life Years

HALE- Healthy Life Expectancy.
Best Indicator of Bureden of Disease

PQLI- Physical Quality of Life Index

	HDI (Human Development Index)	PQLI (Physical Quality of Life Index)
RANGE	0-1	0-100
VALUE	0.624 #	70
RANK	131th	

COMPONENTS

1) Life Expectancy At Birth

2) **Knowledge**
   - Mean years of expected schooling + yr. of schooling

3) Income – GDP/GPP/GNI

P
Q
- L → Literacy
- I → Life Expectancy at 1 year
- 1 → IMR

HPI :- Human Poverty Index

1) Complement of HDI

2) Developed by WHO + UN

3) HPI
   - 1 – ~~Development~~ Developing + under developed countries
   - 2 – Developed countries

4) **HPI-1** – 3 Indicators

Deprivation of

a) Knowledge ⇒ Adult Illiteracy Rate

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

b) Life Exp. ⇒ Probability of survival till Age of 40 years

c) Deprivation of Std. of Living :-

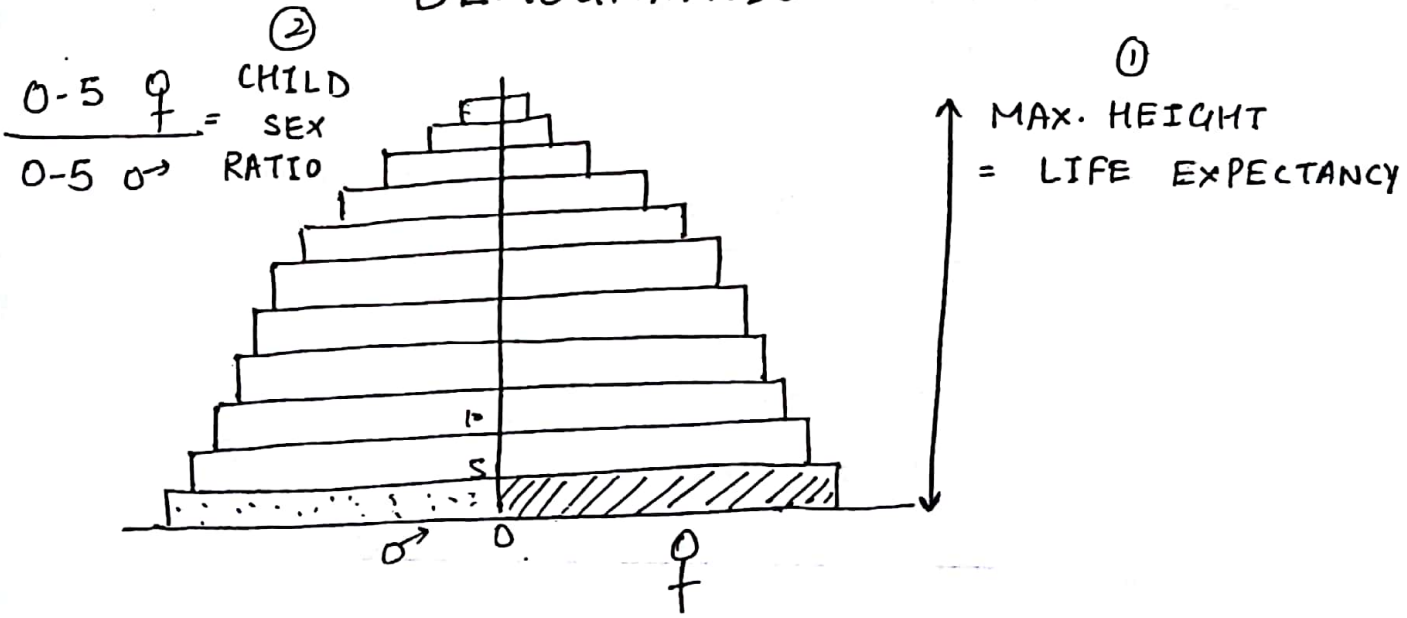
i) % Age of children underwt. for age

ii) % Age of People not using clean drinking water.

Multidimensional Poverty Index is the Best Indicator.

DEMOGRAPHY : FAMILY PLANNING

DEMOGRAPHIC PYRAMID



AGE, SEX - PYRAMID - Double Histogram

SHAPE → I & IV ⇒ Stationary

II & III ⇒ Upright / Expansive

V ⇒ Constrictive / Inverted

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

CRUDE BIRTH RATE

$$\frac{\text{No. of Live Birth}}{\text{No. of People / Total / Mid yr Population}} \times 1000$$

CBR = 8 x TFR +1 (simplest measure of fertility)

CBR = GFR x 0.2.

SOCIETAL DEPENDENCY RATIO

$$\frac{<15\text{yrs} + >65\text{yrs}}{15-65\text{yrs}} = \text{SDR}$$

↓ SDR = BETTER

[India is having currently having the Lowest SDR of all Times.]

HEALTH STATISTICS REPORTING

* SOURCES -

1> CENSUS - a) 1st - 1881

b.) Last - 2011

Census stop 00:00 HRS 1st March.
(Reference date + Time)

MID YEAR POPULATION - 1st July

2> **CIVIL REGISTRATION SYSTEM**

Births & deaths to be registered within 21 days

Marriage ~~in~~ in 30 days

Born outside ~~in~~ in 60 days of return to India

3> **SRS (Sample Registration System)**

CONTINUOUS ENUMERATOR

⇓

Continuous counting of Births & deaths

SUPERVISER

⇓ Births Counts & Deaths every **6 months**

* ~~ED~~ **INDICATORS**

Mortality Indicator + CBR.

↓

CBR / IMR / NMR / SBR / still

U5 MR / MMR

4> **NFHS**

National Family Health Survey

DLHS

District Level Health Survey

⟷ completed 4 rounds.

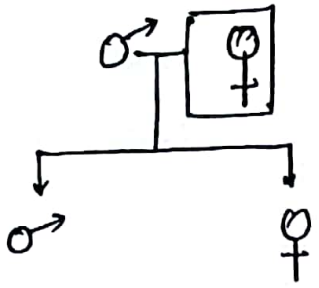
Immunization ⟷

⊕ ⊕ ⊗

NFHS - Fertility Rate (TFR, GRR)

+ Mortality Rate

FERTILITY INDICATORS



TFR = 2

GRR = 1

TFR/ TOTAL FERTILITY RATE = No. of children

GRR/ GROSS REPRODUTION RATE = No. of girls.

NRR/ NET REPRODUCTION RATE = Real Time Fertility of ♀ child

i.e. GRR + Mortality Pattern, Life expectancy

IMPORTANCE

TFR-

① Standardised Index of fertility

② Magnitude of completed family size

③ To achieve stable Population

TFR = 2.1 (called as Replacement Level)

TFR OF COUNTRY

↓ >2.1

⇓

POPULATION ↑

↓ <2.1

⇓

POPULATION ↓

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

NRR

① Best Indicator of Fertility

② To achieve NRR = 1, CPR = 60%.

③ TFR = 2 × GRR / NRR or ~~NRR~~

Haryana = TFR > 2 × GRR

Kerala = ~~TRR~~ TFR < 2 × GRR

GFR [GENERAL FERTILITY RATE] =

$$\frac{\text{No. of Live Birth in Given year}}{\text{No. of ♀ in 15-44 yr age grp'd}} \times 1000.$$

ASFR [AGE SPECIFIC FERTILIY RATE].

$$\frac{\text{No. of Live Birth in Specific Age Grp}}{\text{Mid year Population of ♀ of same age}} \times 1000$$

$$TFR = \frac{\sum ASFR}{1000} \times \text{INTERVAL IN AGE GROUP.}$$

ELLIGIBLE COUPLE

Married couple ♂ ♀ in reproductive age groups.

[Widow, commercial sex worker] [♀ female] ∴

↓ Not elligible ↓ elligible couple

COUPLE PROTECTION RATE

No. of elligible couples using 4 methods of contraception.

→ OCP
→ Condom
→ IUDs
→ Sterilization.

$$CPR = \frac{\text{No. of elligible couples using 4 modes.}}{\text{No. of elligible couple}} \times 100$$

EFFECTIVE COUPLE PROTECTION RATE

Condoms = 0.5

IUDs = 0.95

OCP = 1

Sterilization = 1

In a community, there are 20 elligible couples using condoms.

Effectiveness = 20 × 0.5 = 10.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

CONTRACEPTIVE EFFICACY

- PEARL INDEX (P.I.) (M/c)
- LIFE TABLE (Best But complex)

$$P.I. = \frac{\text{Total Accidental } ♀}{\text{Total Months of exposure}} \times 1200$$

FAMILY PLANNING UPDATES

1) BRAND NAME OF CONDOMS IN INDIA = ASHA

2) TAG LINE = 'ACHI AADAT HAI'
[It is a good Habit]

3) PUNCH LINE = PLAN BANATE HAI
[Let's make a ♀ plan]

4) DMPA Inj^n → ANTRA
CENTROCHROMAN = CHHAYA. ~~SAHELI~~

5) M/c CONTRACEPTIVE USED IN INDIA
= ♀ STERILISATION

6) MISSION PARIVAR VIKAS = ↑ing Contraceptive Accessories in Areas where TFR >3.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

NON- COMMUNICABLE DISEASE

	INCIDENCE	PREVALENCE
♂		
♀		
TOTAL		

TOBACCO -

Nicotine & CO are non- carcinogenic

CARCINOGENIC SUBSTANCES

P - Polynuclear aromatic Hydrocarbons.

A - Aromatic Amines

N - Nitrosamines

T - TAR

PREVENTIVE STRATEGIES -

1) WHO MPOWER STRATEGY -

↓

Raising Taxes (most effective)

75% of the Pack Price should be Tax

In India - 7.5%

2) PICTORIAL WARNING

WHO	INDIA
Plain Packaging of Tobacco Product	85% on Both Sides

PREVENTION OF BREAST CANCER

1> Any female >25yrs of age →
   a> monthly self Breast Exam"
   b> 3 yearly clinical Breast Exam"

2> Any ♀ >40yrs of age → annual mammography

PREVENTION OF CERVICAL CARCINOMA

♀ 1° PREVEN"

9-13yrs old ♀ (class VI) are given 2 doses of cervical Ca vaccine

2° PREVEN"

any ♀ > 29 yrs of age

↓

PHC → Visual Inspec" of ⊂ acetic acid (VIA)

↓ If ab(N)

District Hosp. - Pap smear

If (N) → Repeat Pap Smear
BEST- <3yrs
Max - <5yrs

If Ab (N) → Rx as per clinical guideline

OBESITY

NEW BMI GUIDELINES

Under wt < 18.5

Normal $18.5 - 22.99$

Over wt $23 - 26.99$

Obese ≥ 27

OBESITY ASSESMENT TOOLS

1) QUETELET INDEX

$$BMI = \frac{Wt\ (in\ kg)}{Ht\ (m^2)}$$

2) PONDERAL INDEX

Not used in India

3) CORPULENCE INDEX

$$= \frac{Actual\ wt}{Ideal\ wt.}$$

(N) ≤ 1.2

4) BROCA's INDEX

$$Ideal\ wt. = Ht\ (cm) - 100.$$

5) LORENTZ FORMULA

$$Ideal\ wt. = Ht\ (cm) - 100 - \left[\frac{HT\ (cm) - 150}{2\ (♀) \,/\, 4\ (♂)}\right]$$

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

SKIN FOLD THICKNESS-

1) Rapid non-Invasive method of fat assesment

2) Herpenden Skin Calliper

3) Measured at 4 site -

⇒ Med Triceps (single Best)
Med Biceps
Subscapular
Suprailiac

CUT OFFS

	♂	♀
Skin Fold Thickness	≥ 40mm	≥ 50mm
Waist Hip Ratio	>1	>0.85
Waist circumference	102cm	88cm
Waist Height Ratio (Best) < age, sex } Independent	← 0.5 →	

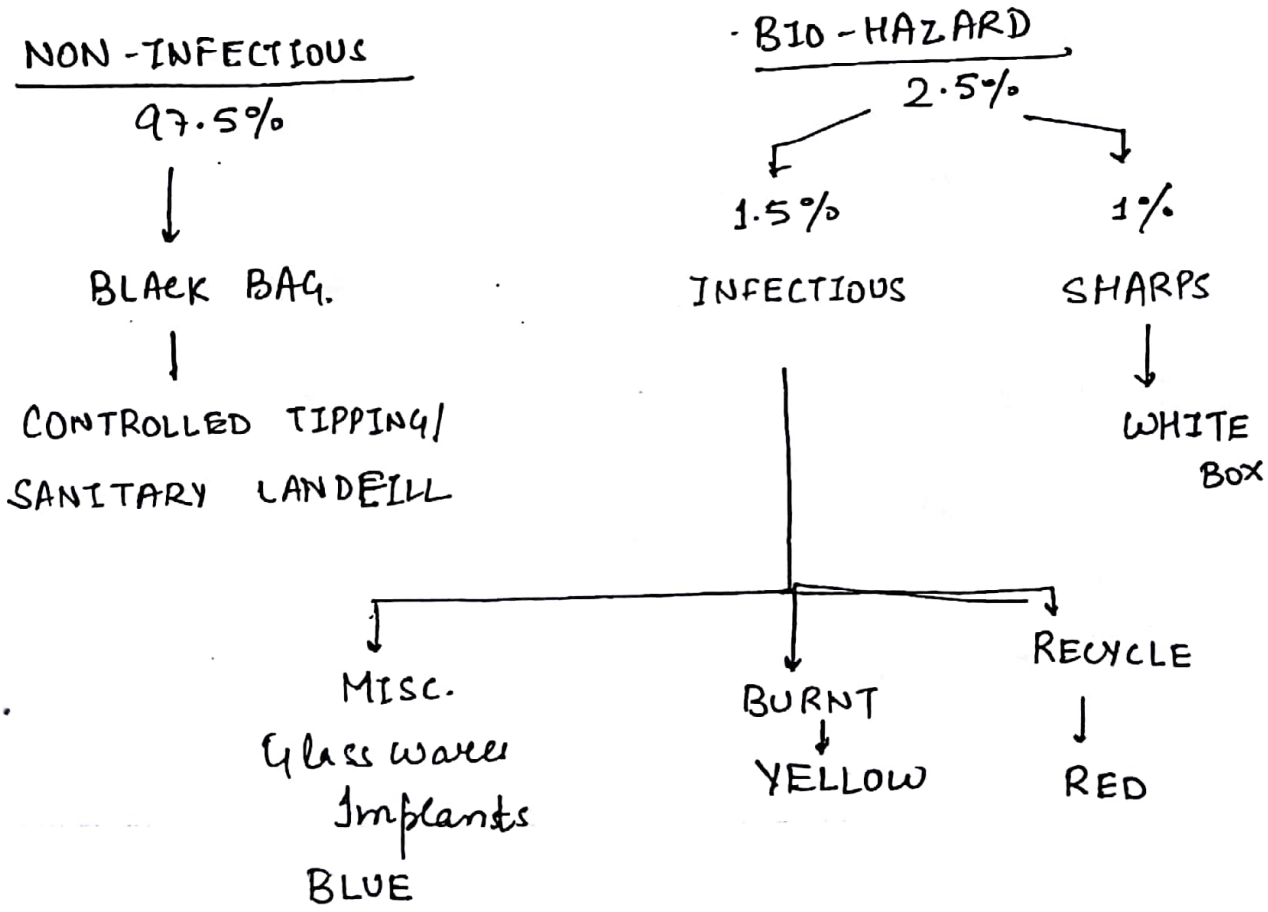
MISCELLANEOUS

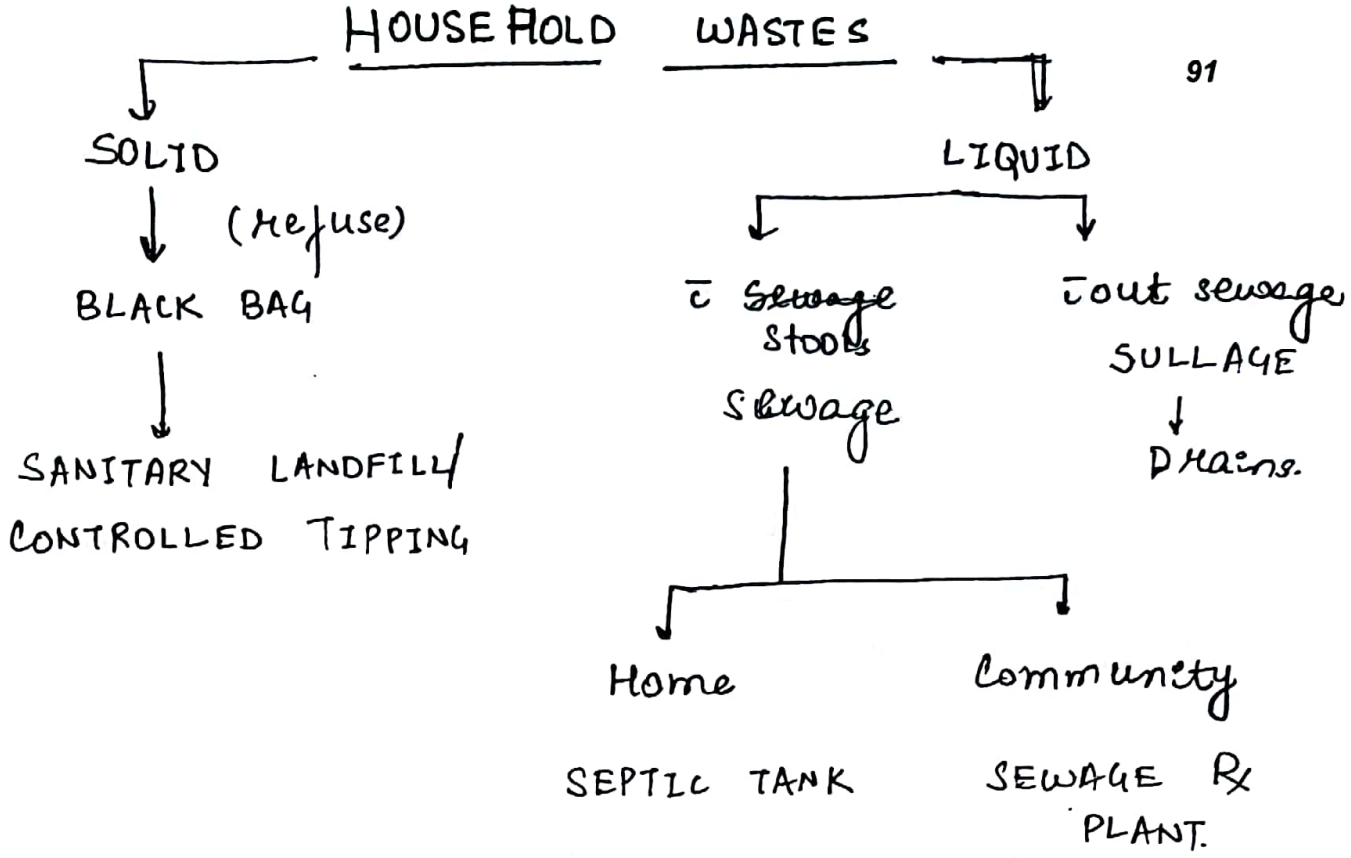
1) JAI VIGYAN - Pilot Programm for RHD

2) HADDON's MATRIX - Prevenn of Road Traffic Accident

3) STEPS - WHO NCD Surveillance of Risk Factors

HOSPITAL WASTE Mx





HEALTH PLANNING

TARGETS :- ① Discrete Activity ∈ helps to measure extent of objective attainment

② Concerned ∈ factors involved in a problem.

Ex. Revise PSM In next 5 days

OBJECTIVE :-

1) Planned Precise end point of all activities

2) Concerned with the Problem.

ex. Qualify neet PG 2019

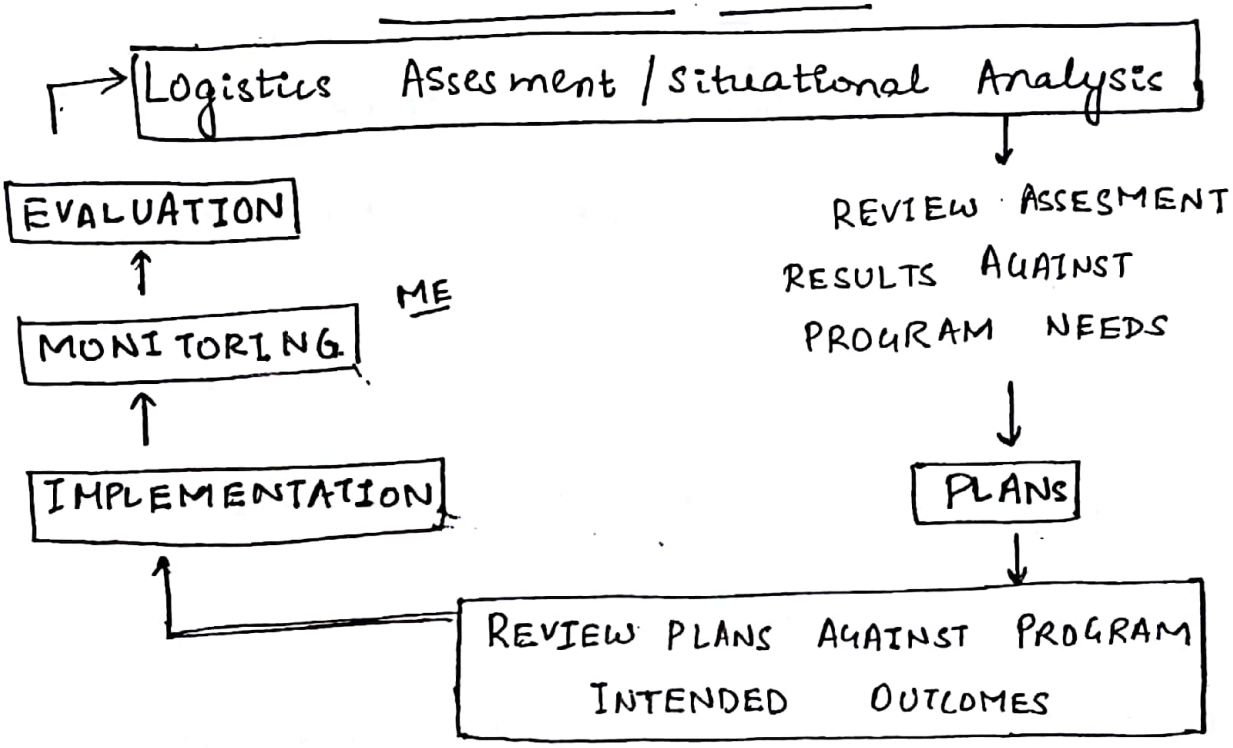
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

GOAL:

1) ultimate Desired state to be achieved
2) may or may not be achieved
3) not constrained ī time

ex. To stay Happy

PLANNING CYCLE



MONITORING	EVALUATION
1> Int. Person	① Int. / Ext Person
2> Continuous	② Intermittent
3> what is happening?	③ How well it happened?
4> Present Tense	④ Past Tense
eg class monitor	Principal

SURVEILLANCE

Ongoing systematic collection, analyses & Interpretation of Data & Use of this Information to take Action for Prevention & Disease control.

ACTIVE

Health worker visits home of people

- Max. RESOURCES
- BEST QUALITY OF DATA

Eg. Polio
TB
Leprosy

PASSIVE

Pt. visits the hospital.

MIN. RESOURCES

POOREST QUALITY OF DATA

majority of health programme

SENTINEL

Methodology varies from Disease to Disease

OBJ -> 1) To find missing cases

2) To find trend of disease

3) Estimate total Burden of disease

Eg. HIV

BLINDNESS & MALARIA are the only 2 diseases in India to utilise all the free types of surveillance

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

SURVEILANCE IN MALARIA

ACTIVE

Health workers make visits the home of people. & any person who has fever in last 15 days MP slide is made

TARGET- No. of ~~fever~~ slides per year = 10% of entire population surveyed

PASSIVE

Pt visits the hospital.
Any pt. ☐ fever has to go for malaria Parasite slid.

TARGET.-
Expected
10% of entire OPD cases have fever

SENTINEL

In Hard to Reach areas & difficult areas Sentenal surveillance is performed.

Deaths due to PUO are Investigated in Detail.

QUANTITATIVE METHODS OF MANAGEMENT

1) NETWORK ANALYSIS -

Graphic Plan of all events & Activities.

PERT	CPM
Program Evaluation & Review Technique	Critical Path Method
updated Progress Report card.	Longest Path. If any activety along critical Path is delayed entire project will be delayed.

ECONOMIC EVALUATION

INPUT

Money

QUDE – cost effective

QALY (cost utility) DALY

Best for health system → DALY

OUTPUT

Money = Cost Benefit A.

QALY = Cost Utility A.

DALY = Cost Effective A.

Systems Analysis → Best M$_x$ technique to find out cost effectiveness

WORK ANALYSIS

a) DEF^n - o systematic Observation + Recording of Individual activity

b) Provides Quantitative Assesment of various activities

c) Done By ~~IT~~ companies mainly

Now started in medical sector also.

But mainly done in Junior staffs

PGI

PPBS/ PLANNING PROGRAMMING & BUDGETING SYSTEM

TRADITIONAL / INCREMENTAL HISTORIC

1) only variances in Budget from past yrs. are justified.
Baseline expenditure is automatically approved

2) Proceeds from Resource to target

3) Time is Less.

4) CORRUPTION & MONEY LAUNDERING.

ZERO PRIORITY BASED BUDGETING

1) Every item of the budget has to be justified.

2) Proceeds from Target to Resource (REVERSE DIRECTION)

3) Time is more

4) Most effecient manner of Financial management

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

ENTOMOLOGY

METHODS OF TRANSMISSION OF DISEASE BY VECTORS -

1) BITING - only ♀ Bite - Mosquito
Sandfly

Both sexes Bite - Tse Tse Fly

2) REGURGITATION - Housefly

3) SCRATCHING / RUBBING OF INFECTIVE SURFACE
Scabies

4) CONTAMINATION OF HOST ~ BODY FLUID OF VECTORS
Lower Animals
Ingestion

LIFE CYCLE OF MOSQUITO -

♂ = Short Lived.

♀ = 8-34 days

Larval = 5-7 days.

Egg = 1-2 days.

Adult = 2 weeks.

MOSQUITO - CONTROL

I> ANTI - ADULT-

1> ITN/LLIN

Long Lasting Insecticidal Treated Bed Nets

↓

Deltamethrin.

NO. OF HOLES/INCH^2 = 150

SIZE OF EACH HOLE OF MOSQUITO NET

= 0.043 INCH

2) IRS :- DDT, MALATHION

└ Indoor Residual Spraying

3> SPACE SPRAYING/ FOGGING - PYRETHRUM.

PREDATOR MOSQUITO [TOXORHYNCHITIS SPLENDENS] → Biological method for Aedes aegypto control

II> ANTI - LARVAL

1) LARVICIDAL → OILS, PARIS GREEN, TEMEPHOL

2) FISHES → GAMBUSIA, BARBADOS MILLIONS → Labister

3) INTERMITTENT IRRIGATION.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

III> INSECTICIDES

CLASSIFICATION

ORGANO P.	ORGANO CHL.	CARBAMATES
⇓	⇓	⇓
Yheons	DDT	Carbaryl
Diazenon	Dieldrin	Propoxor
Chlorpyrifos	BHC	
	Lindane	

RESIDUAL SPRAYS-

TOXICANT	DOSAGE (gm/m²)	DURATION OF EFFECTIVENESS (months) Avg	Max
DDT	1-2	6-12	18
LINDANE	0.5	3	6
MALATHION	2	3	6

COLOUR CODING

COLOUR	TOXICITY	EXAMPLE
RED	Extremely	Zn Phosphorus.
YELLOW	Highly	Endosulphan
BLUE	Moderately	Malathion
GREEN	Slightly	Mosquito Repelants

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

DDT

(1) Sandfly → Insecticide of choice

(2) Pyrethrum → Synergistic Effect

(3) Zeidler → Discovered it

(4) Paul Muller → Discovered Insecticide Property
∴ Given Novel Prize

(4) Most Active form of DDT – Paraisomer (70-80%)

PARIS GREEN

Copper Acetoarsenite
only for Anopheles

ABATE

Anopheles & Aedes

MALATHION-

Least Toxic OP for Man
Most Toxic OP for Insects.

DEET-

Diethyl Toluamide (ODOMOS)

1) All Purpose Repellents
2) Anti fly / Flea / Haemophagus / Mosquito

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

WATER

1) MIN. DISTANCE BET' WELL & SOURCE OF CONTAMINATION = 50 feet (15 m)

2) Safe Yield of water = Adequate for (95%) of year

3) PROBLEM VILLAGE-

a> Drinking water source pt.

>1.6 km in planes

>100 m in Hilly areas.

b> Depth >15m

4) ADEQUATE WATER REQUIREMENT

a) DOMESTIC USE

URBAN	RURAL
150-160 L/p/day	40-60 L/p/day

b) DRINKING WATER. - 2-3 L/p/day

5) UNSUITABLE IN WATER-

Lead - most Unsuitable

	NITRATE	NITRITE
mg/dL	<50	<3
Contamination	remote	recent
Disease	Methemoglobin-emia	Blue Baby Syndrome

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

6> WATER PURIFICATION

URBAN	RURAL
Sand Filters	Chlorination

A) SLOW SAND FILTER.

Element responsible for yielding Bacteria free water → VITAL / ZOOLOGICAL / SCHUMUTZDECKE LAYER.

Present on Sand Bed surface

Made of algae / Planktons / Diatoms

Heart of slow sand filter.

Formation ⇒ Ripening of filter

* When river water is stored for 1st 5-7 days
  ↓
  Bacterial count drops By 90% due to Sunlight

* VENTURIMETER - Device used to measure Bed Resistance in slow sand filter

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

CHLORINATION OF WATER V.V.I.

1) ACTIVE MOLECUE ⇒ Hypochlorous acid.

2) has residual Germicidal effect
[O_3, UV have no such Property]

3) Recommended contact Period for free residual chlorine in water > 1 hr.

4) Acts Best at pH (7)

5) Fresh Bleaching powder has 33% chlorine

6) 1 CHLORINE TABLET = sufficient to chlorinate '20 L of H_2O'

7) Orthotolluidene Arsenite = measures level of both free + residual chlorine

8) Chlorine - Kills Bacteria only

9) chlorine doesn't Kill Bacterial spores,
Protozoal cysts
Helminthic ova
viral agents. (Hep A, Polio)
Cyclops.

10) Amount of Bleaching Powder Required
[CHLORINE DEMAND].

n x 2gm → Disinfect 455L of 'H_2O'

↑
No. of 1st cup ⊆ shows distinct Blue colour.

↳ Indicator = Starch Iodide

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Q. 3rd cup is the 1st cup ≙ can become blue 104
How much bleaching powder required for 1820L. of water.

Ans. $3 \times 2 = 455$

$455\,L = 3 \times 2$

$1820\,L = \frac{3 \times 2}{455} \times 1820$

$= 24\,gm.$

14. HARDNESS OF WATER

- Soap. Destroying Power of water
- Hard water → Protective for non-communicable disease
- Due to Ca, Mg salts
- Softening is recommended when hardness >3 mEq/L or >150 mg/L of $CaCO_3$.

TYPES

TEMPORARY (carbonate)

HCO_3^- salts

Removal By-
- ✓ Boiling
- ✓ Lime
- ✓ Sodium carbonate
- ✓ Permutit

PERMANENT (non-carbonate)

SO_4^{2-}, Cl^-, NO_3^- salts

Removal By-
- ✓ Sodium carbonate
- ✓ Base exchange

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

VI BACTERIOLOGICAL INDICATORS OF WATER QUALITY

1) **COLIFORMS -**

1° ⋆ **most Reliable** Indicator of faecal Pollution.

E. Coli → Most Imp.

Faecal streptococci → **Recent** contamination

Clostridium – **Remote** contamination

2) **TESTS**

Presumptive — MPN
(most probable No)

INDICATOR → BROMOCRESOL PURPLE

Confirmatory – EIKJMANN.

BIOLOGICAL WATER QUALITY STANDARDS

In 100 mL water,

1) No sample should have E. Coli.
2) No sample should have > 3 coliforms
3) NOT > 5% samples throughout year should have coliforms
4) No 2 consecutive samples should have coliform organism.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

AIR

CET / CORRECTED EFFECTIVE TEMP-

1) Imp :- Index of Thermal Comfort

2) COMBINES - Temperature
M mean Radiant heat
movement / velocity of air
Humidity

3) 'Mc ARDLE' MAX Allowable sweat Rate = $\frac{4.5L}{4 hours}$

FROM CRS

Water Quality
Sound level
Housing Std.
Types of Transmission.
Vector : Disease Transmitted
: Mosquito.
Disease by Ticks.
Insecticides

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

VENTILATION :

1) SPACE = fresh air. supply of 3000 ft 3/ HR / Person.

2) Air change = → 2-3 changes / HR. (living room)
→ 4-6 changes / HR (work Place)

GLOBAL WARMING :-

Due to Green House Gases

1) Water vapour → Highest

2) CO_2 → 2nd Highest – Measured by KIFFER's TEST

3) O_3 → Protective , CFC → Depletor

AIR POLLUTION

1) Max in winters (Due to Temp Inversion)

2) Best Indicator of air Pollution.
   a) Chemical → SO_2
   b) Biological → Lichens

3) AQI- (air quality Index).
   ~~8 ID~~ 8 INDICATORS

   DARK GREEN – GOOD
   MAROON – severe

4) Air Quality is monitored by CPCB (central Pollution Control Board)

5) WHO Annual $PM_{2.5}$ Guidelines = 10 $\mu g/m^3$. 108

particulate (2.5 μm) matter (most dangerous)

OVERCROWDING

⇒ AGE = 0-1 yr = 0

1-10 yr = 1/2

> 10 yr = 1.

⇒

AREA (ft^2)	PERSON
110	2
90-100	1.5
70-90	1
50-70	0.5
<50	0

⇒

ROOMS	MAX NO. OF PERSONS
1	2
2	3
3	5
4	7
5	10

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

NUTRITION

OBSOLETE :-

① NPU / BV / PER
② Food Pyramid
③ PFA, AGMARK, ISI
④ BALWADI Nutrition / special Nutrition Programme
⑤ ~~Bfd~~ Balanced / Prudent Diet

HEALTHY DIET -

WHO Definition of 2015.

	ADULTS	CVS DISEASE
Total fats	< 30%	< 20%
Saturated fat	< 10%	< 7%
Sugar	< 50 gm/day	< 30 gm/d

Dietary cholesterol < 200 mg/d
Chl./HDL Ratio < 3.5

Salt Intake . < 5 g m/day
400 gm (5 portion) of fruits . veg - a day

DISTRIBUTION OF CALORIES IN (N) DIET -

Carbohydrate → 55-65%
Protein → 15-20%
FATS → 20-25%

Elderly	↑ Fibre, Iron, Calcium	↓ carbohydrate energy	same fats coil

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

↓ by 5% after 4th decade & 10% after 6th decade

DIETARY FIBRE

RDA Normal = 40mg/dL

RDA Diabetic = 48 mg/dL

RDA

97.5% population

Never eliminate calorie intake as per RDA

EAR (Estimated Avg Requirement)

50% population

PROTEIN ASSESMENT

Best Indicator – DIAAS [Digestibility Indispensable Amino acid score]

Most accepted – PDCAAS [Protein Digestibility corrected Amino acid score]

INDIVIDUAL FOOD STUFFS

1) SOYABEAN

⇒ Richest Pulse

43% Protein (Quantity ↑) But utilization (55%)

⇒ Poor Quality

⇒ Limiting AA = methionine

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

⇒ Richest Source of → Calcium
→ Iron
→ Vit B

(II) Eggs

1) Utilization ~ 96% ≈ 100% (Reference Protein)

2) 6 gm of protein
6 gm of fats
30 mg calcium
1.5 gm Iron
250 mg Cholesterol

3) Wt. = 60 gm. Energy = 70 kcal

4) Richest source of cholesterol

5) Poor source of Vit C & Carbohydrates.

(III) FISH

1) Richest source of Vit A, D.

2) Rich source of proteins, calcium, phosphorus, flourde, ~~Iodine~~

3) Poor source of Carbohydrate & Iodine.

(IV) Banana.

1) Good source of Vit A, B_6, C, Carbohydrate, Energy, fibre, Potassium, Phosphorus

2) Not a good source of Iron, calcium, Zinc due to phytates

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

IODINE

1) RDA_{NORMAL} = 150 µg/d

$RDA_{♀}$ = 250 µg/d.

$RDA_{Lactation}$ = 290 µg/d

2) As per FSSAI,
Amount of Iodine @ point of production = 30 ppm
& @ point of consumption = 15 ppm

3) Iodised oil – Poppy seed oil
(production for 4 years)

4) DFS / 2 in 1 salt ⇒ Double fortified salt
40 µg Iodine + 1 mg Iron / Gm of salt

5) Iodine Def. is a matter of major public health problem when Goiter prevalence >10%

6) Iodine Def. leads to ↓ in IQ By 13 points

7) Global 100 Day : 21st October

8) Endemic Cretenism = when Iodine uptake is < 20 µg/dl

9) KI ⇒ used for Iodisation.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

FOOD STANDARDS

GLOBAL	INDIAN
↓	↓
Codex alimentarius	FSSAI (food safety - Std authority of India)
(Int Govt Body of FAO + WHO)	

FORTIFICATION

1. Small amount
2. Daily consumption
3. salt Iodisation
   Vit A + D in Vanaspati
   2500 IU / 175 IU / 100 gm of vanaspati

SUPPLEMENTATION

1. Large amounts
2. Intermediate consumption
3. Vit A supplementation.

MID-DAY MEAL PROGRAMME

1) PRINCIPLE - 1/3rd of carbohydrate + 1/2 Protein.
2) MINISTRY - Human Resource + Development
3) Minimum - 150 days / year
4) 1° SCHOOL → 450 kcal
   → 12gm Protein
5) Upper 1° → 700 kcal
   → 20 gm Protein
6) Age Group - 9-12 years
7) upto class 8

Images + Mug-ups

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

PART- 3

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

VACCINES

FULLY IMMUNISED CHILD

child <1yr of age who has received 1 Dose of BCG

3 doses of DPT, OPV, Hep B

1 dose of Measles.

BENEFIT:- Provide max chance of survival

INDIA has largest no. of unvaccinated children

Drop out = Total - not fully immunised

VVM (VACCINE VIAL MONITOR)

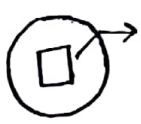
1) IMPORTANCE- a) Direct marker of heat exposure & effeciency of cold chain.

b) Indirect marker of potency of vaccine

2) Direct Relationship bet^n

Rate of colour change ∝ Temp.

⇒ Lower Temp ⟶ slower rate

3)  → 10% of area of outer circle Temp. sensitive material.

4> Ex. of Nominal Scale < Usable / non-usable

5> Validation → Optical Densitometer

MISSED DOSES

1) If a single dose is missed

a) No need to restart vaccine schedule again

b) Give the missed at earliest opportunity

Eg. 6wk → DPT 1, OPV 1, Hep B-1

10wk → missed

Came at

12 wk → DPT 2, OPV 2, Hep-B2

↳ Next dose of 14wk given at 16 wk

2) If not a Single Dose is Taken.

<1yr → Give as per NIS

NEW GUIDELINE

	1-5yr	> 5yr [DPT causes urological Ab(N) in >5yr]
1st visit	OPV, DPT, Hep B	dT / TT, Hep B
2nd visit (after 4weeks)	OPV, DPT, Hep B	dT/ TT, Hep B
3rd visit	OPV, DPT, M/MR	M/MR

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

1yr Later	1-5yr	>5yr
	OPV, DPT, HepB	Hep B

COLD CHAIN (Storage of vaccines)

DISTRICT/ PLACE OF PRODUCTION → (COLD BOX) → CHC/ PHC → (DAY CARRIER) HOUSE TO HOUSE; (VACCINE CARRIER) SUBCENTRE

- DISTRICT/ PLACE OF PRODUCTION → WIC [WALK IN COLD RM]; LARGE ILR's (Ice Lined Refrigerator); (Store for 3 months)
- CHC/ PHC → Small ILR's (Store for 1 month)
- SUBCENTRE → No vaccine storage

MAX. Damage to vaccine occurs in SUBCENTRE or VILLAGE LEVEL

DEEP FREEZER

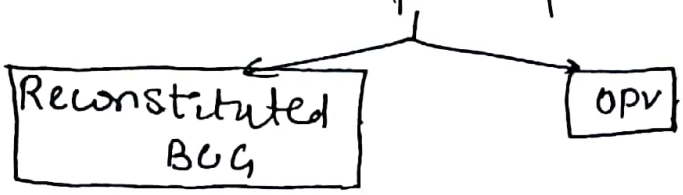
- PHC/CHC → Prepare Ice Packs
- Dist Hosp. → Preparing Ice Packs + storing vaccines like OPV & BCG for long Time Periods

ICE PACK-

1) Prepared in deep freezer

2) 320 mL In capacity, Horizontal Mark, Water is filled, nothing else to be added.

3) 2 Holes on surface for



4) Day carrier → 2 Ice Packs
Vaccine carrier → 4 Ice Packs

ILR (ICE LINED REFRIGERATOR)

1) With an uninterrupted Power supply of 8hrs, ILRs an maintain Temp for 24hrs

2) Instrument & we use is k/a DIAL THERMOMETER

3) Measured twice a day, even on Holidays.

PRINCIPLE
Thermo-couple

4) Temp +2 to +8°C

5) ~~SEQUENCE~~

SEQUENCE OF STORAGE –

Top

Diluents	De
Hep B	Humein
IPV	Itni
Penta	Permanent
DPT	Daya
TT	Teri
BCG	Bhagwan
Measles	Mere
OPV	OH

Temp. ~~Seen~~ Sensitive

Reconst BCG > Yellow fever

Bottom.

OPEN VIAL POLICY

Reconstituted vaccine

↓

+ ROTA

↓

BCG, Measles, JE

(Yellow fever, Rabies)

↓

NEVER REUSED after 4hrs of Reconstitution.

Other vaccines

↓

If VVM is intact then can be used till 28 days

AIIMS

eVIN · (Electronic Vaccine Intelligence Network)

'SMS' Based Temp. Monitoring Sense System where ILR is connected to a computer & sends messages In case of Temp. Fluctuation To Medical officer Incharge + District Immunization officer Numbers.

" Lowest Level It is Being Used is PHC"

NATIONAL VACCINE REMINDER

AIIMS

1) Free SMS Service
2) Where child's name + DOB are sent to helpline No.
3) Reminder for vaccination of child is received '2d' In advance
4) continued till child is 12yrs old.

WASTAGE MULTIPLICATION FACTOR (WMF)

BCG → 2

RoTA
Measles } → 1.33
JE

Others → 1.11 ~~1.15~~

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

AIIMS

VER (VACCINE EFFECTIVENESS RATIO)

VER = 1 - RR

(Relative Risk)

IPV

India started ē 0.5mL I.M. Dose of IPV single Dose at 14wk

↓

Now we gave fIPV (fractionated IPV)

0.1mL I.D. 2 doses of IPV at 6 & 14wk

VIT A Supplementation

<1yr = 1 Lakh IU/1mL

>1yr = 2 Lakh IU/2mL

9 month → 1mL given

After every 6 month till 5yrs we give Vit A 2mL/2 lakh I.U.

Total = 9 Doses

1x1 + 8x 2 = **17 lakh IU**

BCG

1) DANISH 1331 Strain
   Mycobacterium Bovis

2) DOSE = 0.1 mL
   < 1 month = 0.05 mL

3) Route - I.D. (Tuberculin Test)

4) Site = (L) Upper arm

5) Diluent = NS

6) ADVERSE Rxn - Ulceration
   Suppurative Lymphadenitis
   osteomyelitis
   Disseminated T.B.

DPT/DT

1) DT- Toxoids P → killed acellular

2) $AlPO_4$/AlOH (Adjuvent - ↑ses Immunogenicity)

3) THIOMERSAL (Preservative)

4) Route - I.M. 0.5 mL middle part of Anterolateral thigh

5) ADVERSE Rxn- neurological
   Shock

C/I → a) Severe Rxn in previous dose upto 48 hrs. after vaccina.

a) ~~Screaming~~ Screaming

b) Fever > 40°c

c) Neurological

MEASLES

1) EDMONSTRON ZAGREB

2) Diluent - Sterile/ Distilled water

3) Stabilizer - Sorbitol.
Neomycin,
Hydrolyzed Gelatin.

4) Route - 0.5 mL S.C (R) arm

5) C/I - High Fever
Anaphylactic Rxn

♀

7) Complication - TSS
ITP.

VACCINATION IN ELDERLY

NO GUIDELINES IN INDIA

1) Influenza I.M. (live attenuated - C/I)
2) Pneumococcal (single Dose)
3) dT Booster (every 10yrs)
4) High Risk Pt
   a) Shingles/ Zoster / varicella
   b) Hep A & B
   c) MMR
   d) Meningococcal
   e) yellow fever

GENERAL GUIDELINES

a) All 'LA' vaccines are C/I in ♀ except

Yellow fever
OPV
Cholera
} Travel/ outbreak + Rabies

2) Any vaccine (except OPV & Yellow fever) if accidently frozen are discarded

3) Any no. of vaccines (live or killed) can be given together (no need for any form of gap)

4.) ND spirit is to be used to clean vaccination site

5) Minor fever, Diarrhoea are not C/I for vaccination

acute resp. Infn

~~HIV~~ HIV

PPTCT

Prevention of Parent to child Transmission of HIV

MOTHER

If a ♀ is on 'TEL' Therapy from 1st Trimester no need to go for Prophylactic LSCS. (unless obstetrically Indicated)

CHILD

1) Nevirapine Prophylaxis start at Birth.
   Min - 6 weeks
   Max - 18 months

2) Cotrimoxazole Prophylaxis Therapy
   Start → 6 weeks
   Continue → Till clinical discretion.

3) Exclusive Breast Feeding for 6 months.
   ↓
   Abrupt stop
   ↓
   Switch to artificial feed
   No ♯ mixed feeding is allowed

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

* In India, there is no C/I for Breast Feeding

4) Early Infant Diagnosis
Done using HIV DNA PCR + Confirm" of HIV -ve status of child is done only @ 18 mnths

POST- EXPOSURE PROPHYLAXIS

→ Any Person who has come in parenteral or mucosal contact ~ Infective secretion of Body (all secretions of human Body is infective except Urine, sweat, tear & not blood stained saliva)

→ PEEP to be Started as soon as possible. (Max 72hrs)

→ Given till 28 days

→ Confirm" of HIV status can only be done at 3 months.

REGIMEN

>10 yrs - Adults
↓
TEL

<10 yrs
↓
ZIDUVODINE/TENOFOVIR + LAMIVUDINE + RITONAVIR/ LOPINAVIR.

Ziduvodine Based Regimen is Preferred

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

HIV Rx IN INDIA

India now follows TEST & Rx POLICY
i.e. There is no cut off for Initiating HIV Rx In India.

CD_4 is only used for monitoring Reponse to HIV Rx.

HIV pt ⟶ CD_4 Every 6 month

HIV + TB pt → CD_4 done every 3 month

≥ 3 yr → Adults
↓
TEL

< 3 yrs
↓
LOPINAVIR/
RITONAVIR.

HIV Rx SERVICES UNDER PROGRAMME-

ART+	Select Medical college	3rd Line ART + CD_4 Count
ART	All medical colleges + Dist' Hospital	1st Line ART + CD_4 Count
LAC Link ART CENTRE	All Subdistrict Hosp + CHC ~~PHC~~	1st Line ART

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

NATIONAL STRATEGIC PLAN FOR HIV/AIDS & STI

2017 - 24

VISION - Paving way for AIDS free India

GOAL - '0' new Infec".
'0' AIDS Related Deaths.
'0' Discrimination.

TARGETS -

By 2020	By 2024
① 75% Reduc" in new HIV Infec"	80% Reduction in new HIV Infec".
② 90-90-90	95-95-95

90% of people who are HIV +ve know their **Status**

90% of people who know the Status are on **HIV Rx**.

90% of People who are on HIV Rx should have viral **Load suppression**

③ Elimination of **Stigma** + Discrimination

④ Elimination of **PTCT** of HIV + Syphilis

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

HIV SENTINAL SERVICES (2016-17) 130

PREVALENCE OF HIV INF^{n}

100 ⟶ 6.26%

ANC CLINIC ATTENDES ⟶ 0.28%

3 GROUP OF POPULATION

HIGH RISK GROUP	BRIDGE POPULATION	GENERAL POPULATION
⇓	⇓	⇓
Injec^{n} Drug user	Long Distance	ANC
Trans-Gender	Truck Driver	
Hijaras	Single migrant MEN	
Men having sex ĩ men		
Commercial sex workers.		
(n) 250	250	400
Sampling Random	Consecutive	Consecutive

TESTING STRATEGY

Linked Anonymous 2 TEST STRATEGY

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

POLIO

POLIO ELIMINATION STRATEGY-

HISTORICAL

① Routine Immunisation (RI) → under NIS

② Supplementary Immunization activity (SIA)
→ Pulse Polio
(0-5yrs)

③ AFP surveillance
(0-15yrs)

④ MOP UPS → Difficult areas

NEW / END GAME

① SWITCH [2016]
tOPV → bOPV
Type 2

② SHIFT (2018)
OPV — IPV

③ Continue AFP surveillance

V.V. Imp

VAPP
[Vaccine associated Paralytic Polio]

Rare
Less Dangerous
Doesn't cause outbreak

Due to Type 3 strain

PATHO - OPV is a Live attenuated Vaccine & in it vaccine virus converts to wild ~~variety~~

VDPV
[Vaccine derived Polio Virus]

Rarer
More Dangerous
Causes Outbreak
(cVDPV)
↳ circulating
Due to Type 2 strain

Unknown But commonly seen in areas of low

Variant & causes Paralysis

SOLUTION - ~~Sto~~ shift (2018)

Vaccine coverage

switch (2016)

ACUTE FLACCID PARALYSIS

DEF^{n} - Onset of Paralysis c is < 4 weeks in onset (Acute) leading to flaccid/floppy limbs

CAUSES -

4 causes

1) Acute Paralytic Polio
2) Transverse Myelitis
3) Traumatic neuritis
4) Guillian Barre Syndrome

TIMELINE -

1> c in **2 days** of notification AFP **Surveillance** has to be done
2> c in **2 weeks** of **onset** of Paralysis
3> Checking for **residual Paralysis** has to be done after **2 months** ~~of~~ onset of Paralysis

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

STOOL SAMPLE COLLECⁿ-

→ 2 samples 24 hrs ~~after~~ apart are collected each sample being 8g in amount (Size of distal phalanx of the thumb)

→ is collected in a clean, dry, screw capped container containing no preservative.

→ Transported in Red coloured vaccine carrier (Temp. of +2 to ±8°C) [Reverse cold chain]

INFECTIVE EPIDEMIOLOGY

EPIDEMIC ⇓ > Mean + SD. even a single new case of new/ eliminated/ eradicated Disease

- Point source — Rapid Rise, Rapid fall, 1 incubation Period, clustering of cases
- Propagated — slow rise, slow fall, multiple I.P.

ENDEMIC ⇓ < Mean ± 2SD

- HYPERENDEMIC — Only in paediatric population
- HOLOENDEMIC — All age grps are equally affected

PANDEMIC ⇓ >1 country involved at a time

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

PART- 4

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

DISASTER

1) DEF^{N} :- Extra-ordinary Response from outside

2) M/c DISASTER / MAX FATALITY -
Hydrological (cyclone + Flood)

3) Dis. c Max Morbility / Mc DIST. POST DISASTER
Aute Gastro enteritis.

4) M/c Vit. Deficiency Post Disaster
Vitamin A

5) Most Preventive Strategy for AGE -
a) clean drinking ~~Post~~ water
b) SAFE Disposal of stores.

6) Clean Drinking water
is ensured by Chlorination

* Amount of Residual Chlorine

(N) Drinking water — 0.5 ppm

Post Disaster water — 0.7 ppm

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

7) Potassium Iodide → Drug to be consumed prophylactically Post Natural ~~Disaster~~ Disaster

↓

Replaces Radioactive 'Iodine' from Thyroid Gland

8) TRIAGE CLASSIFICATION OF DISASTER

BLACK - Dead - Least Priority

RED - Max. ~~Priority~~ Priority → Rx In 4-6 hrs

YELLOW - Intermediate → Rx In 24 hrs

GREEN - Ambulatory Pts.

Reverse Triaging :- GREEN (Max Priority) in Defence/ wars.

9) VACCINES TO BE GIVEN

DISASTER VICTIMS (After Disaster)

⇓

Measles
+ VIt-A
Chicken pox
ROTA

* Typhoid & Cholera Usefess

DISASTER RELIEF TEAM (Before Disaster)

⇓

Hep B
Tetanus
Typhoid
Cholera

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

NODAL

HEAD → PM

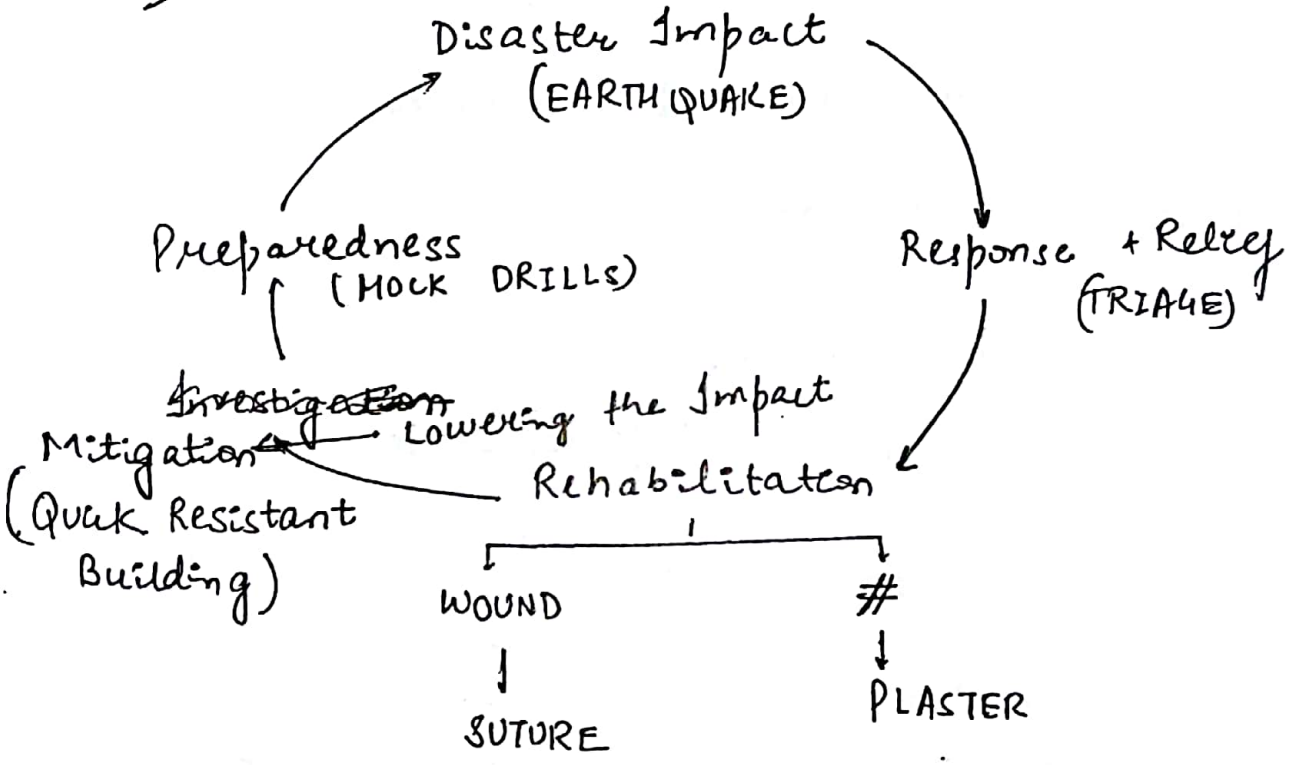
Ministry → Home

Agency → National Disaster Mx agency/ authority

Health Unit → District

PGI

DISASTER CYCLE



INTERNATIONAL HEALTH

UNICEF

GOBI FFF

G - ~~Growth~~ Growth Monitoring

O - Oral Regulation

B - Breast Feeding

I - Immunisation

F = Female Educ°

F - Family Planning

F = Food supplementation

HQ	ORGANISATION
GENEVA	WHO, International Red. cross, International Labour Organisation
NEW YORK	UNICEF, UNPP
ROME	FAO (food & Agriculture Org°)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

ERGONOMICS → Right Man In Right Job

NOSOLOGY → Classification of Diseases

EMPORIATRICS → Study of International Disease of Travellers

UNDP → Development

UNFPA → Family Planning, Reproductive Health.

WORLD BANK - Economic Loan.

WHO

① 07/04/1948 → constitution of WHO adopted ∴

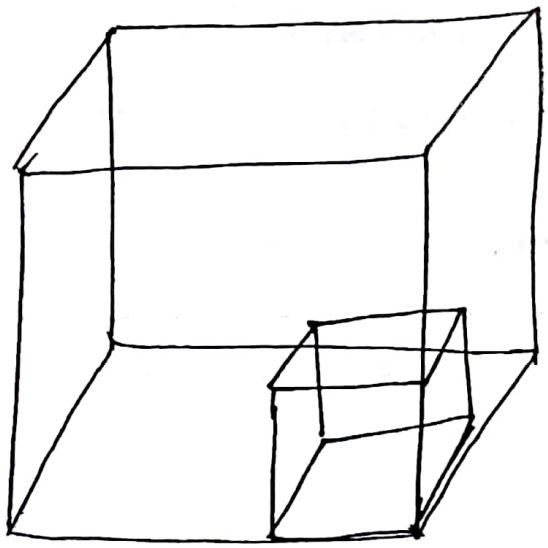
② ∴ celebrated as WORLD HEALTH DAY

↓

2018 (THEME) :- UNIVERSAL HEALTH CARE

↓

3 COMPONENTS



→ ↑ coverage to no. of people served

→ ↑ coverage of services being provided

→ ↓ cost

3) OLIVE LEAF - Emblem of WHO

4) WHO has 6 Regions
India come in South East Asian Regions [SEAR]

5) SEAR has 11 countries → India + neighbours (NO PAKISTAN)

COMMUNICATION

Most Imp. Component = FEEDBACK / EFFECT

TYPES

ONE WAY	TWO WAY	FACE TO FACE
DIDATIC	SOCRATIC	1 to many / 1 to 1
↓		Advice / Counseling
T.V., Internet	Focussed Group Disc' (FGD), workshop, Pannel Discussion, Symposium	Max. Resources
News Paper		Min. audience
Min. Resources		Max. Behaviour change
Max. Audience	INTERMEDIATE	
Min Behaviour change		

ADVICE → ONE TO MANY

COUNSELING → ONE TO ONE

↳ ~~Gather Approach~~. G.A.T.H.E.R.. APPROACH

↓

Emergency contraceptive Pill

TWO-WAY

I) FGD

a) Min = 6 participitants

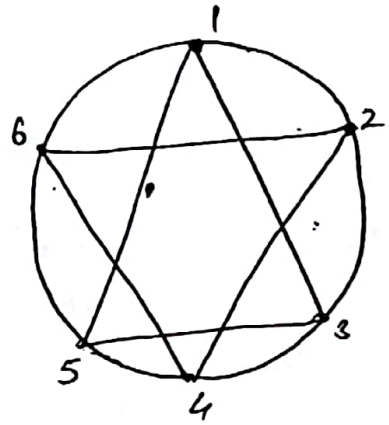
b) Max = 12 ,,

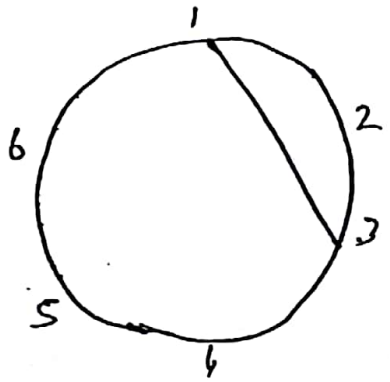
c) should know each other from before

d) should discuss on the same issue

e) SOCIOGRAM

a) Provides detail of Participatione of Participants





(II) WORKSHOP

a) Practical skill Development Demonstratoy Place

b) 30-40 participants.

c) Cataract

d) Laproscopic workshops.

(III) PANEL DISCUSSION ⟷ (IV) SYMPOSIUM

is sequential

[3-4 Participants who discuss in front of a large audience]

AIIMS, PGI

DELPHI'S METHOD

1) Systematic Interacting & forecasting method

2)
   a) Group of Experts
   b) Independent
   c) Geographically Dispersed
   d) Brought to a consensus

3) Ex:- Dengue

SOCIOLOGY

1) ACCULTURATION -
Mixing of 2 cultures

2) OPINION - Temp. Subjective view
BELIEF - Permanent subjective view
ATTITUDE - Permanent Objective Acquired
HABIT - Accustomed Acquired automatic way of doing a thing

3) LEVELS OF LEARNING -
COGNITIVE - knowledge → H/C Q. (lowest level)
AFFECTIVE - Attitude
PSYCHOMOTOR → Skills → HIGHEST (USMLE step III)

4) TYPES OF FAMILY - CENSUS DEF^{n}.
a) NUCLEAR - MA + PA + Bacha
b) JOINT - 2 Eligible Couple
c) EXTENDED - Nuclear + Any extra family member
d) NEW - Nuclear & (10 yr of marriage.
(Imp. for family planning)

5) SOCIO ECONOMIC STATUS
URBAN
MODIFIED
KUPPUSWAMI
RURAL
UDAI & PAREEK

URBAN MODIFIED KUPPUSWAMI

Income of Family
+ Education + occupation of head of household

~~BEFO~~

6) BELOW POVERTY LINE

Amount of Money required to buy 2400 kcal/day
In RURAL. → 32 Rs/day.
or
2100 kcal/day In Urban → 47 Rs/day.

I) SOCIAL PATHOLOGY

→ It is the study of Relationship Between Disease + Social Factors

II) SOCIAL SECURITY- BISMACK (Germany)

Social Assistance	Social Insurance
Non-contributory Benefit	Contributory Benefit
Extended to vulnerable Population	Extended to Individuals
Ex- Old age / Widow/ Disability Pension scheme	Ex- LIC, ESI

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

III> SOCIAL SAFETY NET –

Collection of services provided by Govt. & prevents Individuals from falling into Poverty

INCLUDES – welfare,
Employment
Universal Health care
Shelter homes

IV> SOCIALISED MEDICINE–

Govt. provides all aspects of healthcare
(JULES GUERIN, Russia)

- Pt. Doesn't Pay any amount
- Employs all DR's
  - Stds. of care maintained.
  - No private practice
  - NO competition

UNIVERSAL HEALTH CARE

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

OCCUPATIONAL HEALTH

M/C occupational D/s in India ⇒ LUNG DISEASE

Q. Lung Disease → Pneumoconiosis → Silicosis. → Occupational Cancer → Skin cancer > Lung ca

OCCUPATIONAL HEALTH EXAMINATION

PRE PLACEMENT

⇓

① ERGONOMICS
(Right man in Right Job)

② Occupational Dermatitis

POST PLACEMENT

⇓

1) Annual - Majority

2) Monthly - Lead
Radium
Dyes.

FACTORIES ACT 1948

1) Factory is an establishment
≥ 10 persons + usage of electricity
or
≥ 20 persons

2) 29 Diseases are notifiable
a) all pneumoconiosis [except Bagassosis]
b) all occupational carcinomas

3) Work Related NORMS_
a) AGE - <14 yrs - Prohibited

15-16yrs - Declared fit by Dr. can only work Between 6am - 7pm

B) HOURS OF WORK

15-16yrs - Max 4.5 hrs/d

Adults - 9 hrs/d

60 hr/week including overtime

C) HEALTH, SAFETY & WELFARE RECOMMENDATIONS-

Min - 500 ft^3/worker

1 safety officer / 1000 workers

1 welfare officer / 500 workers.

1 canteen > 250 workers

1 creche > 50 ♀ workers

ESI (EMPLOYEES STATE INSURANCE) 1948

1) INCLUDES

a) all factories

b) all educational institutions (Both govt & private.)

c) Restaurants & Hotels

d) Cinemas & theatres

e) Newspaper agency

f) Road motor Transport

EXCLUDES

Mines

Defence

Railways

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

② Covers all employees earning < 21,000 /mth. #

③ Union ministry of Labour

④ Employer - 4.75% of Total wage
Employee - 1.75% of Total wage

⑤ ESI BENEFITS :-
from CRS

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

RNTCP

Ministry change:- RNTCP has been transferred to additional secretory & director general of NACO

TB NOTIFICATION -

1) On 7/5/2012. GOI made it mandatory to notify TB cases
2) ī in 1 month of Δ to District TB officer (DTO)
3) In 2018, Govt. Declared failure to do so is a criminal offence under sec 269 & 270 IPC with 6 months - 2 years of imprisonment ī/ī out fine

NATIONAL Strategic Plan for TB elimination (2017-25)-

1) Vision → TB free India
2) Goal → To achieve rapid ↓ of T.B. Burden, morbidity & mortality By 2025.
   DTPB approach [Detect Treat Prevent Build]
3) Expected outcome- By ~~2025~~ 2025,
   a) 80% reduction in TB Incidence
   b) 90% ↓ in TB mortality
   c) 0% pt having catastrophic expenditure due to TB

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

FINANCIAL INCENTIVES

→ Every TB pt will receive 500 Rs/month for purpose of meeting TB related expenses

→ 1000 Rps/pt one time ₹ is provided for notification.

RT-MERM

→ Real Time Medication Event Monitor Device

→ This records date & time of Mx intake by patient & provides details about adherence to TB Rx

HIV-TB Rx

5 Interventions-

1) Δ using CB NAAT only

2) Daily fixed Dose combination

3) 99 DOTS

4) Pharmacovigelance

5) Isoniazid Preventive Therapy →

- every HIV pt is given 10 mg/kg of Isoniazid

(In India, ~~IGH~~ TB is M/c Opportunistic Infec" in case of HIV pts)

* In case of HIV TB co-infec" we always start ℂ TB therapy 1st for 1st 15 days & to avoid Immune Re-constitution Syndrome

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

TB Rx

Intensive
4 FDC
Anti-TB schedule
9 drug

Continuation
3 FDC
Anti TB schedule
10 drug
smaller ϕ tablet

* There are 4 wt bands for Adult Rx starting from 25kg
whereas in pediatric age group – 6 wt. bands ranging from 4 to 39 kgs.

* In case of pediatric age group if there is a change in wt band than dose of TB medicine has to be modified.
But not done in case of adult

DOSING

H – 75mg
R – 150mg
Z – 400mg
E – 275mg

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

DRUG SENSITIVE NEW

$2(HRZE)_7$ +

$4(HER)_7$

DRUG SENSITIVE Previously Rx

$2(HRZES)_7$ +

$1(HRZE)_7$ +

$5(HER)_7$

GOALS OF RNTCP

Cure | Prevent Resistance | Break chain of Transmission

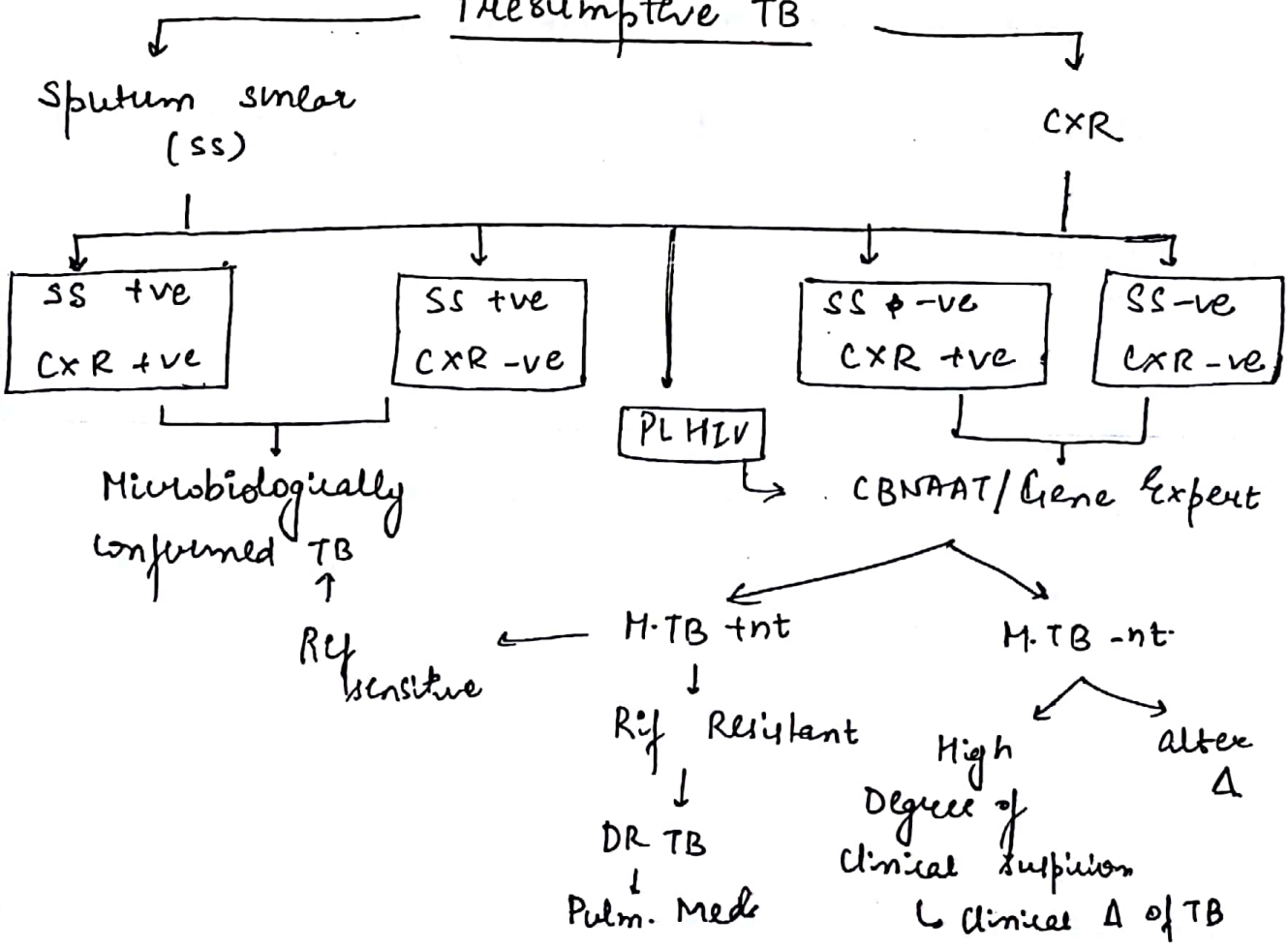
TARGETS

Detection - 90%

Cure Rate →

Drug sensitive New = 90%

Drug sensitive Previously Rx = 85%



CASE DEFINITIONS :-

Microbiologically

Presumptive TB pt. AFB/ Culture +ve/ CBNAAT +ve

Clinically Aided

Presumptive TB Pt. not microbiologically conferred But Aided on CXR/ HPE/ c/f..

FAILURE

Person is SS +ve even at end of Rx.

FOLLOW-UP

Drug sensitive New + Previously Rx

1) SS only at the end of Intensive Phase & Continuation phase

2) If pt is +ve on S.S. at end of Intensive Phase
   a) no need to extend I.P. ~~at~~ By 1 month
   b) Sputum ~~Sputum~~ sent for DST (Drug sensitive TR)

3) Monthly wt

4) CXR. (If required)

DRUG RESISTANT

Sputum smear monthly 3, 4, 5, 6, 7 months. In I.P. & at 3 monthly Interval In C.P. at 9, 12, 15 months.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

99 DOTS PROGRAM-

Def^n- Online monitoring of Rx adherence

2) Pilot programme in HIV - TB

3) Each Anti-TB Blister Pack is wrapped in a custom Envelope, & includes hidden phone no. that are visible only when doses are dispensed.

4) After taking medication pt- makes ~~free~~ free call to hidden phone no.

NVBDCP

1> Malaria
2> Filaria
3> Dengue
4> Chikenguniya
5) JE
6> Leishmania

MALARIA -

National Framework for malaria elimination in India (2016 - 2030)

(Aggressive Target 2016 - 2022)

GOAL - Eliminate malaria ['0' Indigenous cases throughout entire country by 2030

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

CAT	PHASE	STATES/ UTs
0	Prevent of Re-establishment	'0' Indigenous cases of Malaria
1	Elimination	State API < 1/1000
2	Pre-elimination	state API < 1/1000 & some district having API > 1/1000
3	Intensified control	state API > 1/1000

MALARIA CONTROL STRATEGIES : JUNE (malaria control month)

National Dengue Day = 16th May.

1) Surveillance → M_x

2) Case management

3) IVM (Integreated Vector Management)

a) IRS (Indoor Residual Spray)

↳ DDT : Malathion

Mainstay in Rural areas

b) ITN / LLIN → Urban area

c) Anti-Larval (Both the areas)

(2) CASE - M_x :- Non-♀ state

P. vivax P. falciparum.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

P. vivax
↓
CQ × 3 days.
+
PQ × 14 days

P. Falciparum
North-Eastern → ACT - AL. [Arthemether + Lumefantrine].
Other states → ACT + SP [Artesunate + sulfadoxine + Pyrimethamine]

Single dose of PQ on Day 2

♀ PQ in C/I

Uncomplicated
- P. vivax → CQ × 3 days
- P. falciparum
  - 1st Trimester → Doc = Quinine
  - 2nd, 3rd Trimester → Doc: area specific ACT

Complicated Falciparum → ACT in all Trimester

MALARIOMETRIC INDICATORS -

1> SPLEEN RATE :- Best indicator of malaria prevalence in community

2> INFANT PARASITE RATE :- Most sensetive index of Recent Transmission in Locality

3> API (Annual Parasite Index) ⇒
API ≥ 2/1000 population → High Risk area

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

$$API = \frac{\text{confirmed cases During 1 year}}{\text{Population under surveillance}} \times 1000$$

4) ABER [Annual Blood Examⁿ Rate]

$$\frac{\text{NO. of slides examined}}{\text{Population}} \times 100$$

Imp:- Index of operational efficiency

AIM:- To screen 10% of entire population

CHEMOPROPHYLAXIS

< 6wks
(short-term)
↓
Doxycycline (daily)
or
Chloroquine (wkly)

> 6wk.
(LONG TERM)
↓
Mefloquine

JE CONTROL

1) Human Vaccination → Most effective [SA-14-14-2]
0.5mL / S.C. (L) upper arm
Diluent :- Phosphate Buffer

2) VECTOR CONTROL → JE Vector are outdoor resters,
∴ IRS is of no Benefit
a) outdoor spraying
b) Pigs to kept away from human dwelling

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

FILARIASIS CONTROL

1) Chemoprophylaxis-
DEC + Albendazole single dose annually for 4-6 yrs
Given to all except ♀, children < 2 yrs

2) Chemotherapy -
DEC - 6mg/kg x 12 days
DEC medicated salt ⇒ mass Rx of filariasis.
Consumed for 6-9 months i 1 gm DEC/kg of salt

LEISHMANIASIS

1) LAB Δ :- RDK PK 3g

2) DOC :- Liposomal Amphotericin B (I.V.)

3) alternative ⇒ miltefosin

4) obselete ⇒ Na stibogluconate

5) Financial Compensation →
500/mnth → cases
2000/mnth → PKDL
300/mnth → To 1° worker of pt for Rx
200/~~mnth~~ → Generating awareness in community

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

67 CONTROL → A) Sandfly Control
(Done By Resedual Insecticide)

a) DDT / 1st choice
2 metre, 2 Rounds / yr.,
@ 2gm / m^2
alternative → BHC

B) Personal Prophylaxis
avoid by sleeping on floor
Fine mesh nets < 0.2 mm

CRS → Health care of community

PEDIATRICS

Handwritten Note

MBBS Help

http://mbbshelp.com

http://www.youtube.com/mbbshelp

http://www.facebook.com/mbbshelp.com

Name: _____

Subject: **PEDIATRICS**

BLANK

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page _____

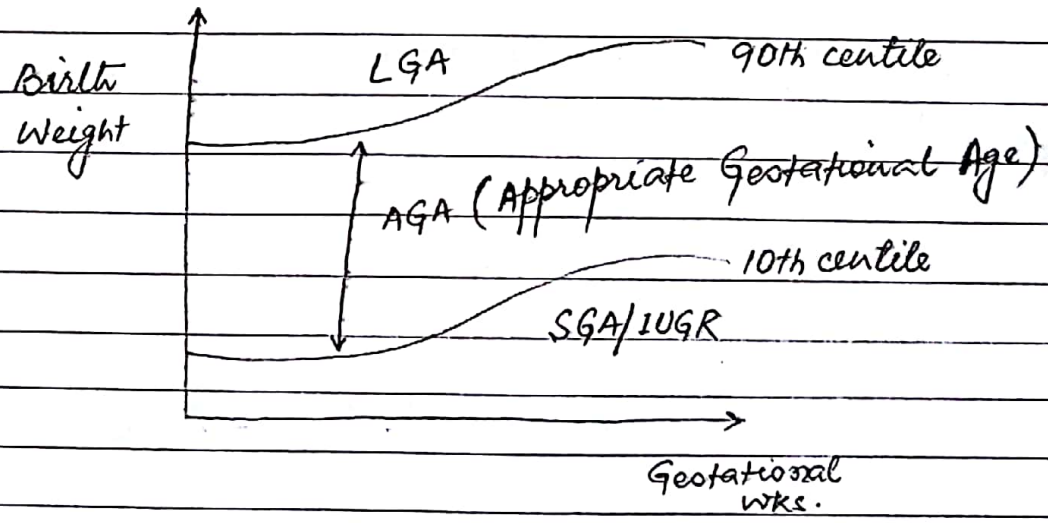
PEDIATRICS

Neonate – First 4 wk. of life.
↳ Early – 7 days, cause of death – Prematurity
Late – 7-28 days, – Sepsis.

Term – 37-42 wk gestation
Preterm – < 37wk
Post term – > 42wk

Normal wt → 2.5-4kg
LBW < 2.5kg
VLBW < 1.5kg
ELBW < 1kg
Macrosomia > 4kg.

Lubchencho chart:



Constitutional:
- LGA (large Gestational Age)
- Short stature.
- Delayed puberty.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date __/__/__
Page

- All term baby has 6 frontanelle:
  - Anterior → ~~closes at 6 months~~
  - Posterior
  - 2 sphenoid
  - 2 Mastoid.

Posterior fontanel - Closes at birth.
open in 3% baby.

Anterior fontanel - diamond shaped.
2.5 X 2.5 cms.
At level
Pulsatile
closes at 18-24 months of life.

Craniosynostosis:
Early closure of all fontanel.

Complication:
- Microcephaly
- ICT ↑ → optic atrophy.
- cosmetic.

Rx - Craniectomy

Syndromes associated - Apert, Crouzon, Pfiffer (AD), Carpenter - AR

Delayed closure of fontanel:
- Rickets
- Down's
- Hypothyroidism
- Hypophosphatasia
- Cleido cranial dysostosis.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date __/__/__
Page _____

Q. 2 wks baby, Hypotonia, hypothermia, umbilical hernia, constipation, physiological jaundice prolonged.

↳ Congenital hypothyroidism
(humeral head – Epiphyseal dysgenesis)
(Ⓐ6ⓗ epiphysis of bone)

Neonatal Screening:
- TSH ; T_4
  - Delayed rise of TSH
  - TBG deficiency (TSHⓗ ; T_4↓)
  - Best time : after 48hrs (72hrs)

M/c/c of congenital hypothyroidism – 85% agenesis/ dysgenesis of thyroid gland.

Congenital hypothyroidism:
Prevalance = 1:2000
Girls > Boys.

Neonatal screening : Continue
TSH; T_4
- Cold temp^r
- Physiological TSH surge 48 hrs.
- APP > 48hrs to 6days.
- In OP Ghai → 3-5days

→ Sample obtained → Heelprick.
Safe area → Side prick.

- pt in shock, venous access can't get in 60sec.
- M/c other site – Near Tibial tuberosity.
  Upper end of tibia
  Lower end of femur.
- In shock → i.v. fluids ⇒ 20ml/kg bolus NS.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date __/__/__
Page

Most easily assesible venous route – Umbilical Vein.

Phenylketonuria: Deficiency of Phenylalanine hydroxylase.

Phenylalanine
PKU ⊖ ≠ Phenylalanine hydroxylase.

Tyrosine
↓ Tyrosinase
DOPA
↓
Dopa quinone
↓
Melanin

↑ Phenyl alanine → Toxic to Brain → so in PKU High Phenylalanine (20 mg/dl)
- Child Mental Retardation.
  - Developmental delay.
  - Exaggrated Reflexes
  - Microcephaly.

Rx – PKU
- Supplement Tyrosine
- Restrict Phenylalanine
- Now Tyrosine essential.
- Aim: Serum Phenylalanine < 6 mg/dl.
- Lifelong.

Q. About PKU Rx, first step–
A) Stop the substrate of the enzyme
B) Supplement the enzyme.
C) Reduce the substrate of the enzyme
D) Provide deficient proteins.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date __/__/__
Page _____

Maple Syrup Urine disease (MSUD):

- Deficiency of α-keto acid branched chain dehydrogenase.
- High Valine : Leucine : Isoleucine blood & CSF.
- Coma
- Severe acidosis.
- We do dialysis — To remove Valine : Leu : Isoleucine.

Neonatal Screening : Continue

- Tandem mass
  - Spectrophotometry → metabolic
- Cystic fibrosis
- Congenital adrenal hyperplasia
- G6PD deficiency.
- Biotin deficiency.

ANTHROPOMETRY : TERM BABY

Length — 50 cms
Head circumference — 35 cm
HC > CC but not more than 3 cm.

- HC > CC (>> 3cm) → Congenital hydrocephalus.
  → Asymmetric IUGR baby.

CC = HC → at 9-12 months
By 1yr ; CC >>> HC

Upper Segment : Lower segment (US : LS)
New born = 1.7 : 1
At 10 yrs = 1 : 1
Adults = 0.9 : 1

Achondroplasia : Short limb dwarf (US/LS ↑)
Hypothrodism : US/LS ↑ (disproportionate short stature)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date __/__/__
Page _____

Meconium:

95% pass meconium at 24 hrs.
99% " " " 48hrs.

Cause of delayed passage meconium
- Imperforate anus
- Hirschprung / aganglionic
  ↳ Rectum biopsy.
- Meconium ileus → Cystic fibrosis.
  ↳ Small intestinal obstruction.

Q 48hrs baby has not passed meconium. Next Ix
A) CFTR gene test
B) Sweat Chloride
C) Manometry
D) Lower GI contrast study.
  ↳ Δ Hirschsprung
  Treat meconium ileus.

Delayed Urine:
- B/L Renal agenesis
  ↳ Maternal oligohydramnios.

Post. Urethral valve (also cause) ↓
B/L pulm. hypoplasia
⇓
POTTER'S Sequence.

Potter's face – Nose pinched in
Retrognathia
Micrognathia
Bag & mask → Pneumothorax.

Q If a baby has not passed urine in 1st 48hrs, Next Ix
→ USG

Q 3 days old, c/o - Weak dribbling urine stream.
O/E - palpable distended bladder.
Δ → Posterior Urethral valve.
IOC : MCU (Micturating Cysto Urethrography).
Rx : Cystoscopic Fulguration

SGA / IUGR :
Complication : TORCH infection / Chromosal disorders.
Symptom - Asphyxia → causes MAS
↓ (Meconium Aspirated Syndrome)
PPHN (Persistent pulm. HTN of Newborn).
Severe IUGR - Pulmonary hemorrhage
Limited stores - Hypoglycemia, HypoCa ; HypoMg.
- Polycythemia
↳ bcoz in IUGR erythropoietin is very sensitive to hypoxia.
- Neutropenia
- Thrombocytopenia.

Q Full term small for date babies are more disposed to -
a) Hyper Ca
b) CNS infection
c) PDA
d) Hypoglycemia
b, c > common in preterm.

Date __/__/__
Page

	Symmetric IUGR	Asymmetric IUGR
Cause →	Chromosal/ Torch	Maternal complications
Cell no.	↓	(N)
Cell size	↓	↓
Brain	↓	(N) spared. HC > CC > 3cm
		Brain/liver ↑

PONDERAL'S INDEX:

$$\frac{Wt\ (gm)}{Length\ (cm)^3} \times 100$$

< 2 → Asymmetric IUGR

> 2 → AGA/ Symmetric IUGR

Normal Neonatal phenomenon:

Milia: Distended Sebaceous gland on face & nose.

Erythema Toxicum: Erythema on face & trunk 2-3 days of life.

Stork bites: Pink/gray capillary hemangioma on back & buttocks.

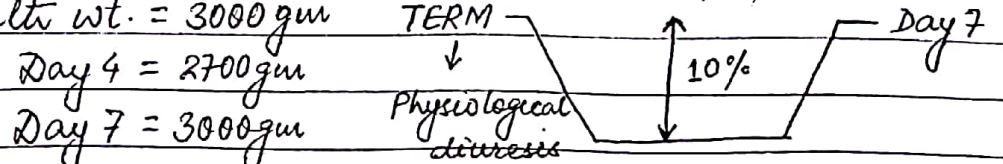
Epstein Pearl: Epithelial inclusion cyst on palate & prepuce.

Natal teeth (Pre deciduos teeth): lower incisor position.

Withdrawl vaginal bleeding: On 5th - 7th day.

Acrocyanosis (Peripheral Cyanosis): Limbs cyanosed Lips pink.

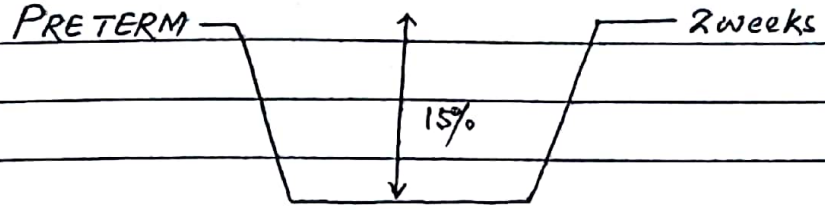
Birth wt. = 3000 gm
Day 4 = 2700 gm
Day 7 = 3000 gm



• ECFC

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page ___



IUGR → do not lose wt (ECF compact)
↳ Wt. stable for 1-2 days then wt. gain.

Q. Not normal in a newborn?
A) Proteinuria] in ELBW
B) Glucosuria]
C) 1-2 pus cells/hpf
D) Bacteriuria

Neonatal Reflexes:

① Moro Reflex:
1st phase – Abduction of shoulder joint
Extension of elbow joint.
opening of fingers

2nd phase – Adduction & flexion.

- Appears 28-32 wks gestation.
- Adduction / complete → 36-38 wks.
- Disappears at around 2-3 months of life.
- Persistence beyond 6 months abnormal.
↓
Cerebral palsy.

- Asymmetric moro's
  - Brachial plexus injury.
  - # clavicle
  - # Humerus
  - Hemiplegia.

Date / /
Page

Early hand preferance is always abnormal
- Hemiplegia at other side.
- 95% cases → Hemiplegia at Rt. side.

Exaggerated Moros → HIE-1

ATNR (Asymmetric Tone Neck Reflex):
Side of face – Extended
Side of occiput – Flexed.
Onset – 35 wks
Fully developed – 1 month
Duration – 6-7 month
Do not roll (Rolling start when this reflex disappear)
Disappears – 6 months

STNR (Symmetric tonic Neck reflex):
Neck extended
→ Tone ↑ UL
↓ LL

Neck flexed
↓
Tone ↓ in all limbs.

- Not present at birth.
- Appears 4-6 months of life.
- Disappears 8-12 months of life.
- Child start to crawl when this reflex disappears.

Parachute reflex:
- Not at birth
- Appears 6-7 months of life.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date 11
Page

- Well developed at 10-11 months of life.
- Persists life time.

LANDAU Reflex:
- Appears at 3 months of life
- Disappears at 1 year of life.

On ventral suspension – Spine strengthen / straighten.
Child get out of flexion attitude by this reflex.

GRASP Reflex:
- Appears 28 wks of gestation.
- Well developed 32 wks
- Disappears 3 months of life.

Sucking & Rooting reflex:
< 28 wks absent.
At 28 wks – Some sucking bursts.
32 wks – Appear
34 wks – Co-ordination

Q 31 wks; 1500 gms; Feed – ?
A) Enteral → NG tube (Expressed Breast Milk)
B) Enteral + i.v. fluids
C) IV fluids.
D) TPN.

Q 33 wks; 1500 gms; Feed – ?
↳ Enteral → Katori / Paladay / Spoon (Expressed Breast Milk)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Dr. Siddharth Sethi

Date __/__/__
Page

AIIMS NICU Protocol 2014:

> 34 wks – Breast feed
32 – 34 wks – Katori (Expressed breast milk)
< 32 wks – NG tube (" " ")
< 1200 gms – i.v. dextrose + minimal enteral feeds 10–15 ml/kg/day.

↓

Rapid enteral feed can cause – Necrotising Enterocolitis.

Fetal alcohol Syndrome:

- Skin folds at the corner of the eyes
- Low nasal bridge.
- Short nose
- Indistinct philtrum (groove b/w nose & upper lip)
- Small head circumferance (microcephaly)
- Small eye opening.
- Flat mid face / midfacial or maxillary hypoplasia.
- Thin upper lip.
- Septal defects < ASD, VSD.

Q. Ass. c ~~xxxxx~~ Fetal alcohol Syndrome except –

A) Microcephaly
B) Overgrowth
C) Flat face
D) Small palpabral fissure.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date / /
Page

PREMATURITY

Respiratory System: RDS (Respr distress Syndrome).
Chr. lung disease / Bronchopulm. dysplasia
(O_2 dependence on 4 wk of life)
Rx: Home O_2 therapy.
Prevention: Nasal CPAP.
Vit. A supplementation.
Furosemide
Keep underhydrated in ICU.

CNS: ① Apnea (>20sec); or any period if ass. c central cyanosis & bradycardia).

Q. M/c Sign of acute hypoxia in neonates
~~A)~~ Bradycardia
B) Tachycardia.

Types of Apnea: 3 types
① Central: asphyxia; preterms.
② Obstructive:
all newborn are obligate nose breathers till 4 months of life.

Q. Full term newborn
episodes of cyanosis — worsen when feed.
Seems better when crying.
↳ Choanal atresia → B/L; posterior.

③ Mixed (M/c)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date __/__/____
Page _____

Apnea of prematurity:

Risk: [redacted] < 28wks → 100%

Onset: 1-2days ; never > 7days.

Rx:

1st step: Nasal CPAP

Methylxanthines – Aminophylline (Narrow therapeutic range)

Caffeine citrate (DOC)

↳ Wide margin of safety

Q Loading dose of Aminophylline: 5-6mg/kg.
followed by maintenance dose
1-2mg/kg every 6-8hrs.

Caffeine Citrate: loading dose → 20mg/kg
Maintenance dose → 1-5mg/kg/day

② Intracranial hemorrhage

(Only subdural hemorrhage is common in term baby).

– Capillaries in the subependymal germinal matrix is fragile; so they rupture.

Preterm; sudden pale; Shock, fontanel bulging; seizures – Intra ventricular hemorrhage (IVH)

↓

Risk IVH preterms – < 1500gm → 30%

[50% IVH ☐ in 24 hrs.
75% " " 72hrs.

IOC for newborn having seizure → Trans fontanel USG

Term; Breech → IVH

Instrumental delivery → IVH

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page ___

Prevention of IVH :
- Antenatal steroids
- Low dose indomethacin to baby.
- Prevent acidosis, infections in baby.

③ Asphyxia

Preterm → Periventricular leucomalacia (PVL)
Power : UL > LL
↓
Diplegia
(upper limbs strong
LL are weak)
↳ Spastic diplegia type of Cerebral palsy.

Term → Parasagittal injury
↓
Spastic quadriplegic cerebral palsy.

MRI : Coronal Section
- parasagittal injury.

• Mentally Retarded

Q. M/c sequal of Periventricular leucomalacia in preterm
- Spastic diplegia

MRI : PVL (IOC)
- less white matter
- Shrinkage Ventricle.

- Mentally Retarded.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date __/__/__
Page

Status marmoratus : diffuse neuronal loss following asphyxia.

APGAR Score : 1, 5, 10 minutes
- doesn't help in resusitation.
- 5' ; 7' ; 10' low → Worse neuronal outcome.

	0	1	2
A = Appearance	Central cyanosis/ Pale	Acrocyanosis	Pink.
P = Pulse (HR)	0	<100	>100
G = Grimace	No	Grimace	Crying
A = Attitude	Extended	Mid	Flexed
R = Respr effort	Apnea	Gasping	Crying.

NORMAL – 7-10

Moderate to severe asphyxia ; out of hospital CPR
↓
ischemia reperfusion injury
↓
Free radical damage.

Rx - Therapeutic hypothermia / Selective head cooling :
33.5°C c in 6hrs of life ; Keep for 72hrs.
↓
preventive

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date / /
Page

Hypoxic Ischemic Encephalopathy (HIE):
Injury to brain at severe asphyxia.

Signs	STAGE 1	STAGE 2	STAGE 3
• Loss of consciousness	Hyperalert	Lethargic	Stuporous; Coma
• Muscle tone	Normal	Hypotonic	Flaccid
• Posture	Normal	Flexion	Decerebrate
• Tendon reflexes/ clonus	Hyperactive	Hyperactive	Absent
• Myoclonus	+nt	+nt	-nt
• Moro reflex	Strong	Weak	-nt
• Pupils	Mydriasis	Miosis	Unequal, poor light reflex.
• Seizures	None	Common	Decerebration
• EEG finding	Normal	Low voltage changing to seizure activity.	Burst suppression to isoelectric
• Duration	< 24 hr if progresses; otherwise may remain (N)	24hrs – 14days	Days to weeks
• Outcome	Good.	Variable	Death, Severe deficit

DOC: Seizures in Newborn: Phenobarbitone.
(Bolus, 20 mg/kg)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page ___

③ CVS : Hypotension ; PDA (Patent ductus arteriosus).

PDA : Preterms ⇒ Asphyxia → PGs

Term ⇒ Rubella infection → Vessel wall defect.

↓

Rx : Surgery

In preterm : Rx : NSAIDs

(Ibrufen > Indomethacin)

↓

Less nephrotoxic

If Medical management fails → Sx

C/F of PDA :

- 6-10 wks of life CHF
- Preterm baby, failure to wean off ventilator (hypoxia ; CO_2 retention)

O/E : • Bounding pulses c wide pulse pressure.

• Continuous machinery murmur at the upper left sternal border.

④ GI System : Necrolising Enterocolitis

⑤ Eye : ROP / Retrolental fibroplasia.

⑥ Hypothermia ; Hypo Glycemia ; Hypo Ca ; Hypo Mg.

⑦ Anemia ; jaundice ; Infection.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page _____

Necrolizing Enterocolitis (NEC):

R/F: ① Immature Gut.

NEC: Susceptibility of premature infants
- Reduced proteolytic enzymes
- ↑ Gastric PH
- ↓ peristalsis
- ↓ motility
- Altered epithelial membr & tight junction
- Altered bacterial flora.
- ↓ mucous coat
- Altered mucous protein
- ↑ epithelial permeability.

- Sepsis toxins
- Top fed (Cow milk)

② Malure Cocaine
③ PPIs ; Anti H_2
④ Rapid advancement of feed.

Prevention: ① Antenatal steroids
- ↓ IVH
- ↓ PVL
- ↓ NEC
- ↓ RDS
- ↓ Neonatal mortality.

HUMAN MILK: ↑ proteolytic enzyme
↓ Gastric pH
↑ peristalsis
↑ motility
Less pathogenic bacterial flora

Date ___/___/___
Page ___

- Altered mucus coat (Improves)
- ↓ epithelial permeability.

② Trophic feeds – expressed milk
10-15 ml/kg/day.

③ Avoid PPIs ; anti H_2
④ Avoid rapidly feed advance.
⑤ Probiotics.

Q. 1 yr old infant; 10-12 episodes of watery stools/day for last 9 days. Along c Zn, which else should be advised —

A) ORS c antibiotics
B) ORS orally.
C) ORS c low lactose diet
D) ORS c low lactose diets & probiotics.

PROBIOTICS:

Prevents NEC – Lactobacillus acidophillus & Bifidobacterium infantis to VLBWs

– may use in Rotavirus:
Lactobacillus rhamnosus & Saccromyces boulardii

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

HMT = Hyponatremia, Metabolic acidosis, Thrombocytopenia.

Date ___/___/___
Page ___

Modified Bell's Staging for NEC:

Stage Ia: Suspected NEC	; Distention ; ileus ; occult blood in stool
I_b: Suspected	Gross blood loss.
IIa: Definite	Focal pneumatosis
II_b: Definite	HMT, Diffuse pneumatosis ; Portal Venous Gas.
IIIa: Advanced	DIC ; Shock ; Peritonitis
III_b: Advanced- perforation	Pneumoperitoneum

Q. Neonate ; distended abdomen & B/L gas shadow under the diaphragm.

Δ - NEC

↳ 9a 90% preterm

2nd - 3rd wk of life.

Q Features of NEC are all except

A) Abd. distention

~~B)~~ ↑ Bowel sound

C) Pneumoperitoneum

D) Metabolic acidosis

Rx: NEC

- Stop all oral feeds
- TPN (Glucose, AA's, Lipids)
- Antibiotics (Cefotaxime ; Vancomycin ; Metronidazole)
- Stage III — may require Sx.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page _____

Q. Child c NEC c perforation & poor general condⁿ is treated c :

A) Conservative t/t only.
B) Foark drain c glove
C) Laprotomy c resection anastomosis
D) Extracorporeal membr oxygenation.

Stage III < Stable — Laprotomy
Unstable — Peritoneal drain

NEONATAL SEPSIS:

= Symptoms + Bacteremia

	EARLY	LATE
	< 72 hrs	> 72 hrs.
R/F —	Maternal Fever < 7days	M/c/c — Nosocomial
	Foul liquor	M/c/c world — Coagulase -ve staph
	PPROM: Chorioamnionitis.	In India — Klebsiella, S.aureus.
M/c/c World:	Group B streptococcus, E.Coli (M/c)	Meningitis ⇒ CSF examⁿ
Rx —	Ampicillin + Gentamycin	— Cefotaxime + Amikacin

M/c/c India : Klebsiella, S.aureus

Sepsis screen for early diagnosis :

① TLC < 5000/cumm or > 20000
② ANC < 1500/cumm
③ PS for band cells / Immature neutrophils > 20% (I/T > 0·20) & toxic granules
④ Micro ESR (6mm (N) - 3days of life) > 15mm fall in 1st hour
⑤ CRP ; Procalcitonin +ve
⑥ Lumbar puncture (In late sepsis)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page _____

⑦ Chest X-Ray

ANC = Neutrophil + Band cells

Q Lab finding in Neonatal Sepsis except –
A) ↑ CRP
B) Leucocytosis
C) ↓ ESR
D) Toxic granulated multilobulated nuclei

Duration of Antibiotics in Neonatal Sepsis:
Bacteremia = 10-14 days
Meningitis = 21 days
Arthritis, Osteomyelitis = 4-6 wks

Temp^r regulation of newborn:
Non-shivering Thermogenesis –
Brown Fat
- Nape of Neck
- Interscapular
- Around kidneys & adrenal
- Around blood vessels (around mesentery).

Axillary temp^r:
- Normal 36.5 - 37.5°C
- Cold stress / mild hypothermia (36 - 36.4°C)
- Moderate hypothermia (32 - 35.9°C)
- Severe (< 32°C)
- Hyperthermia > 37.5°C – mostly iatrogenic.

Prevention of hypothermic: KMC (Kangaroo mother care).

Date __/__/__
Page

Q. All components are of KMC except:
A) Kangaroo position
B) Kangaroo nutrition
C) Early discharge & follow up.
D) Supplementary nutrition.

Q. When to stop KMC:
- When a child reaches 2500gm wt.

Q. Delivery room temp^r – > 72°F (AAP)
> 25°C (WHO)
↳ (25-28°C)

AIIMS NICU protocols
- < 28wks / < 1000 gms → put baby in Polythene bag.
↓
reduces convection
- Incubator → Reduces convection.

Q Mechanism of heat transfer in overhead radiant warmers :–
Radiation + ↓ convection loss.

Hypothermia:
CNS : Asphyxia
CVS : Asphyxia Cardiomyopathy.
Lungs : ARDS
Kidneys : Asphyxia ATN
Hypoglycemia ; Hypo Ca ; Hypo Mg.

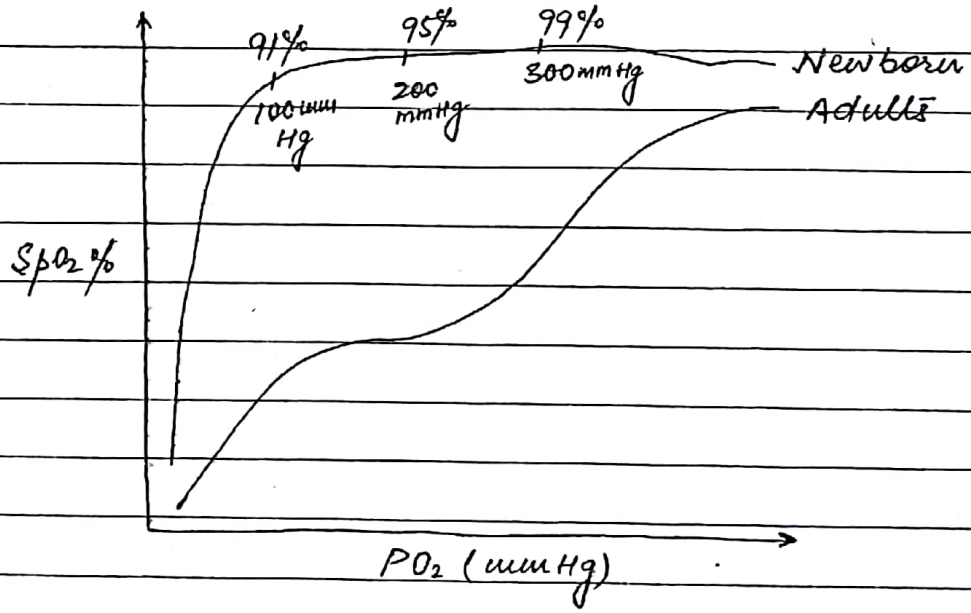
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Data ___/___/___
Page_____

Retrolental Fibroplasia / ROP (Retina of Prematurity):

R/F : Preterm.
High flow O_2.

- Proliferation, dilatation & tortuous vessels.
- Tractional retinal detachment.
- ROP stage I-V : 'plus' — Blindness.
  Stage IV : Incomplete tractional RD
  Stage V : Complete " "



WHO targets SpO_2 = 91-95% in preterm.

Inv. of ROP
BLINDNESS: Regular indirect ophthalmoscopy.
AAP ROP guidelines — (Risk <30 wks / <1500gms)

Gestation (wks)	1st visit to ophthalmologist: Post menstrual (wks)	Interval (wks)
22	31	9
23	31	8
24	31	7

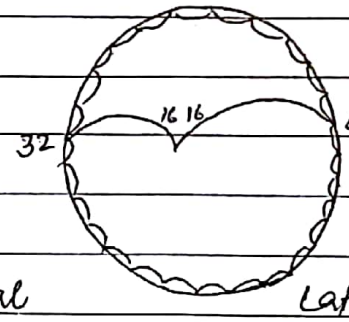
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page ___

25	31	6
26	31	5
27	31	4
(28)	32	4
29	33	4
30	34.	4

Q. Pediatrician in a district hospital calls ophthalmologist for-
a) Newborn c Respiratory distress
b) New born 28 wks gestation
↳ After first visit, baby has to go to ophthalmologist, every 2wks till his/her eye look like term retina.

Retinal Vascularization: Left eye.



Vascularization of Retina starts at 16wks, finishes medially at 32 wks & laterally at 40wks.

Rx: ROP
- Laser Photocoagulation / Peripheral ablation
  - Type I ROP (all plus disease)
- Cryotherapy.
- Stage V → Retinal reattachment.

New drug — Bevacizumab → Anti-VEGF; resistant.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page ___

Respiration :

Tachypnea : RR > 60/min.

Silverman Anderson Retraction Score :

Feature	Score 0	1	2
Chest movement	Equal	Respr lag (upper chest inspiration)	Paradoxical/ Seesaw Respr
Intercoastal Retraction	None	Minimal	Marked
Xiphoid Retraction	None	"	"
Nasal Flaring	None	"	"
Expiratory Grunt.	None	Audible c Stethoscope	Audible.

Downes scoring for Respiratory distress :

Feature	Score 0	1	2
RR (per min)	<60	60-80	>80/apneic episode
Cyanosis (Central)	None	In room air	in 40% O_2
Retraction	"	Mild	Moderate - Severe.
Grunting	"	Audible c Stethoscope	Audible c Stethoscope
Air entry (mid-axillary line)	Clear	↓ (Delayed)	Barely audible.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date __/__/__
Page

M/c/c of RD → Surfactant deficiency

Surfactant → Phosphotidyl choline (65%) (Most imp.)
Phosphotidyl glycerol
Phosphotidyl inositol
Phosphotidyl ethanolamine
SP-A, SP-B, SP-C, SP-D.
Other protein.

↳ Homogenates 20 wks gestation
Amniotic fluid – 28 wk gestation
Mature levels – 95% 35 wks.

RDS risk ∝ Degree of prematurity.

Risk of RDS:
< 28 wks — 60-80%
> 37 wks — <5%
Infant of diabetic mothers, at term
Rare in IUGRs → Stress → Cortisol

Lecithin: Sphingomyelin ratio
>2 → lungs mature.
>3.5 infants of DM mothers.

CxR: RDS (lungs): Ground Glass appearance.
(White out lung).

Air bronchogram — Classic feature of RDS.
(N) CxR seen in Early RDS.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page ___

Rx: • Humidified O_2 (40-60%)
- We don't give 100% O_2 bcoz of ROP.
• Nasal CPAP: mild - moderate distress early in ELBW's
FiO_2: Start c 40-60% ----> room air
PEEP: 5cm H_2O

• Intrabracheal surfactant - Severe; as rescue.

- Intubate the baby — IN
Give Surfactant — SUR
Extubate the baby — E

Survanta - Bovine
Curosurf - Porcine
Infasurf - Calf.
Synthetic also available

Q. 32wks, Preterm baby in emergency C.S.
Grunting, RR = 70/min. Best management of choice
A) Humidified O_2 by hood
B) Mechanical ventilation.
C) CPAP
D) Surfactant therapy & mechanical ventilation.

Q. All occurs in RDS except:
A) Cyanosis
B) Occurs in preterm
C) More in IDM
D) Treated by 100% O_2

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date / /
Page

Q. All true about CPAP except:
A) Initiated FiO_2 0.40 – 0.60
B) Used in apnea of prematurity.
C) Improves compliance.
Volume; FRC↑[RDS FRC↓CV]
D) Used prophylactically in ELBW's
E) All true.

Q. Term female, Birth wt. = 3.5kg, uncomplicated delivery.
Respiratory distress after birth.
CxR – Ground glass appearance.
On ventilation & given surfactant.
But cond^n deteriorates & hypoxemia increases.
H/o sibling dying c in one week c similar complain. ECG & blood culture – (N).

↳ Δ = Neonatal Pulm. Alveolar proteinosis
↳ Autosomal Recessive
↳ Mutation in Protein B (Rarely in C)
Rx: Early lung transplantation

Postmortem Bx – Pink eosinophilic material in lung.

- Idiopathic: 90%
  Adult or acquired
  IgG antibodies to GM-CSF
- Secondary – 5-10%
  Hematological malignancy
  Inhalational lung ds.
  Silicon
  Titanium oxide.
- Congenital: 2%

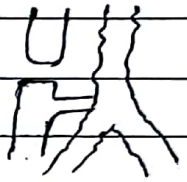
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

CT scan — Crazy paving pattern
(Prominant intraalveolar septae).

Rx — Early lung transplant in neonates.
Adults → Broncho alveolar lavage.

Respiratory distress : Newborn

Tracheo-esophageal fistula (TEF)



M/c type — Type C
Distal TEF
Esophageal atresia
- Cyanotic newborn & frothing
- Aspirates gastric juice lead to pneumonia.
- Not a surgical emergency.

Rx — Keep him propped up.
- Suction catheter in upper blind esophageal pouch.

Diaphragmatic hernia:
85% cases — left.
pushed heart & trachea — to opposite side.
- Scaphoid Abdomen
- Barrel chest
- Mediastinal shift to right.
- Apparent dextrocardia
- Peristalsis on left chest.

Diaphragm — develops from septum transversum & pleuroperitoneal canals.
↳ Fail to close on left side
(Bochadelek hernia)
- <5% are B/L

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date / /
Page

Q. Cause of death in Congenital Diaphragmatic Hernia:
A) Septicemia
B) Pulmonary hypoplasia – Left
C) Hemorrhage.

Bag & mask is absolutely c/i bcoz it will cause further abdominal distension.
↓
So elective intubation is done.

Baby born → Bag & mask c 100% O_2
↓
diaphragmatic hernia
↓
Intubate
Next step – NG tube to decompress the gut.

Born baby → Diaphragmatic hernia
↓
Intubated
↓
Heart further to right
Next Step – Remove the tube
& Reintubate.

Q. Most imp. Prognostic factor in Congenital diaphragmatic hernia:
A) Pulm HTN – Persistent. (PPHN)
B) Age
C) Time of Sx
D) Size of defect.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date / /
Page

Prevention : PPHN
- Elective intubation
- HFOV > 300–600/min

Rx : PPHN
- iNO → Pulm. vasodilator.
- Sildenafil PDE-V inhibitor

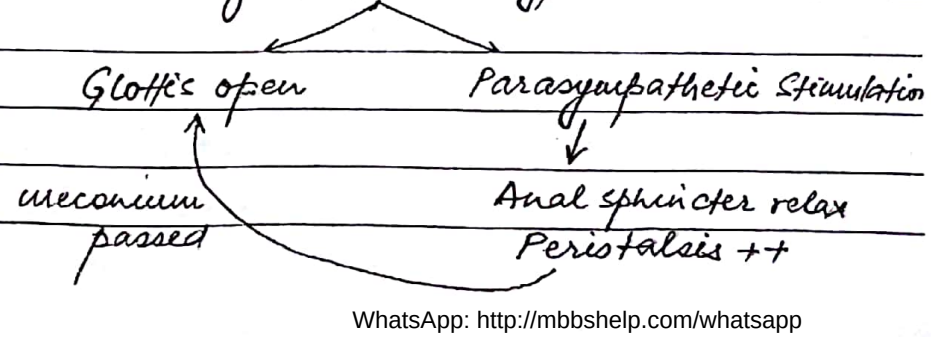
New drug: Bosentan, Ambrisentan — Endothelin antagonist.
- PGI_2 ⇒ Iloprost
- Amlodipine ; ECMO (Extracorporeal membr oxygenation)

Transient Tachypnea of Newborn (TTNB):
R/F : • Term by C.S. (lungs are wet) ∵
• Macrosomia ∵
• Excessive maternal sedation.
• Precipitous labour.

CxR – a prominent horizontal fissure
↳ Most specific feature.

• Benign condn
• Self limited : 48–72hrs.
• FiO_2 requirement < 0.40
• Never require mechanical ventilator.

Meconium Stained Liquor :
Meconium is marker of Perinatal Hypoxia



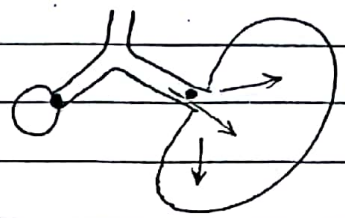
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page _____

Perinatal hypoxia : Common in preterm
bcoz of UPL.

Meconium :

Physical –



– ball valve mechanism
– air leak 20-30%

Chemical – Irritant → pneumonia
↳ Impair surfactant func^{n}.

Biological – Good culture media

Meconium Stained liquor.
↓
Baby born
↓
Vigrous ← Tone is good
Resp^{r} effort is good
HR > 100/min
↓ Yes / No

Yes → Transfer the baby to mother

No → Catheter in the nose
↓
PPV c 100% O_2.

Q Sequence of Resuscitation
A) Mouth → Nose
B) Nose → Mouth
C) Mouth → Nose → Trachea

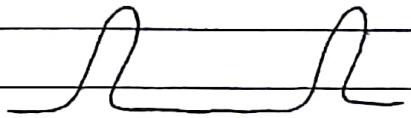
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page ___

Intra uterine TORCH infections:
Others — HIV, HBV, Varicella, Syphilis.

Common features:
① - Asymptomatic

Rubella: Transmission - 2 peaks



10-12 wks ↓ CRS (Congenital Rubella Syndrome).

Delivery ↓ Rubella > 16 wks risk CRS < 1%

② - If Symptomatic
- SGA; failure to thrive
- Anemia; thrombocytopenia
- Hepatosplenomegaly.
- Unexplained Rash & cholestasis.

△ - IgM (static of infection)
IgG persisting beyond 6-9 months

HIV in infants
- Infants can't make IgM-HIV or IgA-HIV.
- Maternal IgG-HIV can persist in the baby for 18 months.
- HIV < 18 month: Diagnosis.

Best: DNA & PCR
P24 assay
Culture is difficult.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date __/__/__
Page

Intracranial calcification & Chorioretinitis] M/c/c – Toxoplasmosis – CMV

Toxoplasmosis	CMV
- 25-50%	- Periventricular Calcification.
- Choroid plexus calcification.	- Atrophy of brain. (Cortical).
- Subependyma & Caudate nucleus calcification.	- Hydrocephalus ex vacuo.
- ~~Hydrocephalus~~ Hydrocephalus	- M/c/c of Non syndromic SNHL
- Seizures.	- Seizures
	- Microcephaly
	- Mental Retardation.

Q. Pregnant lady; no complain. Mild cervical lymphadenopathy in 1st trimester. Prescribe Spiramycin (prevent Vertical Transmission) but she was non compliant. Baby born c hydrocephalus & intracerebral calcification.
↳ Toxoplasmosis

DOC: Rx: Pyrimethamine + Sulfadiazine.

Δ: Best: IgM Immunosorptive assay.

Sensitivity of ELISA: IgA >> IgM

Q. True about transplacental CMV infection:
– It is M/c/c of non-syndromic SNHL.

Q Doesn't establish Δ of CMV in neonate –
A) Urine culture of CMV
~~B)~~ IgG CMV antibodies in blood
C) Intra-nuclear inclusion bodies in hepatocytes (Owl-eye)
D) CMV viral DNA in blood by polymerase chain reac^{n}.

Best specimen – Urine culture & Saliva.

CMV disease: Retinitis, colitis, pneumonia.

Date ___/___/___
Page _____

℞ : CMV

DOC : i.v. Ganciclovir (Severe, child, pregnant)

- Oral ; Prodrug → Valganciclovir
- Resistant to oral Foscarnet.

Congenital Syphilis :

EARLY

- ↓ in 1st 2yrs of life.
- Mucocutaneous rash/rhinitis (Snuffles).
- Lymphadenopathy.
- Hematological (Autoimmune Anemia)
- Renal lesion
- Skeletal (Osteochondritis, metaphysitis, Periostitis)
- Glaucoma
- Pseudoparalysis of Parrot.

LATE

- After 1st 2yrs.

Hutchinson's Triad :

① Hutchinson teeth/ mulbery molars - 1st lower molars.
- Saddle nose, Frontal bossing, Olympian's brow, Higoumenaki's Sign (sternoclavicle prominence)
- Rhagades

② Interstitial Keratitis

③ Nerve deafness. (SNHL)

- Clutton's joints (painless joints) ↳ Risk of injury.

Pseudoparalysis :

M/c/c - Scurvy
- Early syphilis
- Osteomyelitis
- Septic arthritis.
- Hypokalemia → Hypotonia.

DOC - Penicillin G → 10-14 days

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page _____

Rubella Syndrome :

Triad — Microcephaly (Mental Retardness)
PDA
Cataracts.

M/c eye manifestation of Rubella — Salt & pepper fundus
Calaract
Glaucoma
Micro-ophthalmia

HEART — PDA
Peripheral pulm. stenosis
VSD
ASD (Rare).

Q. Rubella embryopathy except.
A) Deafness
B) MR
C) AS
D) PDA

Q. True about Rubella embryopathy except :
A) Diagnosed when IgM antibodies in child.
B) Infection after 16 wks results in major congenital anomalies.
C) Deafness, heart disease, Cataract.

Q. Hypoplastic limb — Varicella (Chicken pox) embryopathy during pregnancy.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Varicella Embryopathy —
- Skin Rash
- Optic nerve hypoplasia
- Brain — Cortical atrophy.
- LS plexus — Aplasia / hypoplasia limbs.

Mother get chickpox — 5 days before delivery
or, c in 2 days of delivery.
↓
Baby chicken pox illness.
↓
Prevention: Varicella Zoster Ig to the baby.
↓
even after 120 hrs of exposure.

Q Pregnant; HBsAg +ve : no gaundice
HBeAg +ve ⇒ 90% chance baby is carrier
& later in life Portal hypertension
↓
Ascites, Spleenomegaly, Varices

HBeAg -ve ⇒ Anti HBeAg +ve
then 10% chance of Vertical transmission

Give HBIg baby to 12 hr of life
HBV vaccine to baby c in 24 hrs of life.

Pricked by HBsAg +ve patient
Are you immunized?
~~Anti HBsAg~~ · Anti HBs Ab titre
Good >10 mIU/ml ; High risk >100

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date __/__/__
Page

Incomplete vaccination / Not know titre

↓

HBV + HBIg

a/c to CDC guidelines.

If titre is good — don't do anything.

'CDC' HBV DNA load > 1000 IU/ml

↳ Can't join Surgecal branch.

Neonatal jaundice

Heam

↓ Hemooxygenase → CO_2 ⊖ Et Co. — hemolysis.

Biliverdin → Metalloporphyrin

↓ B. reductase

Bilirubin

1gm of Hb = 34 mg of bilirubin

1gm/dl Albumin binds to 8 mg bilirubin

- Unconjugate bilirubin passes BBB & cause jaundice & Kernicterus.
- In 1st 2wks, BBB is not developed properly.
- (N) S. Albumin = 3.5-5.5 g/dl
- Healthy term baby can bind 24-25 mg/dl bilirubin.
- Sick, preterm, risk factors can go into early Kernicterus.
- In adults ammonia cross BBB in hepatic encephalopathy.

- Healthy Baby (< 1000g) → We start phototherapy (5-7 mg/dl) ← Bilirubin

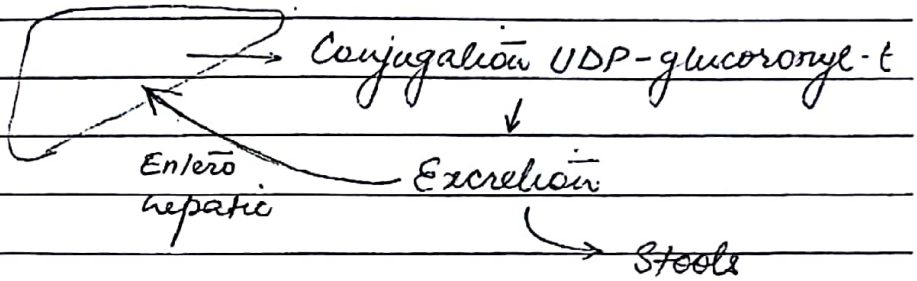
↓

Sick baby → Bilirubin (4-6 mg/dl) — we start phototherapy.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page _____

Bilirubin
↓
uptake by liver (Y-ligandin uptake)



> 2-2.5 mg/dl in adults ⇒ Yellow Sclera.

Kramer's zone:
progression of jaundice in new born is cephalo-caudal
(Bilirubin)

Zone I (5 mg/dl) →
Zone II (10 mg/dl) →
Zone III (12 mg/dl) →
Zone IV (15 mg/dl) →
Zone V (>15 mg/dl) →
↳ Danger Zone.

6 causes of physiological jaundice:

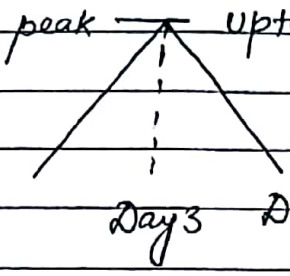
① Life span of RBC is less.
② Hematocrit more
③ Newborn deficient in Y-ligandin.
④ UDP glucuronyl-t deficient in newborn.
⑤ Excretion reduced.
⑥ Enterohepatic circulation ↑.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

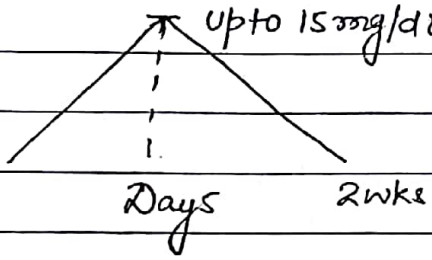
Date ___/___/___
Page _____

Physiological jaundice:

jaundice in term babies.



Preterms — have more jaundice.



Pathological jaundice:

- Hemolysis.

M/C/C — Incompatibility Rh/ ABO [O mother ; baby A/B]
- RBC ~~membrane~~ membr defect.
- RBC enzyme defect.

Def: jaundice c in 24 hrs of life.

* Rh -ve mother ; previous abortions
we take cord blood samples.
- Rh status of baby. → If +ve
- Hb → 10 mg/dl
- Bilirubin → 5mg/dl
- Peripheral Smear (P/s) +ve
- Direct Coomb's test (DCT) → +ve

↓

means Severe hemolysis

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page ___

Rx → Exchange transfusion at birth.

① jaundice c in 24 hrs of life.
② Reaching 20mg/dl
③ Rate rise > 0.2mg/dl/hr.
④ Persisting beyond
- 1 wk terms
- 2-3 wks pre/term.
⑤ Clay stools.

Phototherapy:
- Any jaundice on day 1 of life start phototherapy.

Serum bilirubin cut off.

	Phototherapy		Exchange transfusion	
	Healthy babies	Babies c R/F	Healthy babies	Babies c R/F
Day 1	← Any visible jaundice →		260(15)	220(10)
Day 2	260(15)	170 (10)	425(25)	260(15)
Day 3	310(18)	250 (15)	425(25)	340(20)

R/F ① Gestation < 35 wks / wt. < 2kg.
② Sepsis
③ Hemolysis
④ Asphaxia
⑤ Sick baby.

Principle:
- Structural isomerazation
  - Bilirubin → LUMIRUBIN
- Photo isomerization
  - 4Z 15Z ↔ 4Z 15E (Soluble).
- Minor pathway → photo-oxidation.

40 cms away, falls @ 4-6 mg/dl/day.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date __/__/__
Page _____

- Phototherapy occurs at 425-475 nms of blue green light.
- Irradiance → 6micro Watt/cm²/nm
- Intensive > 30 micro watt/cm²/nm.

Q. AIIMS Nov. 2013
Which does not effect the efficacy of phototherapy?
A) Types of phototherapy lamp.
B) Skin pigmentation.
C) Spectral radiance of incident light
D) Initial bilirubin levels.

Complication:
- Hyperthermia; insensible losses
- Hypocalcemia ♀
- Diarrhoea.
- Cover eyes & genitals
  - Retinal damage
  - Mutations.
- Phototherapy is C/I in conjugated jaundice
  ↓
  Bronze baby Syndrome.
  (Skin, Urine).

Exchange Transfusion:
- Double volume exchange transfusion.

Blood vol. of new born = 80 ml/kg ♀
→ 2 × 80 ml/kg = 160 ml/kg.

- Transfuse fresh. (<7 days) whole blood.
  - Reduces bilirubin by 85%
    ↓
    Not 100% because bilirubin is also in tissue.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page _____

• Albumin ↑ ~~efficiency~~ efficiency.

Complications:
- Infections
- ACD (Acid citrate dextrose)

↓

Bicarbonates

1 mole of citrate ⟶ 3 mole of Bicarbonate.

- Metabolic alkalosis
- Hypokalemia, hypocalcemia.
- Old blood → Hyperkalemia, metabolic acidosis.

Persistent jaundice:

Cause — Hypothyrodism
Breast milk jaundice
Hematoma (Cephalhematoma, IVH)
C Clay colour stool (Cholestasis)
Crijjler - Najjar Syndrome type II (Milder form
↳ deficiency of UDP-glucuronyl-t

Crigglер-Naggar Syndrome type 1 — Very Severe
↳ Absent UDP-glucuronyl-t.

Pathological jaundice

Breast milk jaundice	Breast feeding jaundice.
- Onset → day 14	- Onset → Day 3.
- Some mother have pigment & C inhibit conjugation.	- In primigravida.
- Day 14 = 20-30 mg/dl	- Starvation stimulates entero-hepatic circulation.
- May Kernicterus.	
- Persists 4-6 wks.	

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date __/__/__
Page

Rx: Temporary interrupt 48-72 hrs. Meanwhile give formula milk.

Rx: Ensure feeding.

Q Ture about jaundice in newborn (neonates) is –

A) Can be seen after Ventouse delivery.
B) Physiological jaundice seen c in 48 hrs of birth.
C) Increased conjugated bilirubin leads to kernicterus
D) Breast milk jaundice is max^m in 7 days of birth

Neonatal cholestasis:

Neonate, jaundice & clay stools.
– Direct bilirubin > 2mg/dl or >20% total bilirubin

Medical – Common.
Neonatal hepatitis → CMV
Sepsis
Galactosemia
α-1 antitrypsin deficiency.
Neonatal hemochromatosis.

Surgical – Extra hepatic biliary atresia (EHBA)
Rx – Kasai's surgery c in 8wks of life otherwise 80% die.
↓
M/C/C indication of liver transplant in babies → EHBA.

Q Which is an ominous sign in a 10day old newborn?

A) Unconjugated hyperbilirubinemia
B) Conjugated "
C) Failure to gain wt.
D) Doll's eye reflex
↳ Normal in 1st 10 days of life.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

GGT → Gamma Glutamyl transferase.

Date / /
Page

Medical – Common

Surgical – EHBA
- GGT ten times higher in Surgical causes.
- DO USG → Shows Intra hepatic biliary radicle (IHBR) are dilated.
- Triangular cord Sign

- HIDA nuclear Scan:
HIDA dye not seen in gut, even in delayed images; white in hepatitis excretion of dye.

Best test – Liver biopsy.
↓
Shows dilatation & proliferation of intrahepatic bile duct.

Before doing HIDA Scan we have to give phenobarbitone 2 to 3 days before test.

Gold Standard – Preoperative Cholangiography.

Alagille Syndrome –
- Cholestasis
- AD
- Bile duct paucity Syndrome.
- M/c heart disease → Peripheral pulm. stenosis.
↑
Rubella

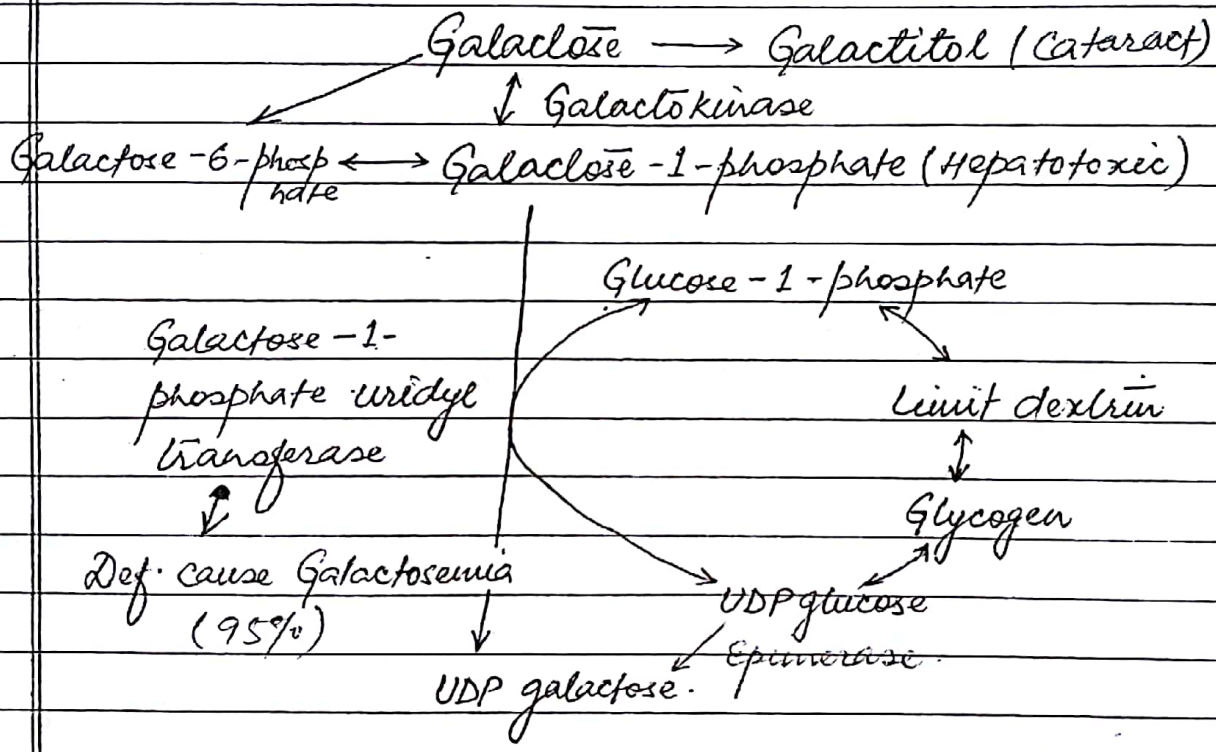
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date __/__/__
Page

Q. 1 month old child present c conjugated bilirubinemia & intrahepatic cholestasis. On liver biopsy staining c PAS, red coloured granules were seen inside the hepatocytes. Probable diagnosis is —

A) α-1-antitrypsin deficiency.
B) Congenital hepatic fibrosis
C) Hemochromatosis
D) Wilson's ds.

CMV — Intranuclear "Owl eye" inclusion bodies.



- He get jaundice, bleeding, hypoglycaemia, PTT↑.
- Galactitol cause cataract.
- Rx — Lactose free milk.

- Galactokinase deficiency → Only cataract
  No liver failure
- Fructokinase def. → Causes Benign Fructosuria
  ↳ No symptom.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Fructose-1-phosphate leads to liver failure.

Date ___/___/___
Page ___

Q. M/c/c of Neonatal Cholestasis:
A) EHBA
B) Neonatal hepatitis
C) Choledochal cyst.
D) Physiological

Q. Neonatal cholestasis seen in -
A) Chronic hepatitis (>6month)
B) Hep. B
C) Galactosemia
D) Rh incompatibility (cause ● unconjugated jaundice

Q. Pregnant lady, HBsAg +ve, No jaundice.
↓
next step → HBeAg

- HBeAg +ve (90%)

Carrier HBsAg → Portal HTN
↓
Triad - Ascites
Splenomegaly
Varices.

- HBeAg -ve
anti HBe Ab ⊕
↳ 10%

Immunization [HBIg - baby c in 12hrs of life
HBV - baby in 24hrs of life
↓
prevent Vertical transmission

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date __/__/__
Page

CDC guidelines :

Pricked by HBsAg ⊕ patient

↓

Are you immunized?

↓

Anti HBsAG titre

Good > 10 mIU/ml

High risk > 100 mIU/ml.

Don't know titre → Incomplete

↓

HBV + HBIg

If Good titre → Nothing is to be done

Q.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date / /

Page

~~New born, Respiratory distress:~~

Neonatal Seizures:

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date __/__/__
Page _____

Neonatal hypoglycemia:

Causes:

- Limited stores → Preterm, IUGRs
- Stress → Sepsis
- Polycythemia
- Galactosemia – liver failure.
- Low cortisol – CAH (Congenital Adrenal Hyperplasia)
  Hypopituitarism.
- Low ACTH; Low LH/FSH → Micropenis.
- Hyperinsulinism – In infants ☆ diabetic mother.
  ↳ Foetus ☆ β-cell hyperplasia.
  ↓
  Foetus Blood glucose ↓
  ↑
  Pedersons hypothesis
- Insulinoma; Nesidioblastosis
- Beckwith weidman syndrome.
  ↳ Hemihypertrophy of limb
  ↳ Macroglossia
  ↳ Risk of wilms
  ↳ Hyperinsulinism

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page _____

Q. A term baby to a diabetic mother, few hours after birth was lethargic & his blood glucose was 38mg%.
What should be done next -
A) Give 10% dextrose orally.
B) 10% dextrose i.v. - Bolus 2ml/kg → Glucose drip
C) Give expressed breast milk GIR ↓ 6-8 mg/kg/min
D) DO exchange transfusion.

Neonatal hypoglycemia:

Symptomatic	Asymptomatic
→ Bolus 2ml/kg 10% dextrose f/by Glucose drip 6-8 mg/kg/min	→ Blood glucose < 20mg/kg ↓ Glucose drip (6-8mg/kg/min)
	→ Blood glucose = 20-45 mg/dl ↓ Breast feed ; 1hrly.

A baby of glucose drip & he gets seizures
how to ↑ glucose rate
- Upto 12.5% through peripheral vein.

Max^{m} glucose infusion rate (GIR) = 12mg/kg/min.
Emergency drug = i.m. Glucagon.
for hypoglycemia ↓
Glycogenolysis + Gluconeogenesis.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date __/__/__
Page _____

Q. Glucagon is effective for Mx in persistent hypoglycemia in all except.

A) Large date for baby.
B) Nesidioblastosis
C) Galactosemia
D) Infant of diabetic mother.

Q. 1 yr old, hypoglycemia & hepatomegaly
No jaundice.
Hypoglycemia doesn't respond to glucagon.
↓
△ → Von Gierke's (Glycogen storage ds - I)

Glycogen —— --- Glucose-6-PO_4

Von Gierke's ⊖ → Glucose-6-phosphatase.
↓
Glucose

Types of Glycogen storage disorder:
V = Von Gierke's → Liver primary
P = Pompe's ds → Heart primary; Cardiomegaly. Large QRS complexes.
C = Cori → Debranching enzyme.
A = Anderson → Branching " deficiency
M = Mc Ardles → Muscle phosphorylase deficiency.
Harding =
Tom =

jaundice never occurs in Glycogen storage ds.

Rx pompe's : Enzyme replacement therapy.

Enzyme absent in pompe's → lysosomal α-1,4-glucosidase
— Also called Acid & neutral maltase.

Date ___/___/___
Page ___

Muscle affected in GSD:

Calcium:

(N) S. Ca^{2+} → 9-11 mg/dl.

Neonatal hypocalcemia:

- S. Ca^{2+} < 7mg/dl
- ~~Basis~~ Best index of body calcium
  ↓
  Ionized < 4 mg/dl (or) < 1 mmol/L

- Tetany is rare in infants.
- Tremors, seizures, jitteriness.
  ↳ Tremulousness is stimulus sensitive.
  ↳ Can stop on passive restrain.

Early Hypo Ca^{2+}	Late Hypo Ca^{2+}
Causes – Prematurity	Cause – Feeding with phosphate rich milk (cow milk)
Asphyxia	
Infant of DM mother.	
↳ Test: Blood glucose + S. Ca^{2+} & S. Mg^{2+}	

Good Ca^{2+} Supplement ($Ca^{2+}/P > 2$)

100 ml	Cow milk	Breast milk
Ca	118mg	34 mg
PO_4	100mg	15mg

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date / /
Page

Advantages of Breast milk:
- protects against late onset hypocalcemia.
- protect against pneumonia
  NEC (Necrotizing Enterocolitis).
  Allergy, Eczema, asthma.
  Rota virus diarrhoea.
  Bronchiolitis (IgA-RSV)

Q. Milk deficient in:
a) Iron & Vit. C

Q Breast milk has enough iron & Vit. C for 6 months.
↓
∴ Scurvy never occurs in 1st 6 month of life.

Q. If baby on exclusive breastfeed for 2yrs.
↓
Iron deficiency anemia.

Q APP recommends Vit. to all infants — Vit. D drops.
- RDA Vit. D infant 400 IU/day
- Breast milk 25 IU/L.

M/c/c of Hypo Ca^{2+} in infants = Maternal deficiency of Vit. D.

25 [OH] Vit. D = Status.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date / /
Page

Infant of DM mother:

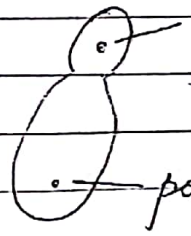
- Can be stillborn; preterm
- Macrosomia
  - ↳ Bcoz of Hyperinsulinism
- Linear growth in utero depend upon insulin & or Insulin like growth factor.
- IUGR → White's classification class F/R
  mother → Placental vasculopathy.
- Hypoglycemia
- Hypo Ca^{2+}, Hypo Mg^{2+}
- Neonatal jaundice
- Polycythemia → Renal Vein Thrombosis (RVT)

Q. ~~All~~. Not seen in infant of diabetic mother:
↓
Hyperglycemia.

Anomaly:

(M/c) - CVS - 8.5% [VSD; HOCM] Asymmetrical septal hypertrophy.
- Neural tube defect → 5%
- Lazy left colon syndrome → Pseudoobstruction of colon
- Sacral agenesis / Caudal regression Syndrome
  - ↳ Most specific.

NEURAL TUBE DEFECT (NTD)



Ant. neuropore → closes at 25 days of IUL
Failure of closure causes NTD
- → Anencephaly
- → Encephalocoele

post. neuropore → closes at 27 days of IUL
- → Spina bifida
- → Meningocoele
- → Meningomyelocoele
  - M/c site → lumbo-sacral

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page _____

Anencephaly:

- Ant. neuropore fails to close.
- No brain, absent of part of hind brain.
- Earliest abnormality diagnosed by USG (10-12 wks) of gestation.
- Most severe NTD
- Don't resuscitate
- Mostly post-term.

Herniation of brain tissue — Encephalocoele.

Lumbo-sacral myelomeningocoele:

Complication:

- Paraplegia / Paraparesis
- Neurogenic bladder → CKD.
- Constipation (Severe)
- Associated hydrocephalous. (obstructed)

↓

Bcoz of Arnold-Chiarri type II malformation

⇓

MRI Brain

Ruptured myelomeningocoele:

Best test — Blood culture.

- Cover c Normal saline soaked gauze.
- 95% of neonatal meningitis have Leukemia.

M/c/c of meningomyelocoele — Folic Acid deficiency.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page ___

Folic acid deficiency:

- −1/+3 months conception − start folic acid.
- 400 mcg given.

Recurrence:

1 child − 3.5% chance
2 child − 10%
3 child − 25%

To prevent recurrence → Folic acid 4mg
↓
reduces risk by 75%.

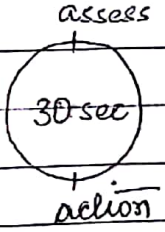
△ : ① USG
② Amniocentesis
↳ Acetylcholinesterase
& α-fetoprotein are markers.

α-fetoprotein in mother serum is marker of Neural tube defect.

Resuscitation:

NRP Guidelines 2015:

T = Temp^r
A = Airway : position neck, suction
B = Breathing
C



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page _____

Indication of Bag & mask c 100% O_2:

- Apned / gasping ~~~~ after initial steps.
- HR < 100/min after 30 sec PPV.
- Central cyanosis despite 100% O_2.

- Chest compression if HR < 60/min, falling after 30 sec PPV.
- Chest compression : Bag mask = 3:1

In 1 minute = 120 events
90 Chest compression & 30 bag & mask.

Compression to Ventilation ratio:

- Children / Infants — Single rescuer 30:2
  2 rescuer 15:2

- Adults — 1 or 2 rescuer 30:2

CPR sequence → CAB

Drugs for resuscitation:

1) 0.9% Nacl 20ml/kg bolus → shock
2) 1:10,000 epinephrine 0.1 - 0.2ml/kg
   ↓
   If HR = 0 or falling.
3) I.V. $NaHCO_3$ — documented metabolic acidosis.
4) I.V. Naloxone — mother opioid addict.

Targeted preductal SpO_2 after birth:

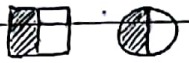
1 min = 60% - 65%
2 " = 65 - 70 %
3 " = 70 - 75%

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page ___

4 min = 75 - 80%
5 min = 80 - 85%
10 min = 85 - 90%

GENETICS

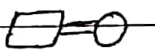
 → Heterozygotes for AR carrier

→ Carrier for sex-linked recessive

→ Death

→ Abortion of stillbirth
Sex unspecified.

→ Proband.

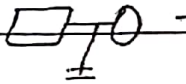
 → Consanguinous marriage

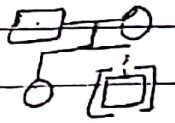
→ Dizygotic twin

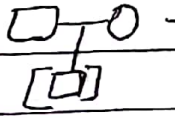
→ Monozygotic twin

→ azoospermia

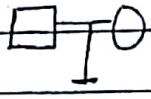
→ Endometriosis

 → Infertility.

 → Adopted in

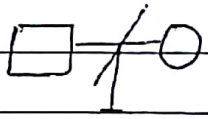
 → Adopted in

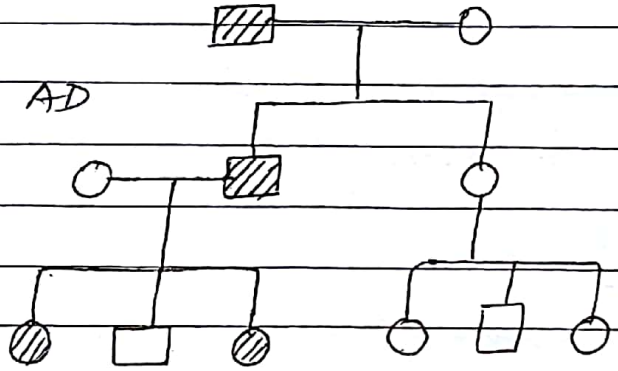
Date __/__/__
Page _____

 → No children for choice or reason unknown

→ Vasectomy

→ Tubal

 → Divorce.



Autosomal dominant:

D = Dystrophy myotonic → distal myopathy.
O = Osteogenesis imperfecta
M = Marfan Syndrome
I = Intermittent porphyria
N = Noonan Syndrome → Turner phenotype XX & XY.
A = Adult PKD, Achondroplasia
N = NF (Neurofibromatosis)
T = Tuberous sclerosis
VH3 = Von willibrand Syndrome
Hutington chorea
Familial Hypercholestrolemia
Hereditary spherocytosis.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page _____

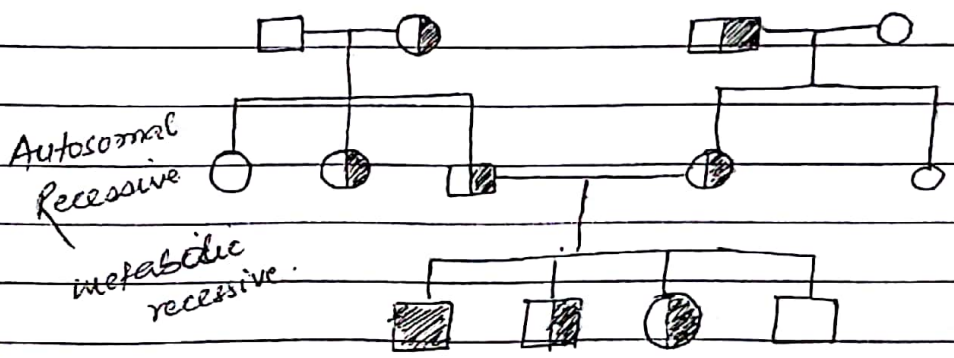
Turner Syndrome	Noonan Syndrome.
- 60% case - XO	AD
- Webbed neck	XX = XY
- Cystic hygroma	
- Lymphedema of hand & feet.	
- Primary amenorrhoea. during puberty.	
- Streak ovaries	
- Cubitus valgus.	
- MR rare.	- 25% MR
- M/c heart ds - Bicuspid aortic valve ± out stenosis ↳ Half to one-third. 20% coarctation.	- Valvular pulm. Stenosis. HOCM ASD.
- Girls infertile	- Girls are mostly fertile. - Boys - Cryptorchidism. - Clotting factor deficiency.

Q. Chance of child being not affected if both parents are affected ± Achondroplasia is -

A) 0%
~~B) 25%~~
C) 50%
D) 100%

$AA^c \times AA^c$

(AA) AA^c A^cA A^cA^c



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page _____

Autosomal Recessive:
- Cystic Fibrosis
- α_1 AT deficiency
- Wilson's ds
- Haemochromatosis
- Friedrich's ataxia
- Gaucher's ds
- Niemann's pick ds.
- Tay Sach ds.
- Hurler's Syndrome.

Mucopolysaccharoidosis (MPS)
- Child c noisy breathing
- Coarse facies.
- Ab ⓝ accumulation of glucose aminoglycans.
- Gargolism
  - ↳ Chronic rhinitis.

Mucopolysaccharoidosis type I → K/A HURLER's Syndrome
↓
deficiency of L-Iduronidase.
Rx – Enzyme replacement therapy.

HURLER	HUNTER Syndrome.
– MPS-I	– MPS-II
– AR	– XL recessive
– Corneal clouding	– Cornea clear.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page _____

Enzyme Replacement therapy:

1st to be treat → ① Gaucher's ds
(β glucocerebrosidase)
↓
Company name — GENZYME
CER-zyme.

② Pompe's
③ Hurler (MPS-I)
④ MPS-VI (Maroteux-Lamy)
⑤ X-linked recessive Fabry's
(CNS & kidney problem)
↓
Lysosomal disorder.
Cherry red spot macula seen.

Gene therapy:

1st to be treated by Gene therapy → X-linked recessive
Severe combined immunodef. (SCID)
(Adenosine deaminase deficiency)

British guy British lady
Chance of child having cystic fibrosis

Uk/Europe/ askenazi jews → 1/25 carrier cystic fibrosis.

$\frac{1}{25} \times \frac{1}{25} \times \frac{1}{4} = \frac{1}{2500}$

$AA^c \times AA^c$

$A^cA^c \cdot A^cA \; AA^c \; AA$

1/4

British guy British lady (brother died of cystic fibrosis)

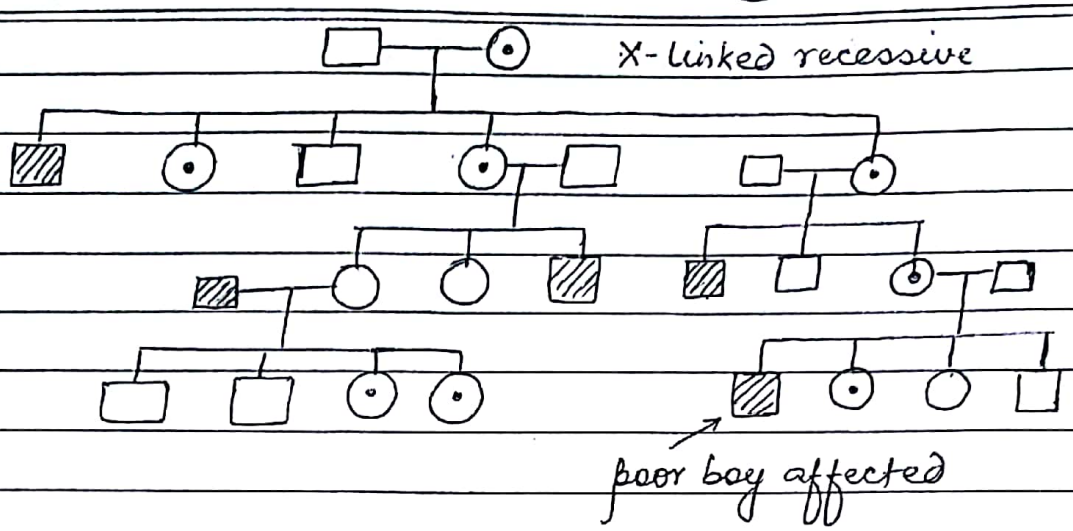
Chance of child to have cystic fibrosis

$\frac{1}{25} \times \frac{2}{3} \times \frac{1}{4} = \frac{1}{150}$

$AA^c \times AA^c$

$A^cA^c \; A^cA \; AA^c \; AA$

Date ___/___/___
Page ___



$X X^c$ $X Y$

XX XX^c $X^c Y$ XY

X-linked Recessive: (Poor ~~boys~~ boys)
- Duchenne muscular atrophy. (M/C hereditary Neuromuscular dz)
- Hemophilia A & B.
- G-6PD deficiency.
- Wiskott-Aldrich syndrome.
- Colour blindness.
- Lesch-Nyhan syndrome.
- Chronic granulomatous disease.

Duchenne muscular hypertrophy (DMH):
- Pseudohypertrophy of calf muscle bcoz of fat deposition.
- Proximal muscle weakness
- Gower's Sign → Not specific.

△ → CPK = 10,000 IU

Valley Sign ⇒ Hypertrophy of Supraspinatus
Atrophy of Infraspinatus
↳ Specific for boys who don't have calf hypertrophy.
↓
Also seen in DMH.

Date ___/___/___
Page _____

Human Genome:
- 30,000 gene.

Largest gene – Dystrophin
↳ Skeletal muscle
↳ Heart – Cardiomyopathy.
↳ Brain → 1/3 cases MR.

Boys – Duchenne – die teens due to recurrent chest infection.

Duchenne → XLR, 1/3 denovo mutation.

Becker's dystrophy:
- Similar to duchenne
- Mild form & present late.
- X-linked recessive.

Wiskott-Aldrich:
- X-linked recessive
- Eczema
- Thrombocytopenia
- Immunodeficiency.

Chronic granulomatous dz –
- X-linked recessive
- Immunodeficiency.
- ~~Hexo~~ NADPH oxidase deficiency
- Dx → NBT dye test

Lesch-Nyhan Syndrome:
- X-linked ~~Sporadic~~ recessive
- Purine defect
- HGPRT ase deficiency.
- Hyperuricemia > 6.5 mg/dl
- Self-mutilation → nose, palate, fingers.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date __/__/__
Page

Q. A mentally challanged child c dysphagia & opisthotonic spasms. He is also having choreoathetoid movements & self mutilation behaviour c +ve family history. Which of the following investigation is suggested?

A) Serum uric acid. → Leesh Nyhan Syndrome.
B) S. ALP
C) S. LDH
D) Lead level in blood

Q. A male child c Fanconi Syndrome c nephrocalcinosis have a variant of dent disease. All true except

A) Hypercalciuria → 24hr urine Ca^{2+} > 4mg/kg
B) Proteinuria → LMW (β_2 microglobinuria)
C) Similar presentation in father
D) Rickets

Urolithiasis
Nephrocalcinosis

Fanconi Syndrome — Proximal tubular defect

Na^+	HCO_3^-	PO_4^-	AA, Glucose
60%	>85%	>88%	100%

Lowe Syndrome — X-linked recessive.
↳ Oculo-cerebro renal gene. (OCRL gene).

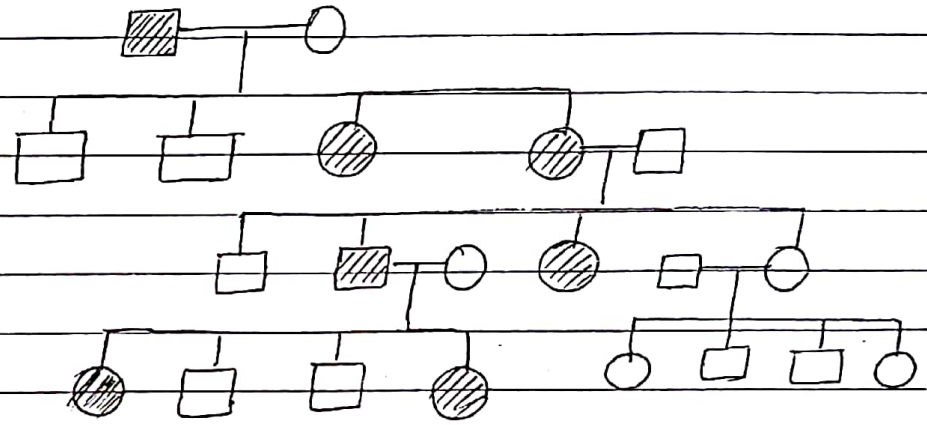
Congenital cataract	Microcephaly	Fanconi's
" glaucoma	MR	Syndrome.

Fructose-1-phosphate
Glucose-1-phosphate
] proximal tubular toxic.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page _____

Fanconi's Syndrome:
- Genetic
  ↳ X-linked recessive – Lowe
  XLR Dent
  AR
  ↳ Cystinosis.
- Metabolic – Galactosemia, HF-1
  Tyrosinemia (Rx – Nitisinone).
- Acquired – expired tetracycline



X-linked dominant father to
all daughters – none sons

X-linked dominant: Males are more severely affected
- Familial hypophosphatemic rickets.
- Urea cycle defect due to OTC deficiency.
- Incontinentia pigmenti] Only seen in girls.
- Rett's syndrome.]

↓
bcoz boys die.
(lethal in male fetus).

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date / /
Page

Rett's Syndrome:

- Pervasive ~~pervasive~~ developmental disorders.
  - ↳ Autism (Common in boy [redacted] <3yrs)
    - Asperger
    - Rett's

Q. Not seen in autistic ~~dis~~ disorder –

A) Social avoidance
B) Visual impairment.
C) Interest in one self
D) Introvert person.

Asperger's Syndrome: Common in boys
Very good IQ.

Rett's Syndrome – Common in girls
X-linked dominant.
Normal till 6-18 months
Decrease in head growth.
Microcephaly; MR
Hand movements
Repetative behaviour
$MeCP_2$ gene mutation

↳ Macrocephaly not seen.
↳ Abnormal dendritic morphology in cortical pyramidal cells (postmortem brain biopsy).
↳ Seizures.

Cause of death → Arrhythmias (Cardiac)
↓
Sudden death.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date / /
Page

Ornithine transcarbamoylase deficiency:

Orotic aciduria → URACIL
→ X-linked disorder.
- The mother of these child have also high Uracil level in urine.

Deletions:

Major deletion	Microdeletion
→ Cri-du-chat	→ Williams (7q23-) Syndrome
↳ Deletion of 5p chr.	→ Prader-willi Syndrome (15q11-13-)
- Cry like cat due to abn. larynx.	→ Di-george's Syndrome (22q11-)

Δ → by FISH.

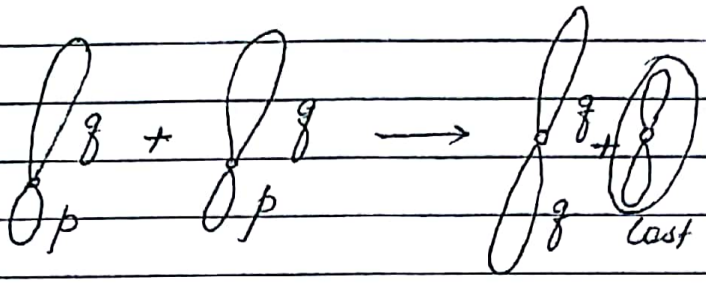
Williams Syndrome:
Supravalvular aortic stenosis
c peripheral pulm. stenosis.
- Hypercalcemia
- Elf in facies.

Di-George's Syndrome:
- Hypoplasia of 3rd & 4th parapharyngeal pouch.
- Absent < Thymus
Parathyroid.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date __/__/__
Page

TRANSLOCATION:



- Unbalanced
- Robertsonian Translocation:
  Translocation b/w two Acrocentric chromosome.

M/c/c (Genetic) of MR = Trisomy 21 (Down's Syndrome)
↓
Extra chromosome is of females.

Trisomy 21 – In 95% cases: Maternal meiotic non-disjunction.
- 3-4% – Robertsonian translocation
- 1-2% Mosaic 47/46 ↓
  carrier of RT look normal but they can have abn children.

MOSAICISM:

A single zygote giving rise to different cells.

CHIMERA – different zygote giving rise to different cells
↳ Rare in humans.

- Mosaicism Seen in humans
- 1-2% are downs

Klinefelter Syndrome → 80% XXY; XY/XXY; XY/XXXY.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page ___

Turner's Syndrome:

Cytogenetics

60% 45-XO

15% Mosaic XX/XO

10% Isochromosome Xq or Xp. — Mentally Retarded.

10% 46X deletion.

5% Mosaic XO/XY ⟶ Risk of Gonadoblastoma.

loss of one arm & duplication of other

↓

Isochromosome.

Mosaicism { Somatic — Not transmitted
Germline — Transmitted
↳ Blood DNA is normal.
eg: ~~Germline~~ Osteogenic imperfecta.

Q. Couple has two children c tuberous sclerosis. On detailed clinical & lab evaluation (including molecular studies) both parents are normal. ∴ one of the following explains the 2 affected children in this family —

A)

B)

C)

D) Germline mosaicism.

Maternal inheritance ⟶ Mitochondrial.

Mitochondrial inheritence:

- MERRF (Myoclonic epilepsy & red ragged fibres.
- Mitochondrial encephalopathy, stroke-like episodes, & lactic acidosis (MELAS)
- Leber hereditary optic neuropathy (LHON)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date __/__/__
Page _____

- Leigh disease
- Kearns - Sayre Syndrome (KSS) (ophthalmoplegia)
- NARP (Neuropathy, Ataxia, Retinitis pigmentosa).
- Chronic progressive ophthalmoplegia.
- Pearson's Syndrome : Pancytopenia + Pancreatic insufficiency

Anticipation : Severely of genetic disorder ↑ in every successive generation.
More repeats — more problem.

eg: All Trinucleotide repeat disorders
- Fragile X — CGG repeats
- F. Ataxia — GAA "
- Myotonic dystrophy — CTG, CCTG
- Spinobulbar muscular dystrophy — CAG
- Huntington's — CAG
- Spinocerebellar ataxia — CAG/CTG.

Fragile X : genetic
- 2nd m/c cause of MR in boys.
- X-linked
- Large face
- Large ears
- Prominent jaw
- Large testis.
- CGG repeats > 1500 repeats

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page _____

Genomic imprinting:
Chr. 15q 11-13 deletion.
↳ Paternal inheritance cause Paderwilli Syndrom
↳ Maternal " " Angelmann "

- Differential expression of genetic appearance depending upon parents.

Prader-Willi Syndrome
- Severe neonatal hypotonia.
- Obesity
- Small hands & feets. (Rx - GH treatment)
- Unusual behaviour
- MR.
- High Ghrelin → So obese. (Rx - Anti Ghrelin)
  ↓ apetite hormone for fundus.

Angelmann Syndrome:
- (N) at birth
- K/A happy puppets.
- Subsequently develop seizures
- MR
- Ataxia

Genomic imprinting → (1) Prader Willi Syndrome (70%
↓
Almond shaped eyes.

(2) Angelman Syndrome (70%)
(3) Neonatal DM
(4) Beckwith Weidman
(5) Seckle
(6) Temple
(7) Wang
(8) Pseudohypoparathyroid Ib.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date __/__/__
Page

Q. Father carrier of cystic fibrosis – AA^c

Mother – (N) → AA

↓

Yes there is a chance of cystic fibrosis in child

ACA^c

↓

Uniparental bisomy.

- In some cystic fibrosis
- In some sickle cells.

- 30% Prader Willi – Unimaternal disomy.
  5% Angelmann – Uniparental disomy.

PRADER WILLI :

70% – Paternal inheritance deletion.
30% – Unimaternal disomy
↳ Maternal silencing gene.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Data ___/___/___
Page _____

Congenital Heart ds:

NADA's CRITERIA:

1 Major & two minor criteria at least.

Major:

1. Systolic murmur grade III or more ass. c thrill.
2. Diastolic murmur
3. Cyanosis (central)
4. CHF

Minor:

1. Systolic murmur < grade III
2. Ab(n) S_2
3. Ab(n) ECG
4. Ab(n) X-Ray
5. Ab(n) BP

&

A_2 ------- P_2 Expire

A_2 ---------- P_2 Inspire

ASD – Wide & fixed S_2.

A_2 ---------- P_2 Expire

A_2 ---------- P_2 Inspire.

- Volume overload in right ventricle.

VSD – Wide & Variable S_2.

A_2 ---------- P_2

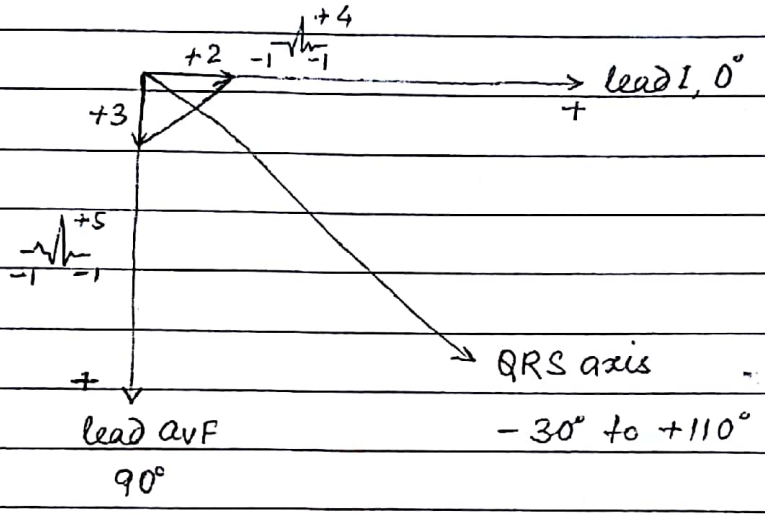
A_2 ---------- P_2

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page ___

TOF – Single S_2 (A_2).

All newborn has RVH & RAD.
- Axis like adult > 1st month life.
- T-wave V_1 ; V_3R ; V_4R
  - 'up' first 48 hrs.



- Negative after 48 hrs
- Never be +ve < 6yrs
- > 6yrs → positive.

Prevalance of CHD:
- Prevalence = 0.8 – 1%
  Recurrance = 2 – 6%

M/C CHD = VSD (30 – 35%).
2nd M/C CHD = ASD (Secundum) – 6 – 8%
> PDA (6-8%)
> Co-arctation of Aorta (5-7%)
> TOF (5-7%)
> Pulm. Valve stenosis (5-7%)
> Aortic " " (4-7%)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page _____

M/C Syndrome in CHD = Down's Syndrome.

Down Syndrome:
M/C → Complete AV septal defect (CAVSD) / AV canal defect / Endocardial cushion defect
Ostium primum ASD.
(37%) — M/C/C of death.
- VSD (31%)
- ASD (15%) → Secundum
- Partial AV septal defect (PAVSD) — 6%
- TOF → 5%
- PDA → 4%
- Miscellaneous → 2%

Turner's → half to One third bicuspid aortic valve; 20% coarctation.
Noonan's → Turner's phenotype.
AD; XX = XY
Valvular pulm. stenosis.
HOCM; ASD.
Rubella → PDA; Peripheral pulm. stenosis; VSD.
↓
Rubella
Alagille Syndrome
William's "

Maternal lithium → Ebstein's anomaly.

Maternal mumps → Endocardial fibroelastosis / LV obstruction newborn.
Maternal penicillamine → Cutis Laxa.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Maternal SLE << Maternal Sjogren Syndrome
- New born complete heart block.
pacemaker insertion (anti [redacted]. Ro).

Maternal warfarin:
Chondrodysplasia punctata.

Maternal thalidomide: Phocomelia.

Foetal circulation:
1 Umbilical Vein (left)
2 umbilical artery.

Ductus venosus →

PO_2 in umbilical vein = 30-35 mm of Hg
PO_2 of IVC in fetus = 28-30 mm of Hg.

As soon as child takes his 1st ≠ breath
- Umbilical artery constricts.
↓
U. vein closes
↓
Ductus venosus closes.

Ductus arteriosus:
- Physiological ē in 10-15 hrs.
- Anatomical → 10-21 days.

Foramen ovale:
Functionally closes by 3 months.
Anatomically 10-15% open.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

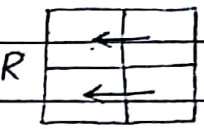
Date / /
Page

CHD

Acynotic Cynolic.

Acynolic : L→R Shunt

ASD, VSD, PDA.



Pulm. blood flow ↑ (Plelhora)

↳ lung vascularity is good.

C/F : Failure to thrive

Recurrent pneumonia

Feeding diaphoresis

CHF in 6-10 wks of life.

Suck-rest-suck cycle

↑ sweating. (d/t sympathetic stimulation).

Tachycardia] in every CHD.

Cardiomegaly]

Cyanotic

PBF

↑ Plelhora

- Persistant Truncus arteriosus (Cyanosis + Recurrent pneumonia)
- d TGA + VSD
- TAPVC

↓ Oligemia

Massive Cardiomegaly.

- Ebstein's (Box/Ballon heart)

→ Tricuspid Atresia - LVH

Ⓝ Heart

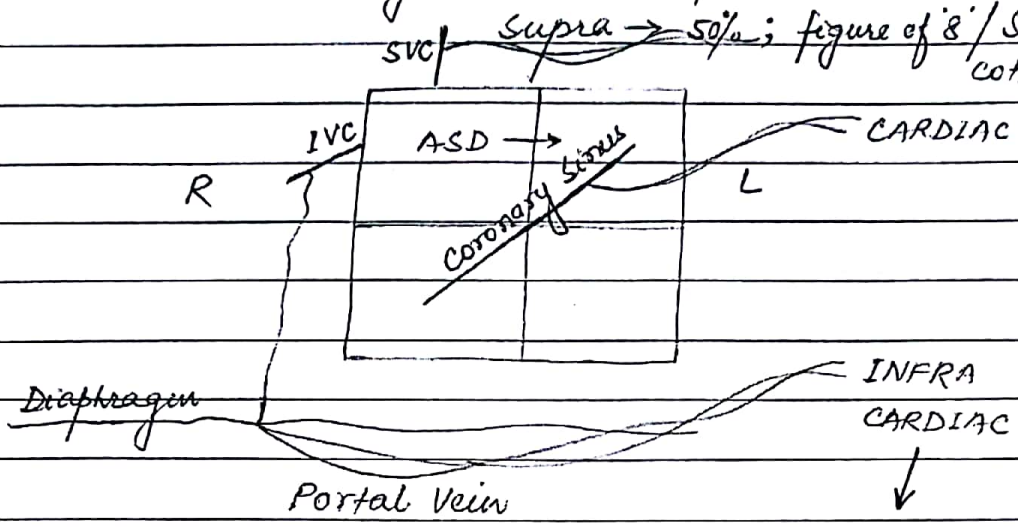
Single S_2

FALLOT's physiology.

- TOF
- DORV + PS
- d TGA + VSD + PS
- Single Ventricle + PS.

Date ___/___/___
Page _____

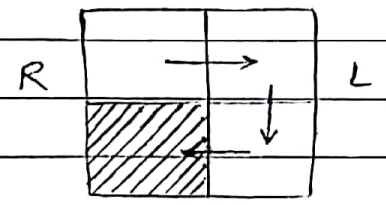
TAPVC (Totally anomalous pulm. venous connection):



More severe TAPVC.

- Cyanosis at birth.
- Obstructive pulm. venous hypertension.
- Ground glass: Kerley B lines.
- Worsen by PGE1 infusion.
- Only pediatric cardiac Sx emergency.

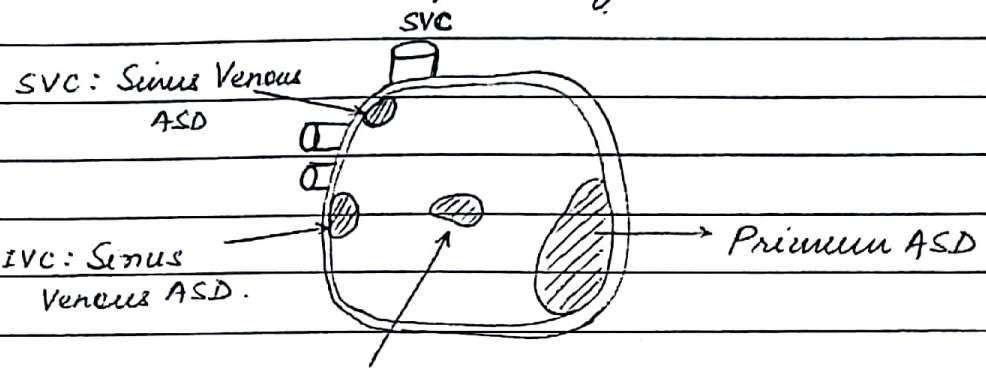
Tricuspid Atresia:



- Cyanosis + ↓ PBF
+
LVH
LAD

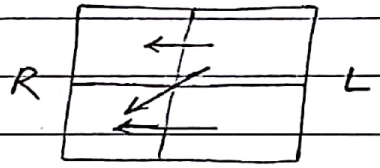
Date / /
Page

ASD (Atrial Septal defect):



M/C syndrome ass. = Down's Syndrome.

Endocardial cushion defect.



- Very large L-R shunt.
- PBF↑
- Pulm. plethora

ASD Syndrome:

- HOLT ORAM : • Familial, AD,
  • ASD Secundum; VSD; 1degree heart block;
  • AF + Bone defect (Absent Radius).
  • Distally placed thumb / Rudimentary thumb / Triphalangeal thumb.
  • A/k/A Hand-heart Syndrome.
  • TBX5 mutation → Pleiotrophy.
  ↳ Common transcriptional factor for hand & heart.

Date ___/___/___
Page _____

Absent Radius associations:
- ECG (Holt-oram)
- Platelet (Thrombocytopenia ; AR).
- Bone marrow biopsy (Fanconi's anemia)
  ↓
  Congenital aplastic anemia
- Rarely Karyotyping (Edward Syndrome)

ASD Syndromes:
- Down's Syndrome
- Holt oram
- Lutembacher → ASD + Mitral Stenosis
- Ellis Van Creveld → ASD + polydactyly.

ASD Secundum:
- Child → asymptomatic, wide & fixed S_2.
- ECG → RAD (Right axis deviation).
- In adult life → Complications
  ↓
  - RV failure
  - Arrhythmias ; AF → CVA
  - Reversal : R → L (Eisenmenger Syndrome)

Natural history:
If < 3 mm → close itself
> 8 mm → Unlikely to close ; Require Sx.

Indication of Sx in ASD Secundum:
- All symptomatic.
- $Qp/Qs > 2$; even if no symptoms.
  ↳ Pulm blood flow / Systemic blood flow.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page _____

Q. Least chances of Infective endocarditis is seen c/c ?

A) Small VSD → M/c/c of IE

~~B)~~ Small ASD secundum → Rare

C) Mild AS

D) Mild AR.

ASD Secundum doesn't require any prophylaxis t/t before going to Sx.

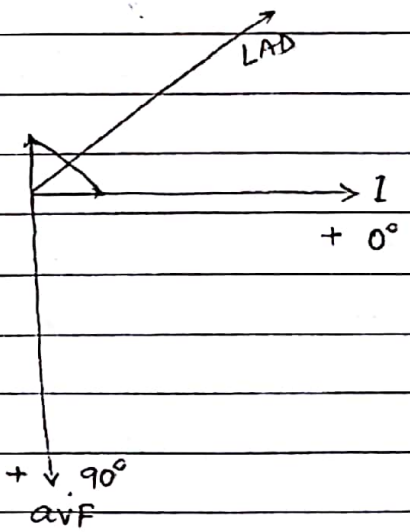
ASD primum + Mitral Regurgitation:

- Wide & fixed S_2 +
  S_1 = = = = S_2 apex → axilla & back.
- 6 – 10 wks presents c/c CHF.
- Conduction defects ; ECG → LAD.
- Common in Down's Syndrome baby.

↓

LAD d/t endocardial Cushion defect.

Down's
AVSD

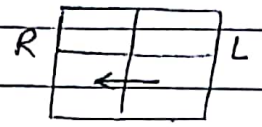


Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

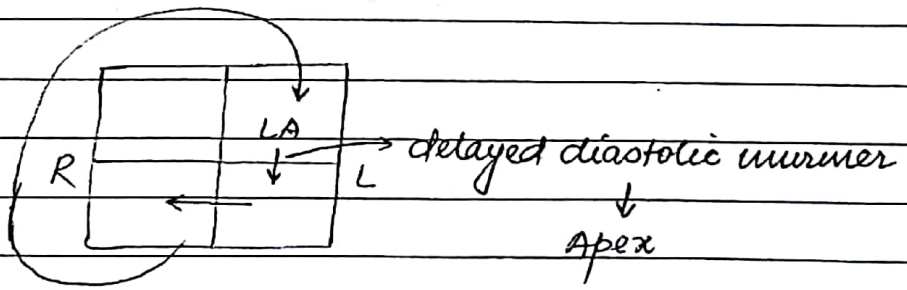
Date ___/___/___
Page _____

VSD (Ventricular Septal defect):

70% → Perimembranous

Small VSD	Medium VSD	Large VSD
• Root of aorta < 1/3		• > 1/2
• < 3 mm		
• Called Maladie de Roger's defect.	← CHF at 6-10 wks of life →	
• Loud murmur (S_1) (Pansystolic) ↓ lower left Sternal border.		• No murmur/ • Ejection systolic murmur. (S_1 & S_2).
• Asymptomatic		

In medium to large VSD, Left Atrium enlarges first.
In Small to medium VSD, left Ventricular hypertrophy. due to blood overload.



Natural course of VSD closure:

- 80% perimembranous
- 50% muscular VSD's close.
- By 4 yrs.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page ___

Indication of Sx in VSD:

- Failure of Medical therapy.
  - ↳ Digoxin
  - ↳ Diuretics
  - ↳ Dilators
  - ↳ ACE i (Remodelling of heart).
- Qp/Qs > 2 ; even if no symptoms.
- Swiss cheese VSD. (Multiple; Apex)
- Supracristal (outflow).

Large L → R shunt

↓

Pulm. blood flow ↑

↓

Irreversible changes pulm. microvascular.

[Pulm. HTN]

↓

RV pressure ↑ ; RVH

↓

Reversal; R → L (Eisenmenger Syndrome).

↓↓

Sx is C/I !

Differential clubbing : Toes > fingers

↓

PDA + Reversal.

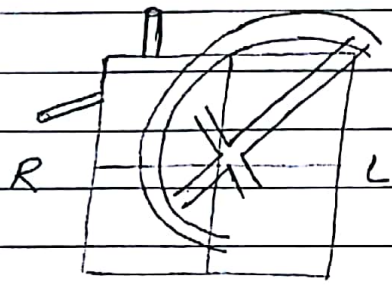
(also differential Cyanosis).

Down's Syndrome baby c Endocardial cushion defect undergoes Eisenmenger Syndrome.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date __/__/__
Page

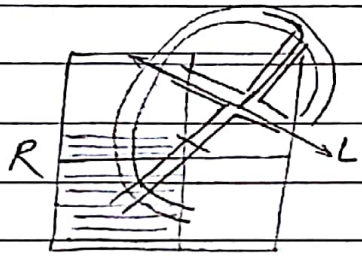
Ductal dependent lesion:



- HLHS ⇒ Rx - PGE1 infusion. ← S/E - Apnoea.
- Critical AS
- Preductal coarctation
- Interrupted aorta
  ↳ Shock.

I) Systemic blood flow dependence.

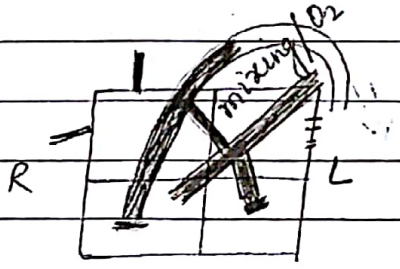
II) Pulm. blood flow dependence.
- Tricuspid Atresia
- Pulm. Atresia

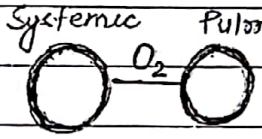


↓
Central cyanosis.

In emergency condn → PGE_1 infusion.

III) d-TGA





R_x - PGE_1 infusion

d-TGA → dependent for mixing.

Truncus Arteriosus is Ductal independent.

Emergency Sx in TGA → Rashkind's Ballon atrial septostomy.

Definitive Sx → Jatene's Arterial Switch.
↳ Best time: ē in first 2 weeks of life.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page ___

M/c Cyanotic Heart ds:

Overall — TGA

In Infants — d TGA (<1yr)

> 1yr — TOF

Hyperoxia test in cyanotic newborns —

- 10L O_2 to cyanotic newborn
- pO_2 > 150 mm Hg ⟶ excludes heart ds.

① 50% d-TGA + VSD ⟶ Mild

② d-TGA + intact septa (complete d-TGA) — Birth.

③ d-TGA + patent foramen ovale ⇒ At birth.

① < ③ < ②

TOF (Tetralogy of Fallot):

M/c cynotic heart ds beyond infancy.

① Narrowing of the pulm. valve (Infundibular).
② RV hypertrophy.
③ Overriding of aorta over VSD.
④ VSD — opening b/w left & right ventricles. (perimembranous).

#. Pink child become a blue TOF.

- Cyanosis; clubbing.
- Polycythemia → R/F of Renal vein thrombosis (RVT)
- Hematuria, [redacted], Flank mass, Anemia.
- Infant — Cyanotic/ tet/ hyperpneic spells → Older Squats
- Complications:

① < 2yrs = Thrombosis

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

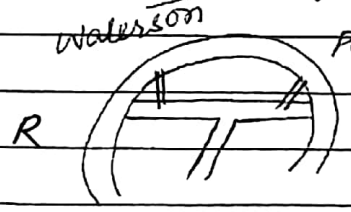
Date / /
Page

(11) > 2yrs = Brain Abscess.
↓
in the territory of middle meningeal artery
(Parieto-Temporal)

Infants → Cyanotic/tet/hyperpnoeic spells — older squats
(Rx: Knee chest position; i.v. Ketamine; Phenylephrine)
- R → L Shunt ↑ — Murmur disappears.
- PO_2 falls (Rx: O_2; i.v. $NaHCO_3$).
- Respiratory centre +++ (Rx: S/c Morphine)
- Dynamic Pulm. stenosis (Rx: i.v. Propanolol)
- Crying (Bcoz of ↑ venous return).

In TOF — loud Holosystolic murmur at the left 2nd-3rd ICS due to pulm. stenosis.

Palliative Shunt
- Modified Blalock-Taussig → Subclavian to Pulm. artery (opposite to Aortic Arch)
- Waterston
- Potts (Descending Aorta to left pulm artery)



25% TOF ⇒ has Right aortic arch.
↓
M/C c 50% of Truncus arteriosus

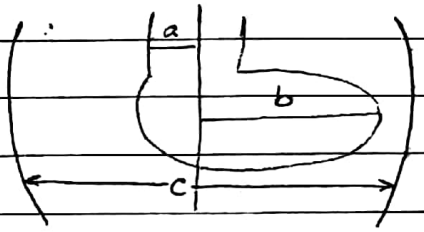
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page _____

Pentalogy = +ASD

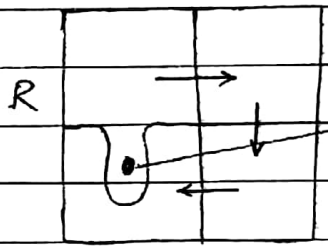
Trilogy = Overriding of aorta absent; VSD absent; ASD present.

- CHF never seen in TOF
- Cardiomegaly never seen in TOF.
  - ↓
  - Cardiothoracic ratio > 0.6 infant
    > 0.55 in older infant.



"Boot shaped heart"
"Coer en Sabat"

Ebstein's anomaly:



- Cyanosis ↓ PBF
- Maternal lithium
- Atrialisation of RV.
  - Pressure = RA
  - Ventricular = ECG
  - → disconcordence b/w pressure & ECG.
- Intracardial ECG helpful in Δ.
- Systolic; diastolic murmers.
  Quadruple rhythm
- Box/Ballon; Massive heart.
- SVT; WPW Syndrome.

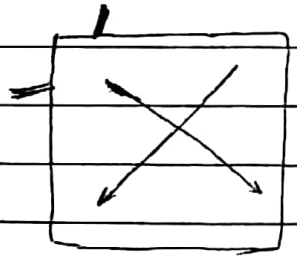
Date __/__/__
Page _____

Q A neonate present c recurrent abdominal pain, restlessness, irritability & diaphoresis on feeding. Cardiac auscultation reveals a non-specific murmur. He is believed to be at risk of MI. The most likely Δ is —

A) VSD
B) ASD
C) TOF
D) Anomalous origin of the left coronary artery = ALCAPA
- Q wave in Lead I ; aVL
- LAD branch absent.
- Ischemic LV → Antero lateral MI.
On Aortography → Rt coronary artery fills.
- Lateral MI in infant.

Rx : Bypass Sx.

l-TGA → Corrected TGA.
Normal Heart.
Atrio-Ventricular discordance.



[RA connected to LV
LA " " RV

No problem to baby.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date __/__/__
Page

KAWASAKI'S DS:

- M/c acquired heart ds in US, japan, & Chandigarh.
- Fever > 5 days & ↓.
- Development of a limp.
- Erythmatous macular exanthem over body
- Ocular conjunctivitis.
- Dry & cracked lips.
- Red throat & cervical lymphadenopathy.
- Grade II/IV vibratory systolic ejection murmur at lower left sternal border.
- Predominant Neutrophils ↑ platelet.

- M/c medium sized vasculitis.
- 20-25% causes develop aneurysm in future.

Q. Which of the following vasculitis not occur in adults?
A) Kawasaki ds (85% are < 5yrs)
B) Susac's Syndrome — Seen in adult females.
C) Giant cell arteritis
D) HSP

Peeling of palm & soles is classically seen in 2nd - 3rd wk of life.
Rare in ~~8~~ before 3 months of life.
DOC : IV Ig.

Δ: Fever > 5 days & any 4 of these 5
① Changes in extremities (eg: Erythma, edema, desquamation).
② B/L conjunctivitis (not ass. ↓ exudates)
③ Polymorphous rash (not vesicular)
④ Cervical lymphadenopathy.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date __/__/__
Page

⑤ Changes in lips & Oral cavity (eg: Pharyngeal erythma; dry/fissured or swollen lips, Strawberry tongue).

Non-classical feature of Kawasaki:
Arthralgia; Arthritis;
Thrombocytosis; urethritis;
aseptic meningitis (Irritable)

M/c/c of death in Kawasaki —
Overall — Coronary artery aneurysm
Acute phase — Myocarditis.

Rx: IvIg 2g/kg in acute phase reduces risk 4-6%
Aspirin 100mg/kg/day x 2weeks.

If Resistant to IvIg: 10-15% cases
↳ Add steroid (Methyl prednisolone).
↳ Repeat IvIg
↳ TNF blockers → Infliximab; Eternecept.
↳ IL-1 inhibitor → ANAKINRA

Recurrance Rate → 1-2% cases.

Mx of aneurysm:

Small → 50% resolve over 1-2yrs.
Aspirin 3-5mg/kg/day.

Medium to large → Add Warfarin
Sx (may be bypass)

Date / /
Page

HSP (Henoch-Schonlein Purpura):
M/c vasculitis (small vessel) Overall.
M/c leucocytoclastic vasculitis.
- Palpable non-thrombocytopenic purpura.
- IgA, deposition of vessels in dermis.

Pathogenesis: Abberrant Galactosylation
Mesangio-proliferative disorder.

Small vessels → Skin
Arthritis
Arthralgia
GIT – mesentric ischemia
Kidneys – HSP Nephritis (40-50%).
↓
84% develop in 4 wks
91% " " 6wks
97% " " 6months.

- Microscopic hematuria
- Proteinuria
- 1-2% RPGN (over days to week).
↳ On Biopsy crescent seen
↳ ∴ Crecentric GN
↓
proliferation of parietal epithelial cells.
Rx: i.v. Methylprednisolone.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date / /
Page

Rheumatic Fever:

- M/c acquired heart ds in India / Developing country.
- Due to Group A β-hemolytic streptococci strains M-type 1, 3, 5, 6 & 18.
- Most frequent b/w 5-15 yrs.
- Latent period 3 weeks.
- Autoimmune: Molecular mimicry

Affects < Myocardium
Muscle.

Modified Jones (2015):

- Era of Echocardiography → Subclinical AR/MR.
- A/c to Risk area.

Low Risk — defined as having an ARF incidence <2 per 100000 school-aged children (usually 5-14 yrs old) per year or an all age prevalance of RHD of ≤1 per 1000 population per year (Class IIa; level of evidence C).

Criteria = 2 major or 1 major + 2 minor
+ Essential criteria.

Recurrance = 2 major or 1 major + 2 minor
(OR)
3 minor

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page _____

Major Criteria:

Low risk populations:

- Carditis (Clinical &/or Subclinical)
- Arthritis (Polyarthritis only).
- Chorea
- Erythema marginatum
- Subcutaneous nodules.

Moderate to high-risk populations:

- Carditis (Clinical &/or Subclinical)
- Arthritis
  - Monoarthritis or polyarthritis
  - Polyarthralgia ⊕
- Chorea
- Erythma marginatum.
- Subcutaneous nodules.

Minor Criteria:

Low risk populations:

- Polyarthralgia
- Fever (≥ 38.5°C)
- ESR ≥ 60 mm in the first hour &/or CRP ≥ 3.0 mg/dl.
- Prolonged PR interval, after accounting for age variability.

Moderate to High risk populations:

- Monoarthralgia
- Fever ≥ 38.5°C
- ESR ≥ 30 mm in first hour or CRP > 3 mg/dl.
- Prolonged PR interval – Also in MR & MS.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page _____

℞:
- Aspirin 100mg/kg/day X 12 wks.
- Prednisolone X 12 wks.
  - 2mg/kg X 3wks → taper
  - Severe carditis or CHF.
- Crystalline Penicilline G X 10 days
- IE prophylaxis.

Mitral valve → M/c involved in RF
↳ Recurrance cause Mitral stenosis.
↓
Primary prevention
↓
In India 2° prevention
↳ Penicillin G
Benzathine (i.m.)
- 600,000 IU for children wt ≤ 60lb
1.2 million IU for children wt > 60lb
every 4 wks.

Or, Penicillin V (Oral)
↳ 250 mg twice a day

or, Sulfadiazine or Sulfisoxazole (oral)
↳ 0.5g once a day for pt. wt ≤ 60 lb
1.0g once a day for pt. wt > 60 lb.

For pt. allergic to penicillin & Sulfa group.
↓
Microlides are given orally.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date __/__/__
Page _____

CATEGORY	DURATION
- Rheumatic fever c out Carditis	5yr or until 21 yrs of age whichever is longer.
- RF c carditis but c out residual heart ds (No valvular ds)	10yr or until 21 yr of age, whichever is longer.
- RF c carditis & Residual heart ds (persistent Valvular ds).	10yrs or until 40 yrs of age whichever is longer. Sometimes lifetime prophylaxis.

Q
- Blood pressure = 86/600 mm Hg
- 4 yr, unconsiousness.
- HR = 180/min
- CFT = 4sec

Δ = ? → Compensated Shock.

Rx = 20 ml/kg 0.9% Nacl.

SHOCK = BP < 10th centile for age & Sex.

Criteria for Shock:

Criteria for Hypotension by age.

Age	Systolic BP
Term neonates (0 to 28 days)	< 60 mm Hg
Infants (1–12 month)	< 70 mm Hg
Children (1–10 yrs)	< 70 + (age in yrs X2)
Children > 10 yrs	< 90 mm Hg

Compensated Shock:

Rx – 20 ml/kg 0.9% Nacl

Repeat upto 60 ml/kg

↳ CVP line (next step).

• Low – fluid given.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page ___

- Normal → Cold epinephrin
  Warm: Nor-epinephrin.

Hypertension BP > 95th centile
- Essential – 10%; increasing
- Secondary HTN
  - ↳ Renal parenchymal – Reflux Nephropathy
    VUR
  - ↳ Renovascular
    - Major → RAS; RVT
    - Minor → HUS
  - ↳ Cardiac – post ductal coarctation (Turner)
  - ↳ Endocrinal – • Hyperthyroid
    • Cushing
    • Pheochromocytoma.
    • CAH 11 beta / 17 alpha hydroxylase deficiency

End organ damage in HTN:
- Fundus
- Echocardiography concentric LVH.
- Any adolescent BP > 130/80
  In children > 10 yrs → 120/80 → HTN
- Urine protein.

Rx: HTN
- Life style modification.
- Pharmacological therapy – end organ; Symptoms; Severe > 99th centile.
  ↓
  ACEi / ARBs.
  ACEi C/I if GFR < 30 → causes hyperkalemia
  ↓
  Rx → Amlodipine (CCB's)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page ___

Hypertensive Emergency:

- LVF ⇒ S3; Gallop; Basal crepts.
- Seizures.

Rx:

Best: i.v. Nicardipine infusion

Rx: Sodium Nitroprusside i.v. /
Esmolol /
Labetalol i.v.

Linezolid, Nitroprusside & Amphotericin B should be covered.

Q. A 12yr old boy c seizure.
BP = 200/140.
Femoral pulses not palpable.
Δ = ?

A) Takayasu aortoarteritis (Rx - Prednisolone).
B) Grand Mal Seizures.
C) Fibromuscular dysplasia (FMD)
D) Renal parenchymal defect.

Date ___/___/___
Page ___

Tachyarrhythmias

- Based on QRS

Wide > 0.09 sec (VT/VF)

- Pulseless
- Arrest.

Rx – Defibrillation 0.5–1 J/kg

- Stable

Rx – Lignocaine
Amiodarone.

Narrow

- Reentrant SVT
- HR > 220 infant; > 180 older
- P-wave absent; inverted

Vagal maneuvers

Stable

Rx – Adenosine (fastly given c saline flush)
↓
as close to the heart as possible.

CHF; Shock

Rx – Synchronized Cardioversion

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Respiratory

Cough & cold caused by Rhinovirus.

IMNCI G/L

Age = 2m – 12 months = RR ~> 50 or more.
Age 12m – 60m = RR ~> 40 or more.

- Chest is indrawing = Pneumonia.
or Fast breathing.

Rx :- Give oral Amoxicillin for 5day.

Any general danger sign ⇒ severe Pneumonia.
or Stridor in calm child or very severe dz

Rx
→ Give 1st dose of an appropriate A/b.
→ Refer to hospital.

Q. 18 m old child wighing 11.5 kg comes to PHC.
with c Resp. difficulty. O/E Lethargic RR = 46/min.
no Chest Retraction = Next Step.
Ans (B) Prescribe oral Antibiotic & Refer to higher centre.

→ Signs (< 2 months)
- convulsions or
- Fast breathing (≥60)
- Severe Chest Indrawing.
- 10 or more skin pustules.
or a big boil or
If axillary temp 37.5°C
or above or less than 35.5°C
- OR Lethargic/Unconscious.
- less than (N) limit.

Next Step
Serious = Give i.v.
Bacterial ⇒ Gentamicin.
Inj (N)
↓
Refer to higher centre.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Page No.: 104 PUVA
Date:

- Umbilicus red or draining → local (= Give oral
- Pus/Pus discharg from: Back, Buttock
ear or <10 skin pustules.

- Causes of Pneumonia Age wise in India & world
- Neonates : Grp. B Streptococcus, E. coli.
<3 weeks.
- 3wk - 3m = Respiratory Syncytial virus (RSV)
S. Pneumonia, H. Influenza.
- 4m - 4yr = RSV, S. pneumonae, H. Influenza.
>5yr = M. pneumonae., S. pneumonae.
- H. Influenza → Vaccination (dlt) → ↓ in Incidence.

Viral pneumonia
- Prodrome.
- Diffuse, B/L
- Not lobar pneumonia
- Interstitial infiltrate

T/t : ① DOC for RSV = Ribavarin.
② Influenza = Amantadine, Rimantadine
H1N1 = Influenza A → Neuraminidase Inhibitor.
↳ oral Oseltamivir.
↳ Inhaled zanamivir.

Pandemics :-
Phase 1 - 3 Animals.
Phase 4 - May 27, 2009 (Mexico)
↳ Hum-human transmission at community
Phase - 5 - 29/5/09 USA.
Human - Human transmission in one zone

Phase 6 : June 11, 2009, US & India.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

→ Human - human transmission in two zones

H1N1 virus :-
- SS RNA.
- Belongs to orthomyxoviridae.
- Size = 80 - 200 nm.

Types :- A, B, C.

Surface Ag = H (Hemagglutinin)
N (Neuraminidase)

As the reassortment occurs in swine flu.
= Swine flu.

D/t Antigenic shift & drift - No vaccines made

Symptoms = Flue like.

Complications of H1N1 → in High risk groups.
⇒ Pneumonia (viral)
⇒ Bacterial superinfection.
⇒ ARDS like features.

High Risk groups :- Comorbidity.
→ They were associated with same ~~mortality~~
→ Pregnancy
→ Nephrotic syndrome, Chronic illness, post transplant
- <1 yr., >65 yrs.

Indications of oseltamivir
① Give it to all suspected cases of H1N1
② Give it to all confirmed case.
Dx is by throat swab & Nasopharyngeal.
Swab is send for Real time PCR.
⊗ H1N1 influenza.
③ Give it to all household contacts, occupational (Post exposure in doctors)-

Adults
Dose = 75 mg Cap BD - 5d.
Prophylactic dose = 75 mg OD → 7-10 days.

Page No.: 106 VVI
Date:

Zanamavir.

T/t dose = Two 5mg Inhalations (10mg total) twice/day x 5 days.

Prophylaxis dose = two x 5mg Inhal® - OD.

Q:- H_1N_1 10 wks pregnant.
→ Give Oseltamivir [Not teratogenic
↳ only in cats]
→ TE®

Q:- Pt on Rifampicin Induces hepatic CYP450.
gets H_1N_1, Sy®
→ What happen to dose of oseltamivir
Ans = Remain same Renal exc®
Q. Dose in hemodialysis
= oseltamivir dose is reduced.

Pneumonia

- St. pneumonia = Causes severe Lobar pneumonia.
- Incub/ Pd. = 1-3 days
- Rx → Ceftriaxone DOC.

→ Resistant Variety = DOC ⇒ Vanco + ceftriaxone

Vaccines :- > 2 yrs. Children = PPV - 23.
< 2 yrs = PCV - 7/11 = conjugated.
6, 10, 14 weeks, f/B booster at 15-18 mnths.

[GAVI] :- Global Alliance for Vaccines & Immun®
- founded by bill gates & Melinda Gates
- Free vaccines in poor country

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Staph. Aureus

- Max Mortality (10-30 %)

Ch: — Air filled cavity (Pneumatocele)
. also seen in dkt.
1) Klebsiella.
2) Kerosene oil poisoning

→ Pneumatocele can Rupture & develop pneumothorax

• S. aureus = M/c of empyema in children.
(Pus in Pleural cavity)
T/t = ICDT.
DOC for S. aureus = Cloxacillin.
Vancomycin for MRSA.

• H. influenza = Usually part of S. sepsis.
- can have arthritis, meningitis.
Rx = ampicillin & chloramphenicol.
20-40 %. are resistant.
Rx. (Ceftriaxone) → DOC.

⊛ Atypical pneumonia
→ Rare - <4 yrs = ~~adults~~. >5 yrs. !
- Symptoms - dry cough.
- Interstitial pneumonia
- Organism = Mycoplasma Chlamydia.
Rx :- Macrolides

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

15 month

Motor → Walks alone, crawls up stairs

Adaptive → Makes tower of 3 cubes, makes a line with crayon, inserts raisins in bottle

Language - Jargon; follows simple commands, may name a familiar object (eg. ball) responds to his/her name.

Social → Indicates some desires or needs by pointing, hugs parents.

18 month

Motor - Runs stiffly, sits on small chair, walks up stair with 1 hand held, explores drawers & waste baskets.

Adaptive → Makes tower of 4 cubes, imitates scribbling, imitates vertical strokes, dumps raisin from bottle.

Language - 10 words (average), names pictures, identifies 1 or more parts of body.

Social → feeds self, seeks help when in trouble, may complain when wet or soiled, Kissed parent with pucker.

24 month

Motor → Runs well, walks up & down stairs, 1 step at a time, opens door, climbs on

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

furniture, jumps.

Adaptive → Makes tower of 7 cubes (6 at 2 month) scribbles in circular pattern, imitates H$_2$ stroke, folds paper once imitatively

Language → Puts 3 words together (subject, verb, object)

Social → Handles spoon well, often tell about immediate experiences, helps to undress, listens to stories when shown pictures

30 months

Motor → Goes up stairs alternating feet

Adaptive → Makes tower of 9 cubes, makes VH & horizontal strokes, but generally will not join them to make cross, imitates circular stroke, forming closed figure

Language → Refers to self by pronoun 'I' Knows full name

Social → Helps put things away, pretends in play

36 months

Motor → Rides tricycle, stands momentarily on 1 foot

Adaptive → Makes tower of 10 cubes, imitates construction of bridge of 3 cubes

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

copies circle, ~~imitates cross~~

Language – Knows age & sex, counts 3 objects correctly, repeats 3 numbers or a sentence of 6 syllables, most of speech intelligible to strangers.

Social → Plays simple games (in parallel with other children) helps in dressing (unbuttons clothing & puts on shoes) washes hands.

48 months

Motor → Hops on 1 foot, throws ball overhead, uses scissors to cut out pictures, climbs well

Adaptive → Copies bridges from ~~parental~~ model, imitates construction of gate of 5 cubes, copies cross & square, draws man with 2-4 parts besides head, identifies longer of 2 lines.

Language - Counts 4 pennies accurately, tells story

Social → Play with several children, with beginning of social interaction & role-playing, goes to toilet alone

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

60 monthly.

Motor – Skips

Adaptive → Draws △ from copy, names heavier of 2 weights

Language – Names 4 colours, repeats sentence of 10 syllables counts 10 pennies correctly

Social → Dresses & undresses, asks questions about meaning of words, engages in domestic role playing.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date / /
Page

Fever & Stridor Inspiratory Sound in upper airway.

Croup / LTB

- 75% parainfluenza
→ Prodrome → Stridor
Barking Cough.
Subglottic narrowing
K/A : Stippel sign on x-ray.
↳ Doc = for mild = dexa = 0.6mg/kg.
mod & Severe
↳ Nebulisation ± Racemic epinephrine.
↳ Westley Croup Score, Criteria to dx it.

Epiglottitis

In world – S. pyogenes.
S. pneumoniae
S. aureus
In India – H. Influenza.
dat X-Ray Neck → Thumb Sign.
Rx → Airway [Emergency tracheostomy]
Ceftriazone + Sulbactam (ESBL)

BRONCHIOLITIS:

- Inflammatory obstruction of Smaller airway.

M/C organism – RSV (50%)
↳ Respiratory Syncytial Virus.

R/F :
- Males, Topfed.
① - Preterm ; Chronic lung disease.
② - L → R shunt.
- Smoking mothers.

Airway resistance, $R = \frac{1}{r^4}$ → air trapping

Prodrome → Wheeze / ~~and~~ Ronchi.

X-Ray chest shows Hyper inflation.

Rx : Antibiotics has no role.
Humidified O_2.
For 2 High Risk group – Nebulised Ribavarin
Palivizumab

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page ___

Long term — Persistent wheeze infancy
↓
Reactive airway disease.

ASTHMA

Classification a/c to severity.

	Step	Symptoms	Night symptoms	Peak expiratory flow rate.
I.	Intermittent.	< 1 time a week; asymptomatic & (N) PEFR b/w attacks	≤ 2 times a month	≥ 80% predicted; Variability < 20%.
II.	Mild persistent.	> 1 time a week but < 1 time a day	> 2 times a month	≥ 80% predicted; Variability 20-30%
III.	Moderate persistent.	Daily use β-agonists; daily attacks affect activity.	> 1 times a month	> 60% & < 80% predicted; Variability > 30%
IV	Severe persistent.	Continuous limited frequent activity.	Frequent.	≤ 60% predicted; Variability > 30%

For intermittent → SOS β_2-agonist
Mild persistent → +++ inhaled beclomethasone, Fluticasone, Budesonide.
Moderate persistent → +++ Salmeterol / Sustained release theophylline.
Severe persistent → ++ Oral low dose, long term, alternate day prednisolone.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date __/__/____
Page _____

2 yrs → Acute severe asthma
↓
Oxygen; Nebulise salbutamol
↓
Nebulised ipratropium bromide
↓
i.v. hydrocortisone
↓
s/c Terbutaline
↓
Terbutaline infusion
↓
50% $MgSO_4$ → aminophylline.

Foreign body:
CxR → Persistent inflation
Ball valve inflation.
Rx → Bronchoscopy & remove foreign body.

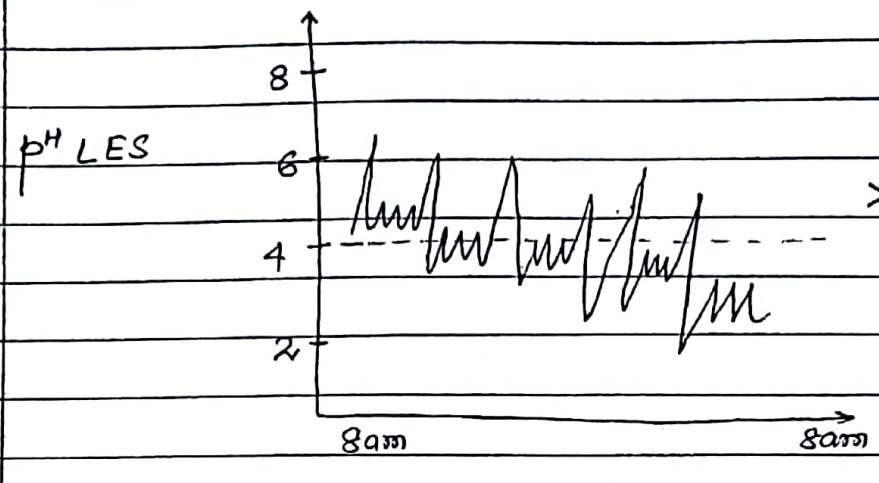
Recurrent pneumonia:
2 episodes of radiographic pneumonia in 1 year
(OR)
3 episodes in any time frame.

Persistent pneumonia:
Persistence of symptoms & radiographic abnormalities for more than 1 month.

Recurrent pneumonia:
Cause → · L → R shunt
· GERD d/t aspiration.
Immunodeficiency.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page _____



24 hr pH LES

M/c/c of Recurrent pneumonia in U.S. = Cystic fibrosis.

Cystic fibrosis

- Incidence : 1 in 2500 in UK

Gene → CFTR gene (7q 31.2 locus)

↓

CAMP regulated chloride channel.

- In CF more Sodium goes to lumen & to mucosa than chloride.
- Autosomal Recessive disorder.
- Respiratory : Pneumonia (>5yrs of life).

M/c organism ass. c cystic fibrosis — Pseudomonas aeruginosa.
(Mucoid > Non Mucoid)

Rx : Inhaled antibiotics
- Tobramycin
- Aztreonam
- Colistin
- Ciproflox

Date ___/___/___
Page _____

- Amikacin
- Levofloxacin

Respiratory : Pneumonia (>5yrs)
- <5yrs — S. Aureus ; H. influenzae.
- 5-18yrs — S. Aureus ; Pseudomonas
- >18yrs — Pseudomonas ; S. aureus.
  Acromonas ; Achromobacter ;
  Burkholderia capacia
  ↳ specific ; fatal
  ↳ Rx Mild — Colrimoxazole
  ↳ Severe — Meropenem + Colrimoxazole / Doxycycline.

- Exocrine Pancreas — Stealorrhoea (<5yrs)
  foul - bulky stools.
  ↓
  Rx — Stealorrhoea in CF
  Lipase 1000 IU/kg supplement.

- Endocrine → 25% DM after 35 yrs.
- GIT → Meconium ileum.
  Adolescents — Distal intestinal obstruction Syndrome.

48hrs old baby has not passed meconium.
Ix → Lower GI contrast study
- Diagnostic
- Therapeutic in meconium ileum.

- GIT : Diffuse pain abdomen
  Colonic mucosal thickening.
  Intussusceptions.
- Nasal polyps ; Azoospermia

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page _____

- Absent Vas : 1% infertile men ; common in CF males.

Q. Which glands are not obstructed in CF ?

A) Cervix → Infertile
B) Pancreas → Insufficiency.
C) Sweat glands

M/c mutation in CF = ΔF508 mutation (Class II mutation) → Causes "Trafficking Defect"
(Seen in 70% caucasions)
↓ (25-30% Indian)
M/c lethal genetic disorder in caucasions.

CFTR gene has 1800 mutations.

How many Nucleotide deleted in CF ?
3 → TTT = Phenylalanine.

℞ : For Trafficking Defect
↓
DOC → LUMACAFTOR (Trafficking corrector drug)
+
IVACAFTOR (Potentiator drug).
↓
opens CFTR 'Cl' channel.

Lumacaftor — induce hepatic Cyp 450
↓
∴ New Corrector → TEZACAFTOR
↓
doesn't induce Cyp 450.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page ___

Q. Which of the following is a calcineurin inhibitor?

A) Tacrolimus
B) Sirolimus → m-tor inhibitor
C) Everolimus → m-tor inhibitor
D) Cyclosporine

Diagnostic Criteria of CF:

① Sweat Chloride > 60 meq/L on 2 occasions
[N < 40 meq/L]

OR, ② Two known CFTR mutations.

OR, Best – ③ Diagnostic nasal electrode potential difference.

Newborn screening for CF

IRT test → Immuno reactive Trypsinogen Assay test.
(Sensitive test)

Q. Male, 10 month boy, Down Syndrome & Recurrent pneumonia

Filling defect → In Ba-swallow
↳ in middle of esophagus.
↳ Abbarrent right subclavian artery vascular ring
↓
Dysphagia lusoria.

Approach to a pt. c recurrent / persistent pneumonia:

↓

History, physical exam^{n}, CxR

— Rule out TB

Difficulty in feeding; choking during feeds.	Infection in other parts of body	Associated Malabsorption.	No clues
↓	↓	Pseudomonas in airway	
GER studies,	Immunoglobulin	↓	
Esophageal PH monitoring,	CD4, CD8	Sweat Cl^{-} test	
Barium Swallow,	NBT, HIV test.	Mutation Studies.	
Direct laryngoscopy.			

Isotonic fluids:

- 0.9% Nacl — 154 meq/L Na & Cl.
- Ringer lactate = Plasma.
  - 130 meq/L Na
  - 109 meq/L Cl
  - 28 meq/L Lactate^{-}
  - 4 meq/L K
  - 3 meq/L Ca

Maintenance fluid:

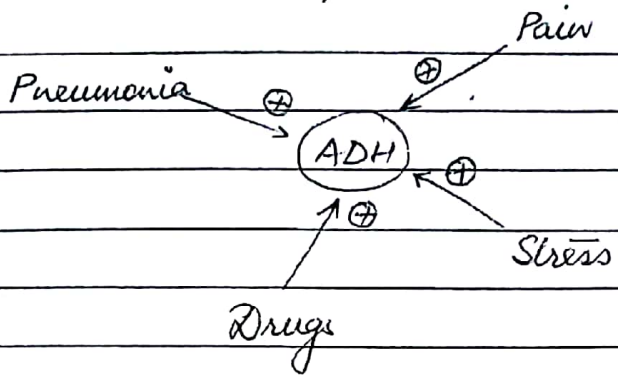
Need:

- Insensible water loss.
- Energy
- To prevent catabolism.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page ___

Type?
- Adult: 5% DNS
- Children 5% Dextrose + N/2 or NS.



Amount?
A/C to Holiday & Segar
< 10 kg – 100 ml/kg/day.
10 kg – 1000 ml/day. (40 ml/hr).
11–20 kg → 1000 ml (for 10 kg) + 50 ml/kg additional kg above 10 kg.
> 20 kg → 1000 ml + 500 ml + 20 ml/kg additional above 20 kg.

Patau's Syndrome (Trisomy 13):
- Cleft lip & palate.
- Polydactyly
- Hypotelorism (Eye sepreted wide).
- Aborfus looks like Cyclops
  ↳ Holoprosencephaly. (Single eye)
  ↳ Fused frontal lobes + lateral ventricles.
  ↳ Aplasia cutis (problem of cleavage of skin).
- ~~Rocker bottom~~

Date / /
Page

Edward Syndrome (Trisomy 18)

- Rocker bottom feet
- Overlapping of fingers.
- 2nd M/C trisomy.
- Maternal age
- GIT anomaly are common
  - ↳ Atresia gut
  - ↳ Exomphalos
  - ↳ Malabsorption.

TTNB (Transient Tachypnea of New Born): Wet lungs.

R/F:

- Term ; Cesarean Section
- Macrosomia
- Precipitous labour.
- Maternal Sedation

C×R – Prominent horizontal fissure.

- It is a benign, self limiting condn & resolves in 48–72 hrs.
  - FiO_2 requirement < 0.4
  - Never require mechanical ventilation.

MSL (Meconium Stained Liquor):

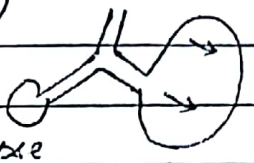
- Marker of perinatal hypoxia (common in Post term)

Glottis open → meconium passed.

Parasympathetic ++ → Peristalsis ++ → Anal sphincter relax

Date ___/___/___
Page _____

Complication of Meconium:

Physical:  Ball valve.

collapse

air leaks 20-30%.

Chemical: Irritant.

Biological < impairs surfactant function (Surfactant given)
Good culture media (Given Antibiotic)

℞: Meconium stained liquor

↓

Born

Vigrous < Tone.
HR > 100/min
Resp^{r} effort.

NO | YES

limp or, HR < 100 or, Apnea. → PPV × 100% O_2.

Transfer to mother

Date ___/___/___
Page _____

GROWTH

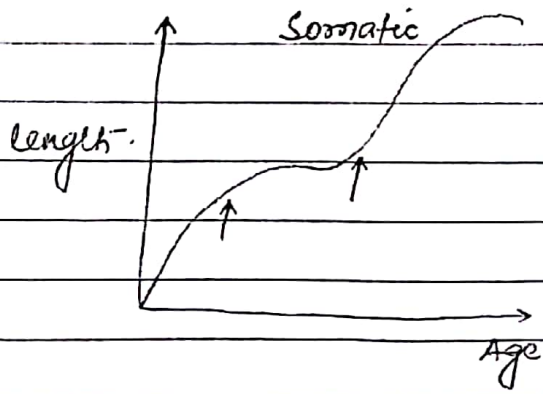
1-4 months : Weight gain 30gm/day
5-8 month : wt. gain @ 20gm/day
9-12 month : wt. gain @ 10gm/day.

Weight multiples:

Wt. × 2 = 5 months
× 3 = 1 yr
× 4 = 2yrs
× 5 = 3yrs
× 6 = 5yrs
× 7 = 7yrs
× 10 = 10yrs.

Length:

At birth – 50cm] Growth Velocity → +25 (first year)
1 yr – 75 cm]
2yr – 90 cm → +15 → second year.
4 ½ yr – 100cm
Add 6cm / year till puberty.



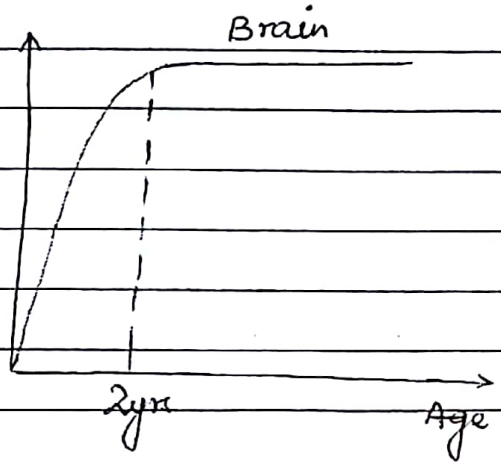
Q. In school going children; the avg height velocity is
→ 5-8 cm

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

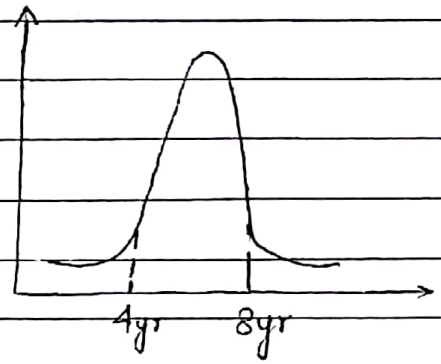
Date ___/___/___
Page ___

Head circumference :

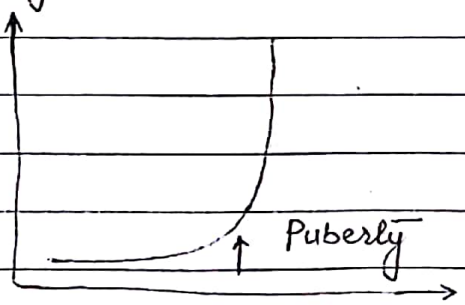
- 35cm at birth
- 3 months → 40cm
- 12months → 45cm
- 2yrs → 48cm (90% of brain grows)
- 12yrs → 52cm.



Lymphoid growth :



Gonad growth :



Date ___/___/___
Page _____

Adolescent — 10 to 19 yrs.

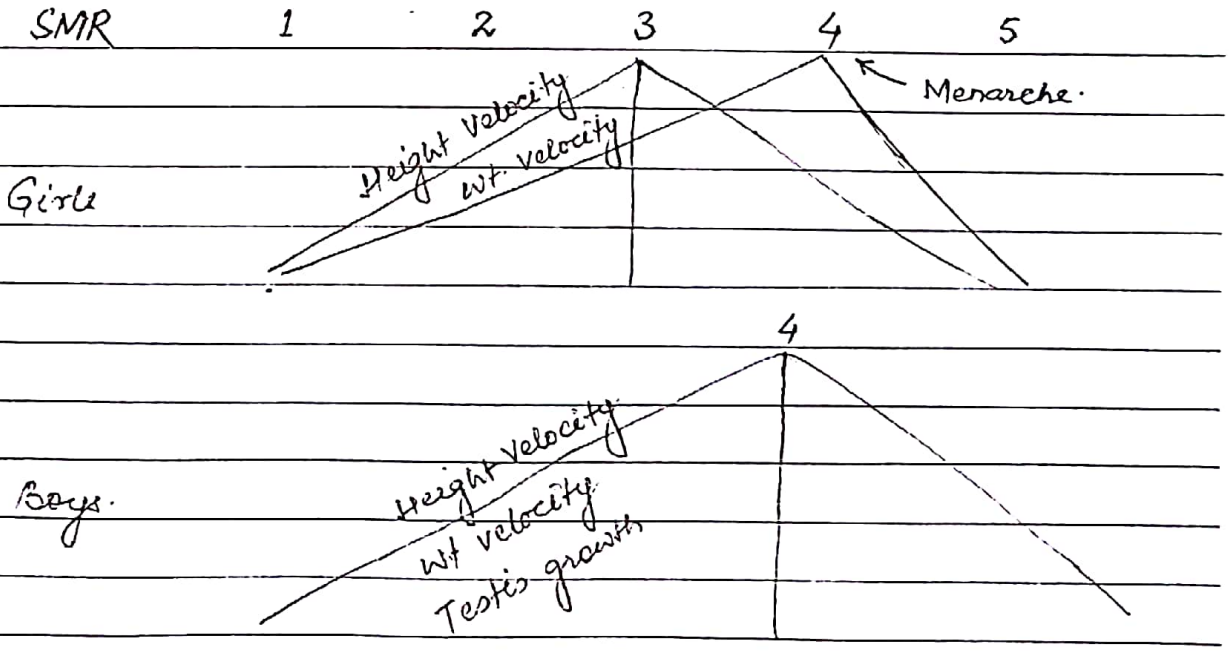
Tanner's Sexual Maturity Rating:
SMR Stage I - V
Stage I — No character
Stage V — Completely developed.

Menarche → SMR-IV

Sequence of puberty:
Girls:
Growth Spurt → Thelarche, Pubarche, Menarche.

Boys:
→ Testis - Penis - Pubic hair, Axillary hair.

Girls: BP (Breast — Pubic hair)
Boys: GP (Genitalia - Pubic hair).



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

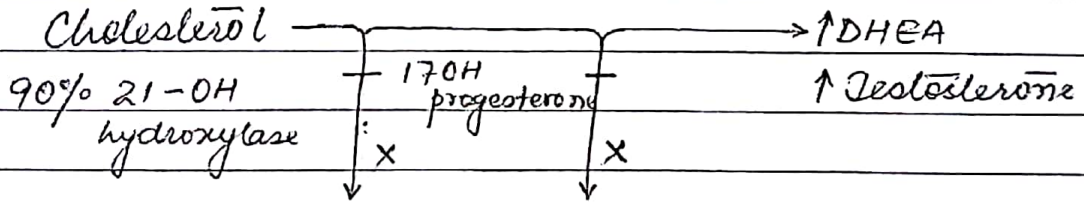
Date __/__/__
Page _____

Most rapid ↑ in height → Phase 3 in girls & Phase 4 in boys.

Puberty – comes by pulsatile release of GnRH.

Precocious Puberty:
- Gonadotropin dependent / Central
- Females – Idiopathic.
- Males – Organic
  (Hypothalamic Hamartoma, Craniopharyngiomas, Hydrocephalus, TBM).

CAH (Congenital Adrenal hyperplasia):
M/c/c of female hermaphrodite.
Karyotype – XX
But looks like Male.



Cortisol
glucose ↓

Aldosterone
Na^+ ↓
Salt-Wasting Crisis (70%)
↑ K^+
Shock

– Cause of precocious puberty in boys.

Genitalia → Ambiguous
Labia is pigmented d/t ACTH.
{ Virilization
Hypertrophy of clitoris

Date ___/___/___
Page _____

- Penoscrotal hypospadias
  + Empty Scrotum.

Due to deficiency of 21-OH hydroxylase lead to accumulation of 17-OH progesterone.

Q Level of 17-OH progesterone in CAH
A) < 150
B) 150 - 300
C) 300 - 500
D) > 600 (> 3500)

CAH associated c Premature epiphyseal closure.
↓
Short Stature.

Rx : CAH
- Supplement of Hydrocortisone & Fludrocortisone
  ↓ Glucocorticoids: 15-20 mg/m²/day, Thrice daily.
  ↓ Mineralocorticoids: 0.15 mg/day.

- Girls require Sx
  - Clitoroplasty
  - Reconstruction Sx.
  - Never get married.

Cholesterol → DHEA → Testesterone.
→ 11-deoxycortisol → Cortisol
→ DOCA : potent mineralocorticoid → Aldosterone → HTN, Hypokalemic metabolic alkalosis.

11 β-OH deficiency

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date / /
Page

Q. 5yrs old boy has precocious puberty. BP = 130/80
Estimation of ♀ help diagnosis?

A) 17-OH progesterone
B) 11-deoxy cortisol
C) Aldosterone
D) DOCA

Deficiency of 17 α-Hydroxylase → ↑ Aldosterone
↓
HTN, Hypokalemia, metabolic alkalosis.

→ ✗ Cortisol
↓ glucose.

→ ✗ Testosterone
↓
Male look like ♀.

(Mineralocorticoid) M T (Testosterone).

2 ↑

↑ 7

↑ ↑

3β Hydroxysteroid dehydrogenase deficiency (3β HSD def.)
↓
Causes ambiguous genitalia in Both sexes.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page ___

Q. Mother; previous child CAH

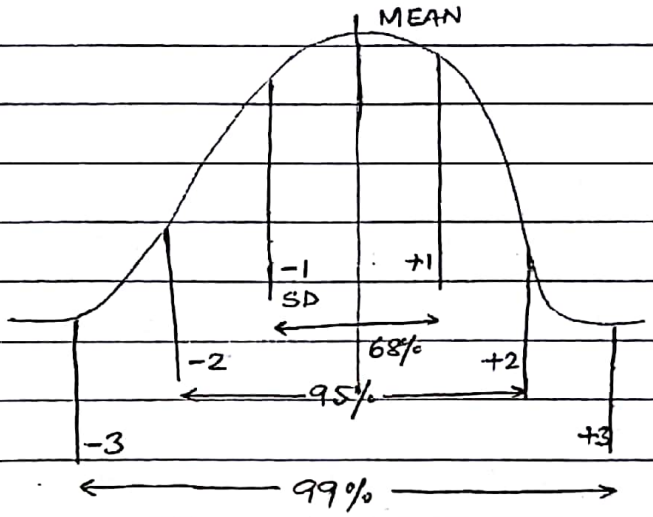
Next pregnancy — To prevent female virilization of foetus

↓

Dexamethasone
(20 mcg/kg prepregnancy wt.)

↓

Inhibits ACTH.



Short height > -2 SD below mean or < 3rd percentile

Mid parental height = Adult predicted height

Boys = average parents height + 6.5 cms
Girls = " " - 6.5 cms.

Causes of Short Stature:

- Physiological
  - Constitutional (M/C)
  - Familial
- Pathological
  - Malnutrition
  - Chronic illness
  - Celiac disease (Present at 6-18 months as mother introduces wheat now)
  - Genetic → Turner

Date ___/___/___
Page _____

℞ : Celiac ds
- Restrict Wheat, Rye & Barley for lifetime.
- Gluten-free diet.
- Also avoid oats.

↓

- Endocrinal → Hypothyroid
Cushing
CAH
GH deficiency.

GH deficiency :
- Birth weight & length normal.
- lag at 1-2 yrs of life.
- Bone age delayed.
- Doll face
- Micropenis } Panhypopituitrism
- Short stature

Micropenis (↓LH, ↓FSH)
↓ACTH → Hypoglycemia

- Hoarseness of voice.

INV: GH level ⇒ IGF, BP3

GH stimulation test – Best
↳ Basal level GH
↳ Stimulated level – 2 stimuli
(Clonidine ; Insulin ; L-arginine).

℞ – Recombinant GH (US, FDA)

Date ___/___/___
Page _____

Indication: rGH

- GH deficiency
- Turner Syndrome
- Prader villi
- Chronic kidney ds.
- SGA height -2.25 SD below mean

When to stop GH?

- Height reaches 50th centile
- Epiphysis fuses.
- Pseudotumor cerebri
- Slipped capital femoral epiphysis.

Disproportionate short stature:

US/LS ↑ → Achondroplasia, Rickets, Hypothyroidism.

US/LS ↓ → TB spine, Mucopolysaccharoidosis IV (Morquio's ds)

Physiological Short Stature:

	CONSTITUTIONAL (M/C)	FAMILIAL
Birth length	(N)	IUGR
Lag	6-12 months	
Growth velocity	(N)	Less
Final Height	(N)/Sub(N)	Less
Puberty	Delayed	(N) ♀
Bone age	Delayed.	(N) ♀

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page _____

Developmental milestones:

Neck holding → @ 3month.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page _____

Gross motor milestones:
3 months — Head holding; Neck holding.
5 months — Sitting c support.
4-6 months — Prone to supine, supine to prone (Roll in bed).
8 months — Sitting c out support.
9 months — Crawling
10 " — Creeping; stand c support
12 " — Standing c out support; walking c out support.
2yr — Walk up stairs c two feet at each step.
3yr — Upstairs c one foot at each step, rides tricycle.
4yr — Hops on one foot
5yr — Skips on two foot

Fine motor:
12wks → Moro's reflex disappears
Grasp reflex disappears
4 months — Goes for objects
5 months — Bidextrous grasp.
6-7 " — Transfer object, palmar grasp.
9 " — Pincer grasp; mature neat.
13 months — Casting.
15 " — Self feed c a spoon
18 " — Self feed c a cup.
24 " — turns pages of a book one at time.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page _____

Social Milestone:

2 months — Social smile
3 " — Recognizes mother.
6-7 " — Smiles at mirror image.
9 months — Waves bye-bye.
6 months — Stranger anxiety.
2yrs — Dry by day
3yrs — Dry by night
Dress / undress himself (Supervision)
↓
c out supervision — 5yrs.

18 month — Seperation anxiety / Clinginess / Reprochment.

Language Milestones:

1 month → Head turns to sound
3 months → Cooing
6 months → Babbles; Monosyllables (ma, ba)
9 months → Bisyllables (mama; ba-ba)
1 yr → 2 words c meaning
18 months → Vocabulary of ten words.
2yrs → Simple sentences c 2words; Phrase.
3yrs → tells age & sex; uses pronouns, handedness; identify colours.
4yrs → tells story
5yrs → Knows colour

15 months: 4-5 words
2yrs → 50-100 words

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page ___

When can a child understand death =

< 3yrs — No idea
3-9 yrs — Idea
>9yrs — Entity ; Irreversible ; himself

Object permanence / Constancy — 9 months.
Cross a busy road — 10-12yrs.
Tie shoe lace — 5yrs.
Bladder control — 85% by 5yrs.
Nocturnal enuresis — >5 yrs.
↳ more than 2/week x 3months.

Q. 14 yrs old child c Nocturnal enuresis
Rx — • Behavioural — +ve reinforcement.*
• Alarm therapy (Best)
↳ 85% relapse free rates.
• Drugs → Desmopressin

Encopresis : > 4yrs
Cause → Chronic constipation.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page _____

CNS

MICROCEPHALY:

→ HC > -3SD below mean

Causes:	GENETIC	ACQUIRED
	- Trisomy 13, 18, 21	- Baby: HIE; Hypoglycemia, PKU, Meningitis, encephalitis.
	- Cri-du-chat 5p deletion	- Mother → TORCH, Hyperphenylalanine > 6mg/dl Alcohol, DM, Radiation.

MACROCEPHALY

HC > 2SD above mean.

Q Neurodegenerative disorders:

GREY MATTER:

- Normal at birth.
- Regression milestones.
  - ↳ Disappear as they come orderly.
- Deaf, blind, seizures
- Anemia, Hepatosplenomegaly.
- Cherry red spot macula.

Microcephaly	Macrocephaly
- GM1 gangliosidosis.	- GM2 gangliosidosis (Tay Sach's ds)
- Gaucher's ds (β-gluco)	- Sandhoff
- Niemann Pick's ds	

Huge spleen

(

VLCFA = Very long chain fatty acid.

Date ___/___/___
Page ___

Tay Sach's ds –
- AR
- D/t deficiency of β-hexose aminidase A.
- 1/25 askenazi jew are carrier.
- 6 months exaggerated startle reflex.
- Cherry red spot macule
- Organomegaly not seen.

Organomegaly + Tay Sachs = Sandhoff
↓
Def. of β-hexose aminidase A & B.

WHITE MATTER DISORDERS:
- All the tracts are white matter.
- Frequent fall, incoordination
- Upper motor neuron sign.

Microcephaly / (N)
- Krabbe's
- XLR adrenoleukodystrophy.
↓
degeneration starts from parieto-occipetal area.
Δ → ↑ VLCFA levels
Rx → Early bone marrow Tx.
lorenzo oil
- Meta chromatic leukodystrophy

Macrocephaly
- Canavan ds.
- Alexander ds.
→ MRI → Diffuse white matter thickening.
→ MRI → Degeneration starts from frontal periventricular area.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page _____

Hydrocephalus:

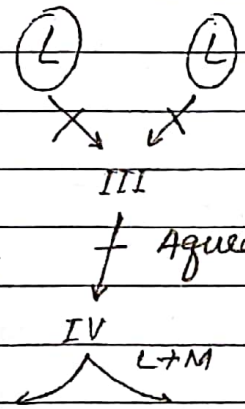
- Enlarged ventricles c or c out ↑ in ICT.

CSF production:

- Choroid plexus (75%) → Lateral, III & IV ventricles.
- Extrachoroidal (25%) → Capillary endothelium in brain parenchyma.

Rate of CSF production → 20 ml/hr.
CSF volume in infants = 50 ml
adults = 150 ml.

CSF flow:



Obstructive / non-communicating.

↓

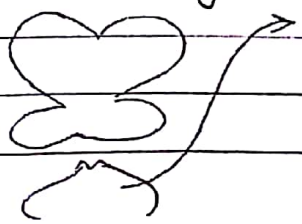
① Aqueductal stenosis (M/c)
② Aqueductal gliosis
③ Arnold chiari Malformation

↓

Downward displacement & hypoplasia in cerebellum leading to obliteration of cisterna magna.

Arnold-Chiari Type I – Adolescent/Adult
Type II – Newborn/c
lumbosacral myelomeningocele.

④ Dandy-Walker Syndrome:



large cyst in posterior fossa communicating c 4th ventricle.
- Child has cerebellar hypoplasia

Date ___/___/___
Page _____

⑤ Vein of Galen malformation:
- M/C arterio venous malformation in brain
- Sinus Venosus ASD.
- Obstructs aqueduct.
- Midline mass c dilated lateral ventricle.

Non-obstructive / communicating:
- Basal exudates
  - ↳ TB
  - ↳ Cryptococcal meningitis.

IOC for congenital Hydrocephalous — MRI.

Rx: Drugs → Furosemide
Acetazolamide.
VP shunts → anastomose ventricles to peritoneum.
- ↳ Gross hydrocephalus
- ↳ Thinned parenchyma.
- ↳ Complication — Blockage
  Infection (Coagulase -ve staph).

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date / /
Page

Febrile Seizures:

- M/c seizure during childhood.
- Between 6month – 5yrs.

R/F for recurrance:

Major:

Age < 1yr
Duration of fever < 24 hr.
Fever 38–39°C (100.4 – 102.2°F)

Minor:

Family H/o Febrile seizures.
Family H/o epilepsy.
Complex febrile seizures.
Daycare
Male gender.
Lower serum Na^+ at time of presentation.

Having no risk factors carries a recurrance risk of approx 12%

If 1 R/F → 25–50%
2 " → 50–59%
≥3 " → 73–100%.

R/F	Risk for Subsequent Epilepsy
Simple febrile Seizure	1%
Recurrent " "	4%
Complex " " (>15 min duration or recurrent c in 24 hr)	6%
Fever <1 before febrile seizure	11%
Family H/o epilepsy	18%
Neurodevelopmental abnormality (Mental Retardation).	33%

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page _____

Complex febrile seizure complication:
- Prolonged febrile seizures.
MRI → Mesial temporal sclerosis
Temporal lobe + Hippocampal lobe.

Epilepsy in children:
Partial:
- Simple
- Complex - aura; automatisms.
℞ — Oxcarbamazepine &
Carbamazepine.

Ring Enhancing lesions.

Neurocysticercosis	Tuberculoma.
- Solitary	- Large > 20mm
- SCOLEX	- Multiple
℞ — Albendazole (DOC)	- Irregular margins
↓	- Perilesional edema
Before giving Albendazole 3–5 days of steroids given.	- Midline shift.

Generalised epilepsy:
- Tonic
- Clonic
- GTCS [aura – GTCS – postictal phase]
↓
Drowsy, unconscious, frothing, tongue bite, upgoing, incontinence.
- Atonic
- Myotonic

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date __/__/__
Page

Rx – Sodium Valproate.
↓
In < 2yrs → It is hepatotoxic.

Absence Seizure:
- Blank stare < 30sec.
- No aura / post ictal phase.
- Hyperventilation provokes.

Rx: Ethosuximide (DOC)
Valproate

Atypical Absence seizure:
- Myoclonic component
Rx – Valproate.

JME (Juvenile Myoclonic epilepsy):
- 12-18yrs.
- Myoclonic jerks morning.
- Drops things.
- Gene 6p gene
- Family History.
- GTCs seizures 90%
- 1/3 Absence seizures.

EEG of JME → Generalised 4-6 Hz spike + photic stimulation.

Rx – Valproate (lifelong) → Excellent.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page ___

Infantile spasms / Salaam / West

- Flexor contractions of Head, trunk & extremities.
- 4-8 months
- EEG → HYPSARRYTHMIA
  ↳ Generalised chaotic · high volume slow wave.
- Idiopathic / Cryptogenic → Good.
- Secondary → HIE, Structural malformation, Down's Syndrome, Tuberous sclerosis.

℞ :— ACTH → inhibit CRH. (DOC).
Vigabatrin → In Tuberous Sclerosis

STATUS EPILEPTICUS:

- Convulsion > 30 min

(OR)

Continuous s/s no regain of consciousness.

Vulnerable to hypoxia — Hippocampus, amygdala. Thalamus, subcortical areas.

℞ : — i.v. Lorazepam (DOC) — longer t½
0.05 mg/kg

- Midazolam + Phenytoin (20 mg/kg)
  Repeat 10 mg/kg — 10 mg/kg
  Phenobarbitone 20 mg/kg — 10 mg/kg
  i.v. Valproate 20-30 mg/kg
  Midazolam infusion 2-20 mcgf/kg/min.
  i.v. ~~Levetiracetam~~ Levetiracetam 20 mg/kg.
  GA propofol ; Thiopentone.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page ___

M/c/c of Status epilepticus → Febrile Seizures.

↓

℞ → per rectal diazepam / Buccal midazolam

Prevention of Febrile Seizures:

- No need
- Risk of Recurrance / concerned parents

↓

Intermittent prophylaxis Oral CLOBAZAM / DIAZEPAM

↳ New BZD

for 48-72 hrs of fever.

MENINGITIS:

Cause:

	India	World
< 2 months	Klebsiella E. coli	Gr. B / D Streptococci E. coli
2 months - 3yrs	H. influenzae type B	S. pneumoniae.
> 3yrs	S. pneumoniae	S. pneumoniae Nisseria

Acute Bacterial meningitis:

- 95% cases occurs b/w 1 month to 5yrs.
- Defect of complement system C_5-C_8 & properdin system
  - meningococcal infection.
- T-lymphocyte defects (eg - AIDS/Chemotherapy)
  - Listeria monocytogenes / cryptococcus.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page _____

- congenital/acquired defects across mucocutaneous barrier → Pneumococci d/t cribriform plate.
- Lumbosacral meningomyelocele & dermal sinus – staph. & enteric bacteria.
- Penetrating CNS trauma/CSF shunt infection – coagulase -ve staph.

Recurrent meningitis in CSF leak pt. M/c d/t pneumococcus.

Autosplenectomy (sickle cell dysfunction/asplenia)
→ Pneumococcal infection
H. influenzae
Nisseria
} capsulated.

Splenectomy vaccination time – 2wks before.

℞: Ceftriaxone (DOC)
DOC in Resistant pneumococci = Vancomycin + Ceftriaxone.

M/c Neurological sequel of meningitis:
- SNHL: via aqueduct cochlear.
- Can we prevent SNHL?
  - Dexamethasone
  - 0.15 mg/kg
  - 30-60 mins before antibiotics.

Post exposure prophylaxis to contacts & doctors –
H. influenzae & Nesseria → i.m. Single dose ceftriaxone.
- Rifampicin X 2 days
Doctors → Fluoroquinolones.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date __/__/__
Page

Q. 3 yrs old diagnosed to have HiB meningitis. Ix done before discharge → BERA.
(Brainstem evoked response audiometry)

ENCEPHALITIS:
M/c/c = Enteroviruses (80% cases).
M/c sporadic = HSV-1
M/c aseptic meningitis in unimmunized children
— mumps.

Q. Child c fever & coma
Focal seizures.
CSF: Hemorrhagic
CT: Temporal hypodense ; MRI → Hyperintense
— HSV-1 infection.

Localised temporal spike → HSV encephalitis.
↓
DOC: i.v. Acyclovir.

Mortality rate of untreated herpes = 70%.

AFP (Acute Flaccid paralysis):
- Acute onset < 6 weeks
- < 15 yrs
- Rule out pseudoparalysis
↳ Septic arthritis
Osteomyelitis
Scurvy; early syphilis
Hypokalemia → Hypotonia.

- Asymmetrical AFP:
• Paralytic polio.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page ___

• Traumatic neuritis → i.m. injection (d/t)

– Symmetrical AFP :

• Transverse myelitis
↳ Herpes, Varicella, mycoplasma
Level → Thoracic area.
Rx : high dose i.v. Methyl prednisolone.

• Guillian Barre Syndrome (AIDP)
↳ Demyelinating.
– Diarrhea (By Campylobacter jejunii).
– Weakness occurs after 10 days.
– Areflexia (DTR absent)
– Symmetric
– Ascending → diaphragm involved.
– Plateaus → 4wks.
– Sensory & autonomic changes.
– Also d/t Mycoplasma; salmonella; S. pneumoniae.

CSF	1st wk	2nd wk
Cells	10/hpf	10
Proteins	50 mg/dl	500

→ Albuminocytological dissociation

– B/L symmetric demyliniating illness.

IOC for calcification : CT scan.

Rx : i.v. Ig (2g/kg)
↓ fails
Plasmapheresis.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page _____

Iv Ig indications:

- ↳ Kawasaki
- ↳ AIDP (Acute inflammatory Demyelinating Polyradiculo neuropathy.
- ↳ Hypogammaglobulinemia
- ↳ Rh isoimmunisation.

General Pediatrics:

- Diarrhea
- ORS
- Zinc
- Malnutrition:

ORS:

ReSoMal	Mmol/L	Old (WHO-ORS)	New/Universal
45	Sodium	90 (Cholera stool loss)	75 (Rotavirus 50-70)
40	Potassium	20	20
125	Glucose	111	75 (for facilitate diffusion of Na in cell)
70	Chloride	80	65
7	Citrate	10	10
+Mn, Zn, Cu		311	245
300			Low osmolarity ORS.

Citrate improves the self life of ORS.

Resomal → Rehydration sol^{n} for malnutrition.

Hyperkalemia Hypernatremia.

Substrate concentration of components of ORS sol^{n}:

Nacl — 2.6gms
KCl — 1.5gms
Trisodium citrate — 2.9gm
Glucose, anhydrous — 13.5gm

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page ___

WHO dehydration:
- No
- Some → Skin pinch slowly; thirsty
- Severe → skin pinch very slowly; lethargic; oliguria.

Rx: No dehydration:
- Replace ongoing losses.
- 5-10 ml/kg.

Some dehydration:
- ORS 75 ml/kg over 4 hrs.

Severe dehydration:
- i.v. Ringer lactate 100 ml/kg.

	30 ml/kg	70 ml/kg
>1 yr	0.5 hr	2.5 hrs
<1 yr	1 hr	5 hrs.

WHO Zn in Acute Diarrhea:
- 2 X RDA for 2 weeks.

Zn dose	RDA	Diarrhea
>6 months	10 mg	20 mg.
< 6 months	5 mg	10 mg

Acrodermatitis enteropathica (periorificial dermatitis)
- d/t Zn deficiency.
- Nutritional
- Genetic (AR) → Intestinal Zn transporter defect.
- Low Zn levels.

Date ___/___/___
Page _____

- Improve on Zn supplement.

℞ — Zn (3mg/kg) — elemental Zn.

Malnutrition:

	Marasmus	Kwashiorkar
Muscle Wasting	++	++
Edema		++
Hepatomegaly		++
Low albumin		++
Pigment		++
Apetite	Voracious	Poor
Sensorium.	Alert	Lethargy.

Weight/Age Criteria (Indian Academy of Pediatrics)

- Normal >80% refrence.
- Grade I → 71-80%
- Grade II → 61-70%
- Grade III → 51-60%
- Grade IV → ≤ 50%

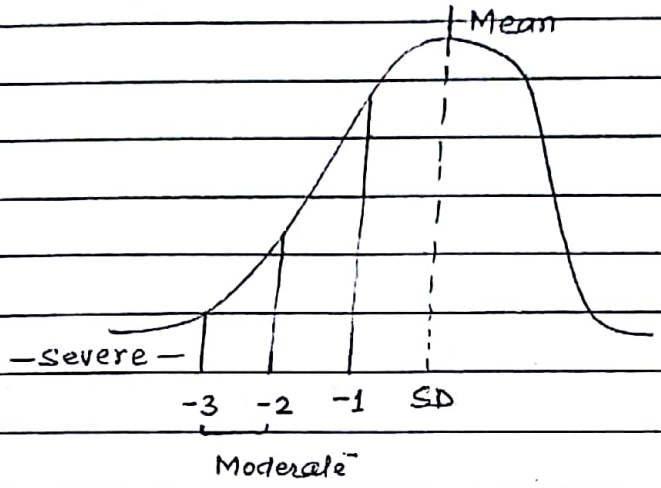
for Edema ⇒ Add K
↳ Bad marker.

WHO

	Moderate	Severe
Weight/Height	71-79%	≤ 70
Acute (wasting)		
(N) > 80% reference		
Height/age		
Chronic (stunting)	86-89%	<85%
(N) >90% reference		

Date ___/___/___
Page ___

Symmetrical Edema ++++



Severe Acute Malnutrition:

Among children — 6-59 months of age.

Any of the following:

① Weight for height below -3 Standard deviation (SD or Z scores) of the median WHO growth references.

② Visible severe wasting.

③ Presence of bipedal edema.

④ Mid-arm circumference below 11.5 cm.

Below 6 months → Mid-arm circumference can't be used.

Criteria for admission — If child fails apetite test.

Criteria for passing Apetite test.

Body wt. (kg)	Min^m amount of RUTF (Ready to use therapeutic factor) to be consumed for passing Apetite test (mL or grams)
< 4 kg	15 mL
4-6.9	25 mL

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page ___

7 – 9.9	35 ml
10 – 14.9	50 ml

Mx:

Complications of SAM

Mx c in 1st 2 day
- S = Sugar (Blood Sugar < 54 mg/dl (OR) < 3 mmol/L)
- H = Hypothermia (< 95.5F (OR) < 35.5°C)

c in 1st wk
- I = Infections (TB, Malaria, UTI)
- EL = Electrolyte (Hypokalemia & Hypernatremia)
- DE = Dehydration
- D = Deficiency of Vitamins & minerals.

	Step	PHASE: STABILIZATION Day 1-2	Days 3-7	REHABILITATION Weeks 2-6
1.	Hypoglycemia	→		
2.	Hypothermia	→		
3.	Dehydration	→		
4.	Electrolytes	→		→
5.	Infection	→		→
6.	Micronutrients	No iron		c iron →
7.	Cautious feeding	→		
8.	Catch up growth.		→	→
9.	Sensory stimulation	→		→
10.	Prepare for follow up.		→	→

Feeding Rehabilitation: Cautious feeding
- F-75 containing 75 kcal/100 ml & 0.9 g protein/100 ml.

B = Begin feeds
E = Energy dense feeds.
S = Stimulation
T = Tender love & care

Date ___/___/___
Page ___

Days	Frequency	Vol/kg/feed	Vol/kg/day
1-2	2hrly	11 ml	130 ml
3-5	3hrly	16 ml	130 ml
6-7	4hrly	22 ml.	130 ml

Energy dense feeds:

After the transition give:

- Frequent feeds (at least 4-hrly) of unlimited amounts of a catch-up formula.
- 150 - 220 kcal/kg/day.
- 4-6gm protein/kg/day.

Criteria for discharge:

- Weight for height > 80% of Reference standard.
- Edema should be absent for 2wks.
- MAC > 12.5cm.
- Weight gain > 5g/kg/day X 3days.
- Apetite is good.
- Complete antibiotics.
- Care taker should have learnt, motivated.

Weight for age < Acute (Wasting)
Chronic (Stunting)

Age independent criteria — MAC (>12.5cm)
6/w 1 to 5yrs.

Age independent index — Kanawati & McLaren index
Rao & Singh index
Dugdale index.
Quac stick index
Teliffe ratio

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page _____

Osmolality = 2 X[Na] + [Glucose]/18 + [BUN]/2.8.

Pediatric Nephrology:
- Development
- Oliguria; polyuria
- Hematuria
- AKI
- CKD
- Nephrotic, Nephritic
- UTI

} Topic

Development:

GFR:
- Newborn → 15 - 20 ml/min/1.73 m^2
- 3 months → 2/3rd adult
- Like adults → 2yrs of life.

- Tubular conc^n:
  - Adult morning urine osmolality >800 mosm/kg.
  - like adult 1yr.

- Nephrongenesis complete @ 36 wk of gestation.

- Barker's hypothesis:
  preterm & IUGR → hypertension in 2nd to 3rd decade
  ↳ Bcoz they have less no. of nephron.

- M/c asymptomatic abd. mass in 1-5yrs — Wilms tumour
- M/c abd. mass in newborn — Multicystic dysplastic kidney.
  ↓
  non-functional mass → bunch of grapes
  - 80% U/L.

Date ___/___/___
Page _____

OLIGURIA:

- U.O. < 1 ml/kg/hr
- Common in AKI & Acute GN.

Causes of Non oliguric AKI — Aminoglycosides
— Neonatal renal failure.
— Resolving ATN (polyuria)

POLYURIA:

- U.O. > 4-5 ml/kg/hr. [Polydipsia ; Polyurea]

Approach —

— Blood glucose [RBS > 200 mg/dl
or FBS > 126 mg/dl]
↳ DM

— Venous Blood Gas.

(i) Hypokalemic hypochloric metabolic alkalosis
↓
Barter Syndrome ; Gittle's [illegible] Syndrome.

Barter's Syndrome	Gitelman Syndrome.
— Severe ; Early.	— Mild ; Well preserved.
— Infancy	— Older child
— Antenatal → Polyhydramnios	— Hypo Mg
→ Nephrocalcinosis	— Hypocalciuria.
— Hypercalciuria	

(ii) Hyper Cl, hyper K, Normal anion gap metabolic acidosis
↓
Renal tubular acidosis.

(iii) Normal < Psychogenic] Water deprivation in psychogenic → Urine osmolality doubles
DI

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page ___

DI → Central / XLR Nephrogenic
- On Vasopressin challange, urine osmolality doubles by 100% in central. Hence differentiated from XLR Nephrogenic.

Q 4 yr; Polyuria & Polydipsia
Venous blood gas normal
Urine Osmolality
- Baseline 50 mosm/kg.
- On water deprivation = 60 mosm/kg
- On Vasopressin challange = 70 osm/kg.

Δ = XLR Nephrogenic DI
DOC = Thiazides.

Best method of GFR estimation = Insulin clearance.

Schwartz eGFR formula:
$$= \frac{K \times \text{height in cm}}{\text{creatinine (mg/dl)}}$$

Formula depends on:
- Height, muscle mass.
- Method of estimation of creatinine. [Jaffe's reaction].

S. creatinine is accurately measured by
- Enzyme assay / HPLC.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page _____

Value of k in Schwartz formula:

Low birth weight infant — 0.33
Normal infant 0-18 months — 0.45
Girls 2-16yrs — 0.55
Boys 2-13 yrs — 0.55
Boys 13-16yrs — 0.70

Schwartz method is independent of — Renal function.

HEMATURIA:

Red urine:
- Beet root
- Phenolphthalin
- Rifampicin

Q. 5yrs old, Red urine. Urine 1-2 RBCs/hpf — Intravascular hemolysis.

If Red urine → look for RBC's.

−	+
↓	↓
Hemoglobinuria	Hematuria
Myoglobinuria.	

Hematuria:
- Gross
- Microscope → >5 RBCs/hpf on centrifuged urine

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page _____

	Glomerular	Extra glomerular
Cause —	- IgA ; MPGN; PSGN.	- Cystitis; Stones; Idiopathic hypercalciuria ↓ 24hr urine Ca^{2+} > 4mg/kg.
Dysmorphic RBC	++	
Colour	Cola	Bright Red.
Pain	Painless	Painful.
Protein in urine	Proteinuria	

Recurrent Gross Hematuria:
- IgA
- MPGN
- Idiopathic hypercalciuria.

PSGN doesn't reoccur.

Alport's Syndrome:
Triad:
Eye : Ant. Lenticonus
Ear : SNHL
Kidney : 75% Boys ESRD before <30yr.

- 80% X linked > AR 15% > AD 5%
- Collagen IV → α-5 domain (in GB membr)

Good pasture Syndrome — d 3 domain of collagen IV abnormality.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page ___

INV: Electron Microscopy.
↳ Basement membr is irregular.
↳ Splitting of the lamina densa
↳ Lamellation
↳ Straited GBM
↳ Basket weave appearance (classical)

Slit lamp examn → Keratoconus
Leuliconus

Acute Kidney Injury (AKI):
Best Biomarker → ① Urine ~~&~~ NGAL
[Neutrophilic gelatinase. associated lipocalcin].
② Urine IL-18
③ Urine KIM-1 (Kidney injury molecule)
④ Urine L-FABP (Fatty acid binding protein).
⑤ Serum cystatin-C

Types:
- Prerenal
- Renal
- Post renal

PRERENAL — Hypotension, Hypoxia
Newborns ~~→~~; hypovolemia, burns, diarrhea.
RENAL — ATN > HUS
POST RENAL — Obstruction.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page _____

Indices	Pre renal	Renal
Urinary Sodium (meq/L)	< 20	> 40
Urine osmolality	> 500	< 300
B. urea / Creatinine ratio	> 20 : 1	< 20 : 1
Fractional excreation of Na%	< 1	> 1

$= \frac{\text{Urine Na}}{\text{Serum Na}} \times \frac{\text{Serum Cr}}{\text{Urine Cr}}$

Cause of AKI:

M/C/C in Children / Adults

Prerenal → ATN

↳ Hypoxia
Hypotension
Drugs ← Exo ← Toxins
Sepsis
Hemoglobinuria ← Endo
Myoglobinuria

Hemolytic Uremic Syndrome (HUS):

- Microangiopathic hemolytic anemia
- Thrombocytopenia
- AKI

- 90% follows diarrhea.
- Developed : E. coli 0157 : H7.
- Developing country : Shigella dysentaie type I.
- Germany June 2011 : E. coli 0104 : H4

SHIGA toxin → Cause Endothelial injury

↓

TMA (Thrombotic microangiopathy).

On PBS → Schistiocytes are Dstic of HUS

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Rx: ECULIZUMAB [DOC] → for PNH
↳ drug against C5.
If not available → Plasmapheresis.

Complications: (↱ Insensible losses – 400ml/m²)
- Fluid overload → Rx → Fluid restriction
- Hyperkalemia → cause arrythmia / Sudden death.
- Dilutional hypo Na. Rx – Restrict fluid
- Dilutional anemia Rx – PRBCs if Hb < 6
- Metabolic acidosis.
- Hyper PO4 → Hypo Ca
- HTN.

Hyperkalemia:
Rx – Glucose & insulin intravenously
↓
c/ in 10–15 min.

- Ca^{2+} stabilises cardiac membr potential.
↳ only given in ECG changes in Hyperkalemia.
↓
Calcium Gluconate i.v.

~~Mechanism~~: Hyperkalemia Rx:
Transcellular shift into cell.
- Insulin c/ Dextrose.
- Nebulised salbutamol.
Cardioprotective → i.v. Calcium Gluconate.
↑ delivery Na to distal
• Furosemide
• i.v. $NaHCO_3$
Dialysis . .

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page _____

· K-binders → Kaexylate polystyrene.

CKD (Chronic kidney disease):
Causes in Children —
- < 5yrs — Hypoplasia
  Dysplasia
  Posterior urethral valves (Boys)
- > 5yrs — Acquired
  ↳ GN / HUS.

Features:
A = Azotemia
Acidosis (metabolic)
Anemia (Normocytic Normochromic)
↳ Rx — S/C rh EPO (Erythropoietin).
B = Bone ds
C = Cardiovascular complication ↑
G = Growth failure ← Multifactorial causes.

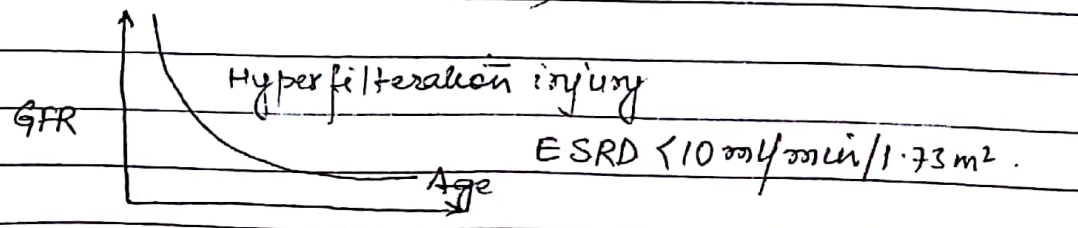
When GFR ↓ — 40-60 ml/min/1.73m²

↓ PO4 ↓ 1 α-OH

↑ PTH ↓ 1, 25 vit·D.

↓ Ca^{++}

Osteodystrophy
(CKD - MBD)



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page ___

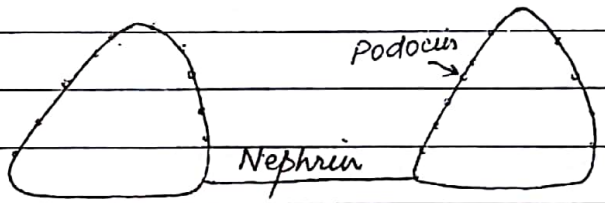
Nephrotic Syndrome:

- Proteinuria > 40 mg/m²/hr or > 2g/24hr
- Hypoproteinemia (Hypoalbuminemia)
- Hyperlipidemia (cholesterol > 200 mg/dl)
- Edema : S. Albumin < 2.5 g/dl.

On light microscopy — Minimal changes.
On Electron " — Effacement of foot processes of podocytes.

DOC : Prednisolone

Cause of Edema in NS → Na^+ & H_2O reabsorption.



Gene	Protein	Disease
NPHS1 (chr 19)	Nephrin	Finnish Congenital nephrotic (< 3 months) Rx : Nephrectomy.
NPHS2 (chr 1)	Podocin	Steroid resistant FSGS Rx : Calcineurin inhibitors ↳ Tacrolimus > Cyclosporine

Steroid toxic ; Steroid dependent

- Cushingoid
- HTN
- Post. subscapular cataract
- Impaired glucose tolerance
- Short

Rx – Oral cyclophosphamide for 12 wks.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date __/__/____
Page _____

UTI (Urinary Tract Infection):

Definition: Symptoms + Urine culture $>10^5$ CFU/ml

- Symptom — Fever
- E. coli
- Females [Boys <1yr]
- Ascending [<1yr → Hematogenous]

Best urine specimen — Suprapubic aspiration.

- Asymptomatic bacteriuria → Shouldn't be treated.

- M/c/c of UTI in children → VUR
  IOC for VUR → MCU

VUR:
- Polar scarring → DMSA nuclear scan
- Function → MAG3 / DTPA nuclear scan.
- Prophylaxis → Antibiotic of choice
  ↓
  Cotrimoxazole.

Sx → Reimplantation of both ureter.
↳ Indication:
- Breakthrough UTIs
- Deterioration of Renal function.

Date ___/___/___
Page ___

GLOMERULONEPHRITIS:

- Hematuria
- Edema
- HTN

M/c/c of GN → Post streptococcal GN.

Acute post streptococcal GN:

- follows infection of throat (serotype 12) / skin (serotype 49) c nephritogenic strains of β-hemolytic streptococci.
- Age → 5-12yrs
- Acute phase resolves in 4-6wks but urine normalises in 1yr.

	4-6wks
Edema	X
Cola Gross hematuria	X
HTN	X

C3 — 6-8wks normalese.

In urine – shows microscopic hematuria

↓

6-12 months. to resolve.

Sore throat → Δ by ASO titre (1-2wks)

Pyoderma → Δ by anti DNAase B (4-6wks)

95% PSGN resolves

5% PSGN → CKD

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Date ___/___/___
Page _____

Kidney Bx → Endothelial & mesangial cell proliferation ± obliteration of capillary lumen.
- Neutrophil infiltration

Immunofluorescence — Granular deposits of IgG & C_3
"STARY SKY"

Good pasture Syndrome has linear deposits of IgG & C_3.

Sub epithelial humps are seen in PSGN.

Q Persistently ↓ C_3 found in all except:
a) Post streptococcal GN (normalise after 6 Sticks)
b) Mesangio capillary GN
c) Cryoglobulinemia
d) SLE
e) IE
f) Shunt nephritis
g) Factor H- mutation → HUS.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Anesthesia

Handwritten Note

MBBS Help

http://mbbshelp.com

http://www.youtube.com/mbbshelp

http://www.facebook.com/mbbshelp.com

Name: _____

Subject: **Anesthesia**

ANAESTHESIA

ARVINDER SINGH

ARVINDERMOON SINGH

MBBSHELP.COM

MBBSHELP.COM

OBJECTIVES OF ANAESTHESIA :-

1> For analgesia
2> Muscle Relaxation
3> Amnesia

⇒ TRIAD OF ANAESTHESIA

HISTORY OF ANAESTHESIA :-

1> Term Anaesthesia was coined by OLIVER WANDELL HOLMES

2> FATHER OF ANAESTHESIA - JOHN SNOW

3> FATHER OF MODERN " W. T. G MORTEN

4> O_2 & N_2O SYNTHESISED By PRIESTLY

5> N_2O → provides analgesia

6> This property Discovered by Humphrey Davy →

1st clinical Demonstration of N_2O anaesthesia was given by Horace Wells → he used N_2O as dental anaesthesia - 1844

7> Ether - Sweet Oil of vitriol

1st clinical demonstration was given by W. T. G. MORTEN on 16/10/1846.

↓

World Anaesthesia Day

8> Cocaine → 1st local anaesthesia.

also shows vasoconstriction.

Nowadays, ~~used~~ 4% sol^n is used as topical anaesthesia for eye

It can cause addiction.

9> 1st Spinal Anaesthesia was given by AUGUST BIER

Cocaine was the 1st drug to be used for spinal anaesthesia

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

10> Curare-

Harold Griffith was the 1st person to use curare ~~use~~ for Muscle Relaxation

11> 1st E.T. Intubation was done by William Mecwen & was made popular by Evan Magill.

ASA GRADING (American Society of Anaesthesiologist)

It determines physical status of patient

Although commonly used for Risk Assesment ; it is not ~~indeed~~ intended to be used for assessment of Risk.

(I) - (N) Healthy Pt
No Systemic Disease
Minimal or NO alcohol Intake
Pt is a non smoker

(II) - Pt. c mild systemic Disease c is well controlled
c no functional Limitation.
eg. well controlled DM , HTN
Pts c BMI of 30-40
♀
Pts c mild lung Disease
Current smoker
Social Drinker

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

(III) - Pt. c severe Systemic Disease c functional Limitation.

eg. - uncontrolled DM & HTN
- Pt BMI >40
- Alcohol Dependence
- EF (40-45%) [Mod. Reduc^{n} of EF]
- Pt. c end stage Renal Disease on regular dialysis.
- > 3 months H/o - MI/ CVA/ TIA/ stents.

(IV) - Severe Systemic Disease c is a constant threat to life of patient

eg. - unstable angina
- < 3month H/o - MI/ CVA/ TIA/ stents
- ARDS
- End stage Renal Disease on irregular dialysis.
- Severe Reduc^{n} of EF.

(V) - Moribound Pt. who is unlikely to survive c out S_x

Rupture thoracic or abdominal aneurysm
Massive intracranial bleed c midline shift
Massive trauma

(VI) - Brain dead pts. - for organ donation

If any of the pt come in emergency, (E) is written before ASA Grading

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

DRAWBACK of ASA Grading :-
surgical risks are not covered

MALLAMPATI GRADING

M/C airway examⁿ done ☆
It is used to asses size of tongue for laryngoscopy

(I) - Facial Pillars
Uvula ī Tip
Soft palate

(II) - Uvula ī out tip
Soft palate

(III) - only soft palate
(IV) - only hard palate
→ Difficult Intubations.

OTHER TESTS

1> Thyromental Distance = Dist Betⁿ Mentum • Thyroid
should be → > 6.5cm

2> Sternomental Distance - > 12.5 cm [mentum → sternum]

3> Adequate Mouth opening
Gap Betⁿ upper & Lower Incisors
should be → > 3 fingers breadth or 2cm

4) Movement of cervical spine

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Difficult in ankylosing spondylitis pt.

MANAGEMENT OF PRE-EXISTING DRUG THERAPY

I> MAO Inhibitors -

Older MAOI should be stopped 3 wks before surgery.

They cause sev. sympathetic Rxn i Pethidine

Newer MAOI SELEGILINE can be continued uptil 1 day before surgery

II> LEVODOPA -

Continued

III> ANTICONVULSANTS -

should be continued

Morning dose to be given

IV> OHD / Insulin -

Morning Dose of is omitted becoz pt is fasting.

Ideal Fasting Period.

Adults → Solid - 6hrs

Clear liquid - 4hrs.

Breast feeding Infant - Solid - 4hrs

Clear liquid - 2hrs

If infant is on formula feed or non-human milk → then it should be 6hours

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

For Major Sx,
Pt is shifted from OHD to Insulin (48hrs) before Sx.

VI) ORAL ANTICOAGULANTS / WARFARIN - Q

INR - 2-3

Stopped 4-5 days before Sx

For Sx INR should be <1.5

For emergency Sx, Vit K / FFP can be used.

For LMWH,
Last Dose - 12-14 hrs before Sx

For unfractioned Heparin, uptil 6hrs before Sx

VII) OCPs -
Should be stopped 4 weeks before Sx
Only Progesterone pill can be continued

(VIII) Anti-HTN - Q
All Anti HTN should be continued if possible
exception of ACEI / ARB
↓
can cause Refractory hypotension during anaesthesia

β blockers are preferred agents to ↓ peri operative mortality

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

VIII) Anti- Anginal -
~~Nco~~ continued

IX) Thyroid Drugs -
continued

X) LITHIUM - Q
should be stopped 2 days before Sx
It prolongs non. depolarising m/s relaxants.

XI) STEROIDS- Q
should be continued, morning dose to be given.

Steroid intake suppresses endogeneous cortisol. If it is withdrawn before Sx, there may be refractory hypotension.

XII) SMOKING- Q
should ideally be stopped 6-8 weeks before Sx

In smokers - mucociliary ~~clearance~~ movement is inhibited
↓
So clearance is impaired.

If stopped 12-24 hrs
↓
↓ CO-Hb level
↓
will shift O_2-Hb dissociation to Right.

Smoking also ↓ surfactant level. & also potency of aminosteroid m/s relaxants.

XIII) ANTI-PLATELET DRUGS Q

1) ASPIRIN-

Low Dose (75mg)
↓
should be contenued
except for closed space surgeries

eg. Sx of Brain, spinal cord & Eye

>75mg
↓
should be stopped 3-5 days before Sx

2) CLOPIDOGREL-
should be stopped 7 days before Sx

3) TICLOPIDINE- Q.
should be stopped 14 days before Sx

XIV) HERBAL MEDICATIONS-
should be stopped 6-8 wks before Sx

XV) STATINS-
should be continued

PRE-MEDICATION

AIMS -

1> To ↓ anxiety ⇒ Longer acting BZD - LORAZEPAM
For Day-care Sx -
Midazolam
Temazepam

2>

2> Provide sedation + amnesia

3> Promote hemodynamic stability

4> To ↓ aspiration.
Gastric juice - PPI + H_2 blockers

Aspiration in ♀ = MENDELSON SYNDROME
↙ ↘
pH < 2.5 Vol. > 25mL

5> To provide analgesia
Morphine or Pethidine can be used
↓
Shouldn't be used in renal failure pt.
As its metabolite Nor-pethidine accumulate + can cause convulsions

6> To Prevent Post-Op Nausea + vomiting
- Ondansetron + Metoclopramide
↓
Main S/E = Headache

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

7) To control Infection
Broad spectrum Antibiotics
1st Dose → upto 1 hour before skin incision
If Sx prolongs for > 6 hours ⇒ Antibiotic dose should be repeated

8) To control oral secretions
Atropine or Glycopyrolate

ANAESTHESIA MACHINE (A.M.)

1st used in 1917.
Also known as EDMUND GASKIN BOYLE Anaesthesia machine
continuous flow- type of anaesthesia machine
↓
fresh gas flow both during Inspiration & expiration

A.M.

HIGH PRESSURE SYSTEM	INTERMEDIATE PRESSURE SYSTEM	LOW PRESSURE SYSTEM
- Cylinders	- Flow control valve	Rotameter
- Yolk Assembly	- O_2 + N_2O Proportionating devices	Vapouriser
- Pressure Gauge	- O_2 flush	Common Gas outlet
- Pressure Reducing Valve	- Central supply Lines	

HIGH PRESSURE SYSTEM

1> CYLINDERS

Made up of special alloy - Mb Steel

In MRI room, cylinders are made of Aluminium

Size of cylinder - A to H
↓ Smallest ↓ Largest

Cylinder M/c by used = E.
↓ Contain 660 L of O_2

Type D - contains 470 L of O_2.

COLOUR CODIND OF CYLINDER

O_2 → Black Body & White Shoulder

N_2O → Blue

CO_2 → Grey

Cyclopropane - Orange

Helium - Brown

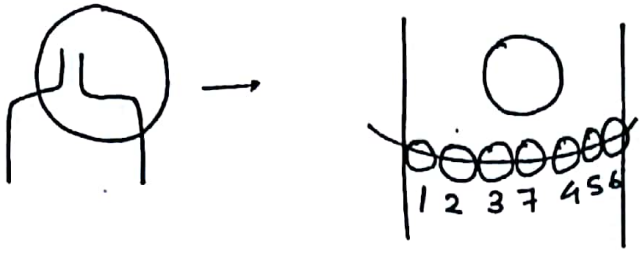
Entonox - ~~50%~~ 50% O_2 + 50% N_2O
Blue Body & Blue + White Shoulder

If O_2 is replaced by N_2O ⇒ Hypoxia occurs

M/c type of hypoxia during anaesthesia = Hypoxic Hypoxia

PIN - INDEX SYSTEM

It prevents wrong fitting of anaesthesia cylinders



O_2 = 2, 5

N_2O = 3, 5

CO_2 = 2, 6

cyclopropane : 3, 6

to.
Entonox = 7

Pin. Index no. can fail if wrong gas ~~can~~ is filled inside cylinder &

* pins of Pin Index System ~~can~~ are damaged.

TARE WEIGHT -
wt. of empty cylinder.

FILLING RATIO -
Ratio of $\frac{\text{\% of wt. of gas}}{\text{wt. of water cylinder can hold at } 60^\circ F}$

It prevents overfilling of cylinder

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

WOOD'S METAL

→ Alloy of low melting Point ∴ is present between the cylinder wall & Body

→ In case of fire, this melts & forms a small gap through ∴ leakage of gas occurs.

N_2O, CO_2, cyclopropane are stored in cylinders in liquid form.

O_2 can also be stored in liq. form.

Critical Temp. for O_2 = −119°c.

Each 1mL of liq O_2 gives 840 mL of gas

Critical Temp for N_2O is 36.5°c

2> **YOLK ASSEMBLY**

It attaches cylinder into anaesthesia machine

Pins of Pin Index System are part of Yolk Assembly

3> **PRESSURE GAUZE**

It measures pressure inside cylinder

Most commonly used is Bourdons ~~P~~ Pressure Gauge

↓

It works well ∵ O_2 as it is stored in gaseous form

In Liq gases, even if amount of is ↓ Pressure remains same until it finishes completely → then becomes zero

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

So, tare wt. is Imp in case of liq gases.

4) **PRESSURE REDUCING VALVE**

O_2 = 2000 psig
N_2O = 750 psig
Cyclopropane = 600 psig. } → May cause BAROTRAUMA

Pressure Reducing valve ↓ this pressure to 35-45 psig

Cyclopropane doesn't req. Pressure Reducing valve

1 atm = **14.6 psi**

INTERMEDIATE PRESSURE SYSTEM

1> **FLOW CONTROL VALVES**

To control flow rate of gases

O_2 - White in colour
Bigger ∴ Broader serrations

N_2O - Blue in colour
Smaller ∴ Finer serrations

2> **O_2-N_2O PROPORTIONATING DEVICES**

⇒ In Earlier machines, initially 100% O_2 then 100% N_2O
↓
[Risk of Hypoxia].

⑥ ⇒ Master : Slave Device-
N_2O is delivered when O_2 is switched off

⇒ O_2 + N_2O proportionating Device-
The devices provide fixed % of total flow as O_2
The min. % of O_2 delivered by these are 25%.

O_2 Req. during Gen. Anaesthesia = 30%

3> **O_2 FLUSH**

It delivers emergency O_2 @ 35-75 L/min

4> **CENTRAL SUPPLY LINE**

Made up of copper.
Central lines are colour coded

O_2 = White
N_2O = Blue
Air = Black
Suction/Vacuum = Yellow

They also have safety Mechanism
↓
DISS (Diameter Index Safety System)
↳ t consists of non-interchangeable different diameter screws for O_2 & N_2O.
Pressure Inside Central Supply Line = 45-55 psig

LOW PRESSURE SYSTEM

ROTAMETER

→ It consists of Glass Tubes known as Thorpe's Tube
→ Made up of special Glass → K/n/a PYREX GLASS
→ Glass tubes are caliberated according to the Gase they carry.
→ These Glass tubes have variable orifice but constant Pressure
→ These Glass tubes contain an indicator for gas flow → Bobbin
↓
Made up of Aluminium

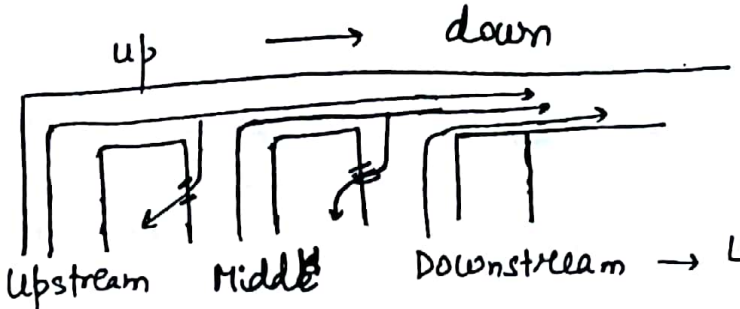
← upper part denotes gas flow

3L

CAUSES OF INACCURATE READING OF FLOW METER :-

1) Dirt
2) Static electricity
3) Vertical alignment
4) Cracked Glass tubes
5) Back flow of gases

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp



→ Less chance of hypoxia

O_2 should always be downstream to all other gases

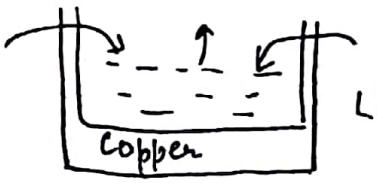
VAPOURISERS

→ used to provide Inhalational Agents like
Halothane
Desflurane
Sevoflurane etc to the pt.

→ Most Imp. Property on ∝ delivery of agent depend is Vapour Pressure of agent.

→ Vapourisers are made of Copper
↓
Good Thermal Conductivity, Specific heat.

→ Vapourisers are Temp. & Pressure Compensated.
⇓
Any change in temp. & pressure doesn't affect delivery of agent

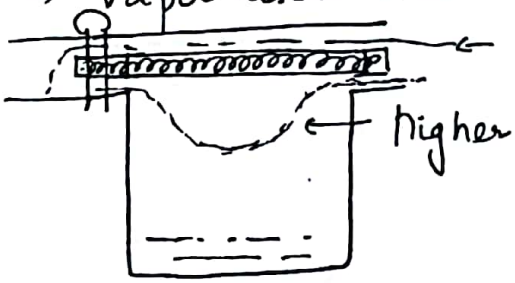


Latent heat of vapourisation released.
↓
Temp. reduces.

} Copper transfer Atmospheric temp to maintain

→ At higher altitude, vapourisers deliver higher O_2 to maintain same partial pressure

→ Vapouriser are Variable Bypass vapouriser



→ Higher the amount of O_2-N_2O passes through vapouriser
↳ higher the conc" of gas.

→ Only exception to variable Bypass
↳ Vapouriser of DESFLURANE
↓
Tec-6 vapouriser.

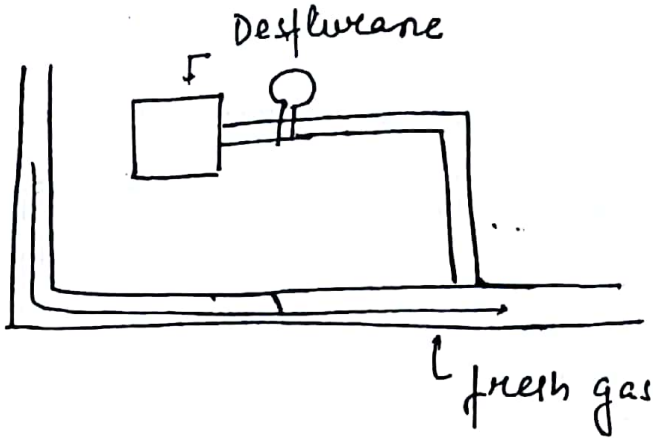
* Desflurane
↳ ↑ B.P. = 23°c
↳ ↑ vapour Pressure

→ Desflurane vapouriser is heated to a temp. of 39°c to achieve this ↑ vapour pressure.

→ To give it in clinical conc", 60-70 Litres of fresh gas is required. ∴ is not possible by variable Bypass vapouriser (6-7L)

→ Vapours of Desflurane are directly injected into the fresh gas flow

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp



Desflurane is directly injected into fresh gas flow.

COLOUR CODING OF VAPOURISER-

Halothane - Red

Isoflurane - Purple

Desflurane - Blue

Sevoflurane - Yellow

All gases come out through common gas outlet.
A Circuit is attached to the common gas outlet

Wheels of Anaesthesia Machine are made Antistatic by addition of Carbon

O_2 CONCENTRATORS

Consist of ~~Ze~~ ZEOLITE & $Al(OH)_3$ Lattice

- absorbs N_2 from air. ⇒ only O_2 will be left
- Provide 95% O_2 not 100%
- Electronically powered
- Rest 5% ~~are~~ - Argon & is inert gas.

O_2 ANALYSER

It measures O_2 leaving the machine
It is usually put upon Inspiratory limb of circuit.

CIRCUITS

They are connecton bet' the anaesthesia machine & the patient.
They provide oxygenation, ventilation.

3 types

1) OPEN CIRCUIT

It consists of a mask → Schimmelbusch mask.
Method is kpha → Open drop method
Agents used are ether, chloroform.

ADVANTAGE
- Easy to use

DIS →
- Cannot control conc" pt inhales
- Theatre pollution
- When pt becomes unconscious, pt. may hypoventilate leading to hypoxia

2) SEMI-OPEN / SEMI CLOSED SYSTEM.

M/c ly used is ~~MABE~~ MAPLESON SYSTEM

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

6 types

(A) MAPLESUM A

↳ MAGILL CIRCUIT.

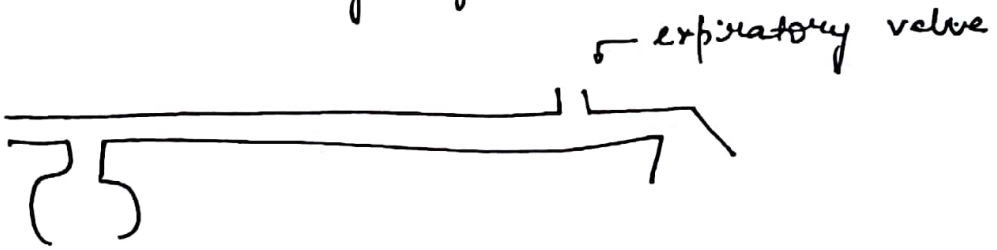
→ Best for spontaneous ventilation.

→ Fresh Gas flow required to prevent Re-Breathing = Minute vol. of Patient

Q. Minute vol = Tidal vol. x R.R.

500 mL x 14 = 7L

T.V. = 7 mL /kg Body wt



Modification of Maplesum A = LACK circuit

↓

Coaxial circuit.

Outer tube = Inspiratory

Inner " = Expiratory

(B) obselete

(C) also k/n/c = waters to * fro circuit.

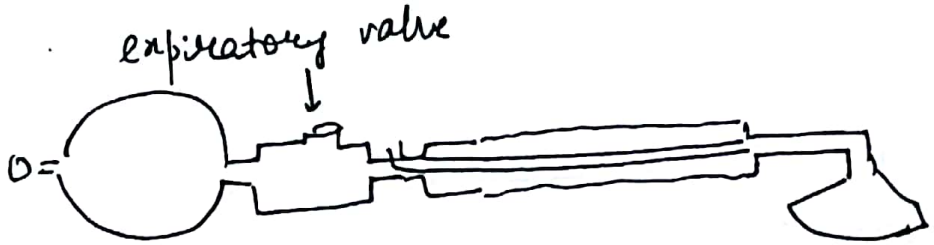
used for transportation & Resuscitation.

(D) also k/n/a = Bain circuit

Best for controlled Ventilation

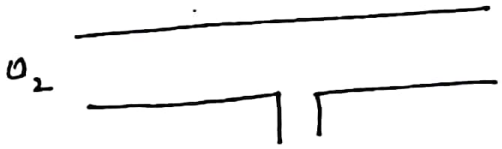
Fresh Gas Flow req = 1.6 x minute vol. of pt.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp



Coaxial Circuit
outer = expiratory
Inner = Inspiratory

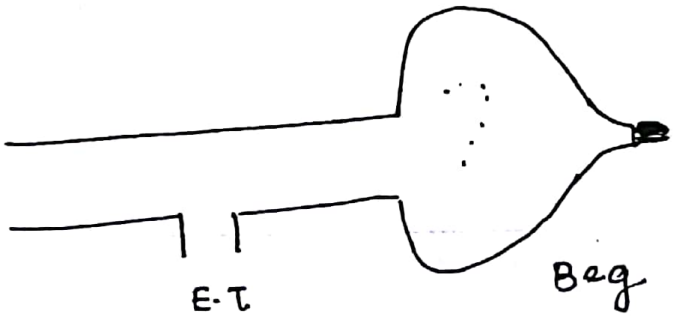
(E) also k/h/a - AYRE'S T PIECE



used in spontaneously Breathing pt
Neonates

No valve tht, no Breathing Bag

(F)



JACKSON. REES MODIFICATION of AYRE's T PIECE

used in children < 6yrs. or < 20 kg

Both (E) & (F) are valveless circuit
Do not contain any valves

3> CLOSED CIRCUIT

$O_2 + N_2O$ + Inhalational Agent → $O_2 + N_2O$ + I:A.

+

CO_2

← Inspired Gas → ← Expired Gas →

If CO_2 removed → gases can be reused

SODALIME

Gases passed through sodalime

It absorbs CO_2

Leading to ↓ req. of fresh Gas flow.

It consists of $Ca(OH)_2$ - 94%

NaOH - 5% as Catalyst

KOH = 1% as activator

Silica for Hardness.

Each 100 gm of sodalime absorbs 23-26 L of CO_2.

Indicator is added ∴ Changes colour of ✱ Sodalime

Ethyl violet → White to violet

Phenophthalin → white to pink

Clayton yellow → Red to yellow

Mimosa 2 → Red to white

SIZE of granules = 4-8 mesh size in Sodalime

C/I -

1) TRILENE

It reacts ē trielene to form Dichloroacetylene
↓
neurotoxic or
phosgene → ARDS

Alternative to Sodalime — BERYLIME
↓
$Ca(OH)_2$ – 80%
$Ba(OH)_2$ – 20%

This mix. is less caustic & hardness occurs due to H_2O of crystallization.

Beryleme causes higher incidence of airway fire, ∴ less commonly used

* Management of airway fire.

→ It occurs most commonly during <u>vocal cord Injury ē Laser</u>

<u>STEPS</u>

1) stop ventilation & remove tracheal tube
2) Turn off O_2, disconnect circuit from anaesthesia machine
3) ~~Ver~~ Submerge tube in water
4) Ventilate ē 100% O_2 & re-intubate
5) Perform fibre optic Bronchoscopy & assess airway damage

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

6) Bronchodilators, steroids, Antibiotics if indicated.

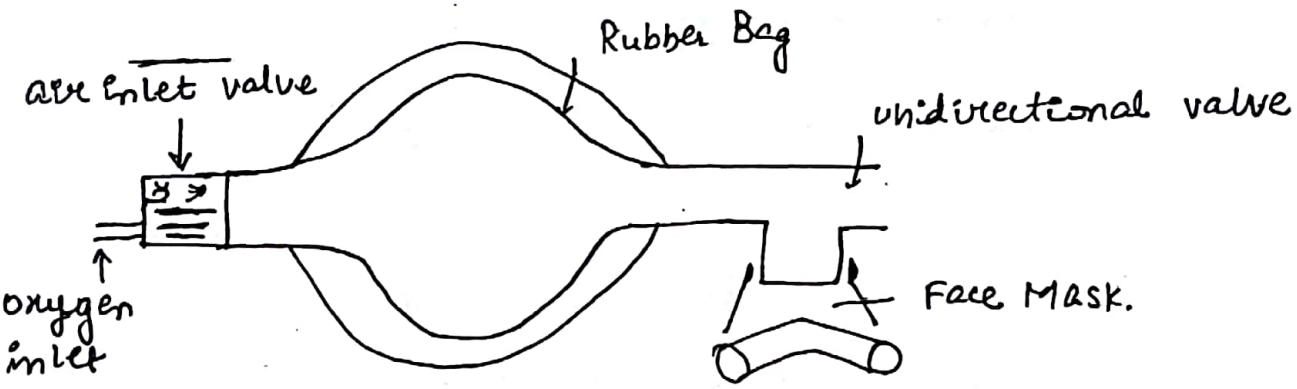
The closed circuit is Best, for maintaining Depth of Anaesthesia.

2) Removal of Expired Gas

3) Humidifaction.

EQUIPMENTS IN ANAESTHESIA

1) AMBU (Artificial Mannual Breathing Unit)



Max. % of O_2 that can be delivered by AMBU Bag = 100%.

It comes in various sizes

Neonate - 250 mL

Children - 500mL

Adults - 1-2L

2) FACE MASK

- It is used to provide seal for Positive Pressure Ventilation.
- made up of Anti-Static Rubber

- Comes in different size

3) GUEDEL'S OROPHARYNGEAL AIRWAY

→ prevents fall of tongue during anaesthesia

→ Correct size depends upon Dist. Bet^n Angle of Mouth & Tragus

4) NASOPHARYNGEAL AIRWAY

→ Prevents fall of tongue

→ Correct size depends upon Distance Between tip of NOSE & Tragus

5) LMA (Laryngeal Mask Airway)

→ Supraglottic Devices

→ They are not definitive airway

→ ADVANTAGE

- Easy to insert
- They do not require laryngoscopy or M/s Relaxation
- Can be used for difficult airway & CPR

Size of LMA depend upon wt. of pt

1-5 Kg → 1

5-10 kg - 1.5

10-20 kg - 2

20-30 kg - 2.5

30-50 kg → 3 → In children
50-70 kg → 4 → In adult
70-100 kg → 5
>100 kg → 6

Largest possible size of LMA should be inserted as it forms Better oropharyngeal seal.

Disadvantage
Higher incidence of sore throat

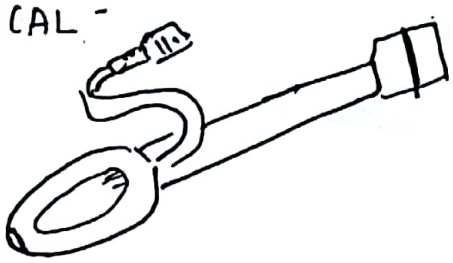
C/I of LMA.
1) full stomach pt. eg
TEF
Recent meal

2) Pts having low pulmonary compliance
eg. morbidly obese pts.

3) Pts ⊂ oral pathologies
eg. Pharyngeal abscess
Ludwig angina
Inadequate ~~mo~~/small mouth opening

TYPES

1) CLASSICAL -



can be autoclaved upto 40 times

Tip of LMA corresponds to oesophagus

2) FLEXOMETALLIC LMA -

Tube doesn't kink

3) FAST TRAC LMA / INTUBATING LMA -

Designed for difficult intubation

4) PROSEAL LMA.

Designed for PPV

Any ↑ in gastric pressure → comes out through drain tube

Disposable proseal LMA = Supreme LMA

DEAD SPACE

Decreasing Order ⟶

Face Mask > LMA > Endotracheal tube > Tracheostomy

6> LARYNGOSCOPE -

→ M/cly used - Macintosh Blade

→ Straight → MILLER BLADE

→ Laryngoscope should always be held in (L) Hand

→ Inserted from (R) side of mouth.

→ Tongue deviated to (L) side

→ Laryngoscope blade should never be levered upon upper Incisors

→ Position of Laryngoscopy -
Extension @ atlanto-occipital Jt. + Flexion in neck. → sniffing position

⇓

It brings oral, laryngeal, pharyngeal axis in a straight line

→ M/c structures Damaged during Laryngoscopy
↳ upper Incisors

→ STRESS RESPONSE TO LARYNGOSCOPY
↳ Sympathetic response
HTN, Tachycardia, Arrhythmia

→ Response can be ↓ by → β blockers
→ Opoids
→ Deepening anaesthesia c volatile agents
→ Lignocaine

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

7) ENDOTRACHEAL INTUBATION

2 most commonly used Tubes

RED RUBBER TUBE	PVC TUBE
1) Reusable	1) Disposable
2) Expensive	2) Cheap
3) Higher tendency to kink	3) Less tendency to kink
4) MURPHY EYE ⊖	4) Murphy eye +nt
5) Cuff → High Pressure Low Volume	5) Cuff → High volume Low pressure
Due to high pressure, ↑ chances of tracheal injury	↓ chances of tracheal injur
6) used for shorter duration	6) used for longer duration
7) Non-transparent	7) Transparent
8) Radiolucent	8) Radio-opaque
9) They have lower incidence of sore throat	9) ↑ incidence of sore throat

MURPHY'S EYES →

- When tube get blocked, through murphy's eye ventilation can be continued
- small hole is present in lateral wall of tube to prevent blockage.

M/c size of tube used for adult ♂ = 8, 8.5

♀ = 7, 7.5

Length of tube ± comes at upper incisor =

♂ 21-22 cm

♀ - 20-21 cm

Cuff of tube should lie in upper trachea 2-2.5 cm below vocal ~~to~~ cords

Cuff pressure should never exceed 30 cm of H_2O

If > 30 cm H_2O → Tracheal Mucosal necrosis

H/c of vocal cord Paralysis → Compression of ant. Br. of Recurrent laryngeal n/v

↓

C is compressed by cuff of tube

CONFIRMATION OF TUBE IN TRACHEA

1) ↑ - ↓ of chest.

2) Fogging of tube → seen in PVC tube

3) CXR → seen in PVC tube

4) Auscultation.

RA LA

RB LB → Most Imp. area for auscultation.

Breath sound confirms tube is above carina

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

GOLDEN STD FOR INTUBATION

↓

CAPNOGRAPHY

↓

$ETCO_2$ → 35-45 mm of Hg

EU - Exp. upstroke
EP - Exp. plateau
ID - Insp. downstroke

* FLAT CAPNOGRAM–

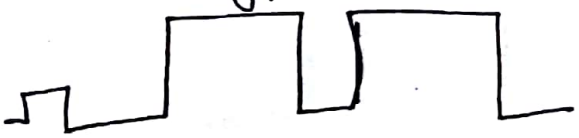
1) Disconnect of circuit
2) Incidental extubation
3) Ventilatory failure
4) Oesophageal Intubation
5) Cardiac arrest

* Sudden ↓ in $ETCO_2$ -

1) Venous air embolism
   ↳ occurs M/c/ly in Sitting Position for Post. fossa surgeries
   Most lethal complication of sitting position

* SUDDEN ↑ in $ETCO_2$ -

1) Malignant Hyperthermia



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

2) Bronchospasm

SHARK - FIN APPEARANCE.

→

CURARE NOTCH

. Notch shows requirement of M/s relaxant during anaesthesia

→

EXP. VALVE LEAK

→

when there is CO_2 in inspiration

Hypoventilation

SPECIAL TYPE OF ENDOTRACHEAL TUBE -

1) RAE tube [® angled Endotracheal Tube]

→ These tube have preformed shape & are used for cleft lip & cleft palate Sx

2) FLEXOMETALLIC TUBE/ SPIRAL EMBEDDED TUBE

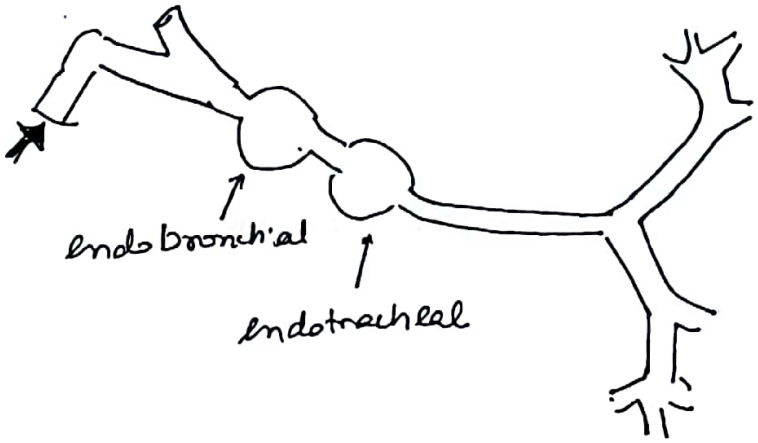
→ Do not kink

→ used for . Head & Neck Sx in prone position
. Spine Sx

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

3) DOUBLE LUMEN TUBE

Used for Single Lung or 1 Lung ventilation.



1 lung can be ventelated by this

In single Lung ventilation = shunt fraction = 50%.

If shunt fraction >50% ⇒ HYPOXIA

Final position of double Lumen Tube is confirmed by fibre optic Bronchoscopy

M/c cause of Hypoxia during single lung ventelation ↑ shunt fraction.

E.T. In CHILDREN

→ uncuffed tube are used ≤ 6yrs

→ Minimal permissible Leak is allowed

→ Leak should be audible

→ If Leak is ↑ Bellow's of ventilator may collapse

↓

Mx

change the tube to a bigger size

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Flow Rate $\propto r^4$

Small ↓ in airway causes large ↓ in flowrate.
So uncuffed tube used

⇒ SIZE of TUBE in children depends upon Age of child

Premature	2.5-3
Neonate	3-3.5
Infant	3.5-4
1-3 yrs	4-4.5
3-8 yrs	4.5-5.5
8-12 yrs	5.5-6] — cuffed tube

• No. of tube → Internal diameter 'd' in mm

⇒ Length of tube, $L = \frac{\text{Age (yrs)}}{2} + 12\text{cm}$

NASOTRACHEAL INTUBATION

INDICATIONS-

1) # Mandible
2) Oral Sx
3) Inadequate mouth opening
4) awake fibreoptic Intubation.
5) If tube is to be kept for longer time

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

C/I :-

1) # Base of skull
2) CSF Rhinorrhoea
3) Nasal mass →
4) Adenoids
5) Coagulopathy
   eg. hemophilia
   platelet disorder

Other Features :-

1) ↓ movement of E.T.
2) good oral hygiene
3) Infection rate of 15-20%
4) Nasal mucosal Damage

C/I to (B) NASAL , ORAL INTUBATION

1) Sev Laryngeal oedema
2) Sev. Epiglottitis
3) Laryngotracheobronchitis

⇓

Tracheostomy should be done in these cases

DIFFICULT AIRWAY ALGORITHM

PLAN (A) → (N) Laryngoscopy + Intubation → Successful

↓

Fail

↓

PLAN (B) → use of assisted ~~Device~~ Device

↓

LMA / LMA → confirm c Fibreoptic Bronchoscope

↓

Fail

↓

PLAN (C)

Maintain O_2 saturation

Bag, Mask ventilation → AIM: make pt. conscious, postpone Sx

↓

Fail

↓

PLAN (D)

Retry LMA → Needle cricothyrotomy

ventilation used is HFJV

(High frequency Jet Ventilation)

↓

~~to~~ Tracheostomy

I.V. ANAESTHETIC AGENTS

BARBITURATES

Thiopentone
Methohexitol

NON-BARBITURATES

- BZD
- Etomidate
- Ketamine
- Propofol

All these drugs ~~except~~ act upon GABA except ketamine

↓

NMDA (R)

↓

Xenon, N_2O } also act upon NMDA

STEROIDAL ANAESTHETIC

1) Althesin
2) Eltanolone
3) Propanidid

⇒ cause ↑ incidence of allergic Rxn
So withdrawn

MAX ALLERGIC Rxn

M/S Relaxant > Latex Products > Antibiotic

Potency of Anaesthetic Agent α Lipid Solubility

17 THIOPENTONE

→ Used 1st Time in 1934

→ Yellow amorphous powder & contains 6% anhydrous Sodium carbonate

→ Prepared, stored in N_2 atmosphere as it reacts & atmospheric CO_2 & precipitates

→ pH - 10.5
Highly alkaline
Shouldn't be mixed & RL
Can be mixed & → NS
5% Dextrose.
Distilled water

→ DOSE - 3-5 mg/kg Body wt
Adequate Dose → Loss of Eyelash Reflex

→ Conc^n = 2.5%
>2.5% causes ⇒ Pain of Injec^n
+
Venous Thrombosis

<2.5% causes ⇒ Awareness during anaesthesia

BISPECTRAL INDEX

→ Type of Frontal EEG
→ Used to detect awareness / depth of anaesthesia

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

For Adequate sedation, BIS value = 65 - 85

Adequate anaesthesia → 40 - 65

Cortical depression → <40

ONSET of thiopentone - 30 sec

Last for 15 - 20 min.

Pt Regains consciousness by thiopentone by Redistribution from

½ life of thiopentone = 10 - 12 hrs

Thiopentone contains sulphur atom

↓

c markedly ↑ Lipid Solubility

It is metabolised in Liver (Hepatic Oxidation)

It is a microsomal enzyme Inducer

SYSTEMIC EFFECTS

1> CVS → Peripheral vasodilatation

↓ venous return

↓

↓ BP

↓

↑ HR

Thiopentone cause Hypotension & Tachycardia

Tachycardia also occurs due to central vagolytic action

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

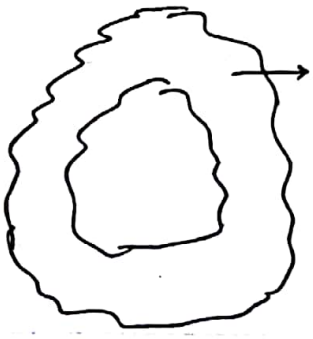
2) Resp- a) causes Resp. depression
↓
Apnea
↓
Rx = IPPV ± Bag + Mask

3) b) Histamine Release-
∴ Pt shouldn't be used in Asthmatic pt

c) may cause Reflex Bronchospasm, Laryngospasm

3> CNS a) potent cerebral vasoconstrictor
ICP ↓
DOC for Head Injury Pts

b) also markedly ↓ cerebral Metabolic Rate
∴ provide cerebral protection



c) Potent anticonvulsant
DOC for epilepsy pts

4> Anti-analgesic
↳ Lowers threshold for Pain.

5> Poor M/s Relaxant

6> Crosses Placenta → Fetal Depression

7) May show Anti-thyroid Action.

C/I For Thiopentone

1) Acute Intermittent Porphyria
   Variegate Porphyria
   can be safely used in Porphyria Cutanea Tarda
   * Other drugs ppt. Porphyria -
     Etomidate
     Pentazocine
     Ketamine (rats)

   Doc for Porphyria pt → PROPOFOL

2) Accidental Intra-arterial Inje" o-
   It occurs most commonly in anticubetal fossa
   Thiopentone ppts in arterial blood
   ↓
   Causes intense vasospasm of artery

   C/F → Pt complains of
   Sharp severe pain
   Loss of distal Pulse
   whiteness + Blanching of hands

   Mx - 1) Do not remove the needle
   2) Flush c NS
   3) Vasodilatons → Lignocaine
   4) Heparin to prevent thrombosis
   5) Stellate ganglion block. for

Brachial plexus block for peripheral (~~ut~~) vasodilatation (upper Limb)

2> METHOHEXITOL

1> ~~Protecting~~ Short acting

2) Cardio stable

3) may cause convulsions in small doses

4) DOC for ECT QQ

BZD

→ Not used as Induction Agents.

→ But as ~~cold~~ co-Induc" agents to ↓ dose of main induction agents

→ BZDs act upon **cerebral cortex** unlike other agents ∴ act upon Reticular Activating system

→ BZDs ↑ Cl^- ion Conductance

M/c ly used BZD

DIAZEPAM
oil Based
Propylene glycol
Pain on Inj"
IV/IM

MIDAZOLAM
water soluble
Short acting
IV/IM / Intranasal
orally

SYSTEMIC EFFECTS

1) CVS → ↓ BP
↓ Syst. vascular Resistance
↑ HR

2) Resp. → resp. depression
Specially given along ± opoids

3) CNS → ↓ ICP
↓ Metabolic Rate
Provide anterograde amnesia
anxidytic
anticonvulsants
Midazolam is 1st Line of drug for convulsions

4) Provide M/s relaxation @ Spinal cord Level ?

ETOMIDATE

→ Lipophillic
→ Rapid onset of action
→ Causes Pain on Injecn
→ Doesn't cause histamine Release
→ Most Cardiovascular stable agent
DOC → severe cardiovascular or cerebrovascular disease

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

→ causes highest incidence of nausea & vomiting

→ causes " " of myoclonic activity

→ causes adrenocortical suppression + inhibit steroid synthesis

↓

↑ mortality

→ Vit C supplement can prevent adrenocortical suppression.

KETAMINE

→ Causes dissociative anaesthesia

↓

Dissociation of Thalamic from Limbic system

Pt. apparently remains conscious but unresponding

→ Phencyclidine derivative

All Hallucinations & delirium seen c Ketamine are due to phencyclidine

→ Ketamine —Metabolised→ Nor-Ketamine

↓

anaesthetic potency

SYSTEMIC EFFECTS

1> CVS – Sympathetic stimulation.

↑ BP . ↑ HR

DOC for acute hypovolemic shock pts.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

↑ myocardial O_2 demand
∴ C/I → HTN.
IHD,
Aneurysm pts

2> Resp- minimal resp. depression
maintains upper airway reflexes
↳ Doc for full stomach pts.
↳ Potent Bronchodilator
Doc for asthmatic pts
causes marked ↑ in oral secretions
∴ always given ī glycopyrrolate

3> CNS - potent cerebral vasodilator.
ICP ↑ & ↑ metabolic rate
C/I in space occupying lesions
Head injury
Epilepsy pts
causes Hallucinations
ē occurs more commonly in young pts
auditory > visual hallucination
Hallucinations can be ↓ by BZDs

4> ↑ IOP → ∴ C/I in Glaucoma pts.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

USES

1) Short surgical procedure
2) Asthetic procedure
3) Burn dressings
4) For field anaesthesia

Ketamine is considered close to complete anaesthetic agent.

PROPOFOL

also k/n/a - 2,6 Diisopropyl phenol

→ Milky white liquid & comes as 1 & 2% emulsion

- contains- Soyabean oil, Glycerol, egg Lecithin } good culture medium for bacterial growth

→ Open propofol vial is discarded after 6hrs

- causes pain on Injection & can be ↓ by mixing Lignocaine in propofol.

→ Associated & quick recovery
↳ DOC for Day Care Sx.

→ DOC for porphyria
Myasthenia Gravis
Liver Disease
LMA / emergency intubation
TIVA
Nausea Sx. - M/cly used drug

SYSTEMIC EFFECTS

1) CVS → ↓↓ syst. vascular Resistance
↓ B.P. ± Bradycardia
↑ Blunts carotid Body Ⓡ response
∴ may cause bradycardia

2) Resp.- cause Apnea longer than thiopentone
causes max depression of upper airway Reflex.
Doc for LMA / emergency Intubation
causes Histamine release but can be safely used in asthmatic pts

3) CNS - ↓ ICP, cerebral metabolic rate ↓
Anticonvulsant
may cause involuntary movements
Antiemetic
Anti-pruritic
Anti-oxidant

4) Metabolism Disease remains intact in advanced liver
Doc for Liver Disease pt
Metabolism of Propofol
70% Liver ← → 30% Kidney & lung

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

* PROPOFOL INFUSION SYNDROME

Metabolic acidosis

Skeletal myopathy — Acute cardiomyopathy

→ It is seen in children on prolonged infusion due to failure of metabolism of ~~fatty~~ FFA

→ Carries ↑ mortality Rate

* TIVA (Total I.V. Anaesthesia)

⇒ DOC = Propofol + Ramifentanyl

Propofol ↓ associated with quick recovery

Ramifentanyl ↓ Ultra short acting opoid

⇒ USE – neuro Sx
Day care Sx
Malignant hyperthermia

⇒ ↓ Nausea vomiting

* NEUROLEPT ANALGESIA

Droperidol + Fentanyl
205mg 50 µg

50 : 1

Characterised by → Immobility
→ Analgesia
→ Variable amnesia

when given along c N_2O ⇒ Neuroleptic Analgesia

DEXMEDETOMIDATE

→ α_2 agonist → like clonidine

→ Provide sedation
Analgesia
Amnesia
anxiolysis

→ used for short term in mechanically ventilated pts

→ doesn't cause resp. depression
May cause airway obstruction.

→ S/E –
1) Bradycardia
2) Hypotension
3) shouldn't be used on pt c β blocker & heart block.

* Drugs Producing Active Metabolite
Thiopentone
Methohexitol
Midazolam
Ketamine

Drugs Producing Inactive Metabolite

1) Etomidate

2) Propofol

~~Stage~~	RESP	T.V.	PUPILS	EYE POSITION	REFLEXES ABOLISHED
STAGE 1 (analgesia)	Irregular	Small	Constricted	Divergent	Nil
STAGE 2 (excitement)	,,	Large	Dilated	,,	Eyelash
STAGE 3 (surgical anaesthesia) Plane 1	Regular	,,	Constricted	,,	Pharyngeal Skin Conjunctival
Plane 2	,,	Medium	½ Dil	Fixed centrally	Corneal
Plane 3	,,	Small	¾ Dil	Central	Laryngeal
Plane 4	jerky	,,	Fully Dilated	Central	Corneal anal
STAGE 4	—	—	APNOEA	—	—

GUEDEL'S STAGES OF ANAESTHESIA

Seen in Ether

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

⇒ Plane 3 → Plane of surgical anaesthesia

⇒ Stage 4 → Brainstem paralysis, Brainstem paralysis

⇒ Lacrimation ↑ in Stage 3 Plane 1, 2

⇒ Lacrimation ↓ in Stage 3 Plane 3

⇒ Pupillary Light Reflex is lost in stage 4.
[Brainstem Reflex]

INHALATIONAL AGENT

ETHER

1) Pungent smelling
2) Decomposes in presence of light
3) Stored in amber coloured bottle
4) Highly inflammable & explosive
   ∟ i.o C/I ⊂ cautery
5) Good analgesia, M/s Relaxant, complete anaesthetic agent
6) Doesn't depress HR/P or myocardium
7) Potent Bronchodilator
8) Only agent ⊆ depresses mucociliary activity

ETHEROMANIA

→ Dependence or addict of ether

METHOXY FLURANE

- Most Potent Inhalational agent
- Lowest MAC - 3%
- Highest B.P. → 105°c
- Highest Blood Gas Coefficient 15
- Extensively absorbed in rubber tubings
- " metabolised to > 70% to Flouride ions (high levels)
  ↓
- can cause vasopressin resistant High output Renal failure.
- Hepatotoxic

TRIELENE

- Most potent analgesic agent
- Reacts with sodalime
- → used for Labour Analgesia

CYCLOPROPANE

- Causes sympathetic stimulation
- useful in shock pts.

CHLOROFORM

Very sweet smelling

Cause ↑ incidence of Nausea & vomiting

Cause sudden death by Ventricular fibrillation

Cause hyperglycemia - avoided in DM

Hepatotoxic

24/5/18

MAC (Min. Alveolar Conc")

Min. alveolar conc" at ≤ 50% of pt: will not respond to stimulus.

Stimulus is usually a abdominal skin incision

MAC = potency of anaesthetic agent

Low ~~MAC~~ = MAC = more potent

eg. methoxyflurane 0.3%

High MAC = Low potent

eg. N_2O 105%

FACTORS ↑ MAC

1) children [Infants > Neonate]
2) Anxiety
3) Hyperthermia > 42°c
4) Hypernatremia
5) Chr. ingestion of alcohol, cocaine
5) Acute amphetamine

Infants > Neonate > Adults

FACTORS ↓ MAC

1) old age
2) opoids
3) Sedatives
4) Hypoxia
5) Hypothermia
6) Hyponatremia
7) Hypercalcemia
8) ♀
9) Anaemia
10) Lithium
11) Acute alcohol, cocaine
12) Chronic amphetamines.

* MAC ↓ by 6% for every decade of life.

MAC_{95} = min. alveolar conc^n at which 95% of ~~the~~ patients will not respond to stimuli

= 1.3 x MAC

MAC_{awake} = min. alveolar conc^n at which 50% of pts will become awake.

= 0.3 x MAC

* BLOOD GAS PARTITION COEFFICEENT :-

It is the solubility of the agent in the blood

Less soluble the agent = Lower is B/G coefficent

⇓

Faster Induction & Recovery

Eg. Xenon, Desflurane

Xenon = ~~17~~ 0.17

Desflurane = 0.42

N_2O = 0.46

Sevoflurane = 0.60

Agents ∝ ↑ B/G coefficent :-

Low Induc^n & Recovery

Eg. Ether = 12

Methoxyflurane = 15

* ~~OIL~~ OIL GAS PARTITION COEFFICIENT :-

It is the solubility of agents in lipid

higher solubility = more potent

Less " = Less "

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

N_2O

Laughing Gas

→ Prepared by heating $NH_4NO_3 \xrightarrow{250^\circ C} N_2O$.

→ colourless, odourless gas

→ supports combustion like O_2
hence not used for laparoscopy

→ 1.5 times heavier than air

→ 35 times more soluble in blood than N_2.

MAC N_2O : 105%

B/G coefficient = 0.46

SYSTEMIC EFFECTS-

CVS - PR ↑ BP Stable
↑ Pul. vascular Resistance
shouldn't be used in Pulmonary HTN pt

Resp - ↓ Tidal volume
↑ RR
Inhibits carotid body hypoxic drive

CNS - ↑ cerebral metabolic rate
↑ ICP
provides analgesia
doesn't affect CSF secretion & absorption

Toxicity of N_2O :-

1) Expands any air containing cavity

* If given for >6hrs ⇒ irreversibly oxedises Cobalt atom of vit B_{12}

⇓

Inhibition of Enzymes.

Methionine Synthetase &

Thymidalate Synthetase

⇓

Bone marrow Depression.

↓

Megaloblastic anaemia
Peripheral neuropathy
pernicious anaemia

* It may be teratogenic
Female anaesthetists tend to have ↑ rate of 1st trimester abortion

* causes max. greenhouse effect among anaesthetic agents

* Chronic exposure to N_2O ⇒ Spinal Degeneration.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

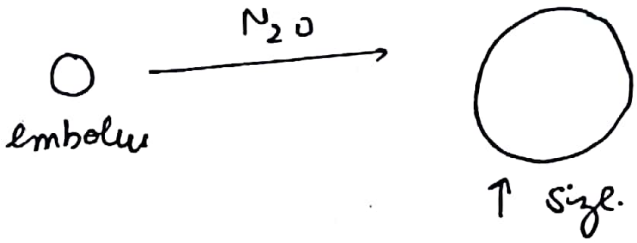
C/I of N_2O -

1) N_2O expands any air containing cavity

∴ C/I → 1) venous air embolism

↓

occurs m/c/y in sitting position for post. fossa surgeries.



Most sensitive monitor to detect venous air embolism =

Trans oesophageal Echo > Doppler > ETN_2 > $ETCO_2$ > CVP > Mill wheel murmur

2) Pneumothorax

N_2O ↑ the size

3) Lung cyst or bulla

4) Intracranial Sx

↳ Especially post. fossa Sx

Post. fossa is a bony space.

So, N_2O → ↑ pressure as vol. can't be ↑

⇓

Pons & medulla can be affected

5) Pneumocephalus-

N_2O is C/I for 7 days

6) Vitreoretinal Sx-

- Vitreous fluid will come out during Sx.
- To maintain vol. betn Ant. Post chamber → Surgeon puts bubble of SF_6

↓

Later vitreous comes back

If N_2O is used → it ↑ the size of bubble

~~may~~

⇓

Surgeon opens it immediately

↓

Sudden decompression

↓

Retinal detachment

7) Tympanoplasty

Due to ↑ pressure, Graft gets dislodged

8) Acute Intestinal obstruc^{n}-

N_2O causes further dilatation of loop.

9) Pulmonary HTN

N_2O diffuses into endotracheal tube cuff

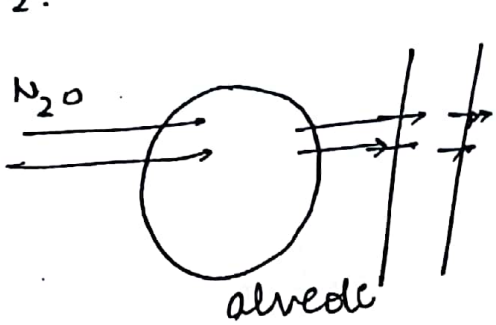
↓

cuff pressure should be intermittently monitored.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Conc^n EFFECT :-

→ N_2O is 35 times more soluble in blood than N_2.



rapid absorp^n of N_2O in blood
↓
-ve conc^n gradient in alveoli
↓
more absorp^n of N_2O
↓
Shortening induc^n time

2nd GAS EFFECT :-

N_2O also ↑ conc^n of other inhalational agent this way.

Rapid Induc^n of anaesthesia

DIFFUSION HYPOXIA / FINK'S PHENOMENON :-

Seen in old + sick pts. ~~in the~~ breathing room air at end of anaesthesia

$O_2 + N_2O$ (anaesthesia) ⟶ Room air $N_2 + O_2$

So, N_2O comes back from blood to alveoli due to conc^n gradient
↓
Diffusion Hypoxia

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Rapid diffusion of N_2O from blood to alveole
dilute alveolar O_2
⇓
Hypoxia

Prevention:-
QQ By giving 100% O_2 at the end of anaesthesia

ENTONOX
[50% O_2 + 50% N_2O]
Used for Labour analgesia
Dental anaesthesia

POYNTING EFFECT :-
→ At -6°c - O_2 & N_2O separates into layers
→ Pt. 1st breathes only O_2 ⇒ so no pain relief
then only N_2O ⇒ hypoxia.

Prevention-
By shaking cylinder before use

HALOGENATED INHALATIONAL AGENT

HALOTHANE

1) It is alkane other agents are ether
2) contains Bromine atom., Cl^-, F^-
3) very sweet smelling
4) undergoes spontaneous decomposition & is retarded by Thymol preservative (0.01%)
5) absorbed in rubber tubings
6) reacts with metals in vaporisers.

SYSTEMIC EFFECTS :-

CVS -. Direct myocardial depression
↓
Leading to fall in BP

. Halothane blunts carotid Body receptor response
↓
So, Bradycardia occurs

. It makes heart sensitive to arrhythmogenic effects of adrenaline.
[Cocaine is C/I with halothane].

Resp :- Potent Bronchodilator.
DOC for asthmatic pts.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

- causes severe depression of hypoxic ventilatory drive

CNS - potent cerebral vasodilator.

↑ ICP.

Q How to ↓ ICP?

1) Mannitol

2) Glycerol

3) Hyperventilation ⇒ for acute ↑ ICP

4) Raise head of bed by 30°

5) VP shunt

6) 3% saline ⇒ acute & chronic ↑ ICP.

7) Extraventricular drainage

CO_2 is most potent vasodilator.

* On Hyperventilation

↓

↓ arterial CO_2

↓

Cerebral vaso constric^{n}

↓ ↓ cerebral blood flow

↓ ICP

Halothane ⟶ ✱

Q C inhalational agent required prior hyperventelation

↳ HALOTHANE to prevent rise in ICP.

→ Halothane doesn't provide analgesia

- can cause shivering : HALOTHANE SHAKES
  ↓
  Best antidote
  PETHIDINE

- potent uterine Relaxant
  DOC for manual removal of placenta

→ use of halothane for LSCS ↓ Cr.A
  ↓
  PPH

→ causes max ↓ in Total Hepatic Blood flow & Portal Vein Flow.

→ maximally metabolised >20%
  Metabolised to ~~Fluoride~~ Trifluoroacetic acid
  ↓
  Immune mediated hepatitis

Pathology - Centrilobular necrosis

Mortality : 30-50%

Predisposing Factors-

→ Multiple exposures at short interval of time
  Time interval should be > 3 month

→ Middle age obese women

→ ℞/ Family H/o toxicity

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

C/I

1) ↑ ICP
2) unexplained liver dysfunc° after exposure
3) Pheochromocytoma → ↑ adrenaline levels.
4) Malignant Hyperthermia
5) Aminophylline → causes arrhythmia

~~TRIGGERS~~

ENFLURANE

→ It is ether
→ cause tonic & clonic convulsions
C/I → epilepsy pts
→ Trigger for Malignant Hyperthermia
→ mildly ↓ Renal concentrating ability
°° C/I in pre-existing renal diseases

ISO FLURANE

→ Chemical Isomer of enflurane
→ pungent smelling ether.

SYSTEMIC EFFECTS-

CVS → Peripheral vasodilatation
↓ B.P. ∵ ↑ H.R.
DOC for deliberate hypotensive anaesthesia

BP can be lowered upto 20% of baseline value

→ Powerful coronary artery vasodilator.
Adc for cardiac Sx

→ It may be associated ē coronary steel syndrome but clinically insignificant

Resp

causes mild Bronchodilatation. • Tachypnoea

CNS

cerebral vasodilatation.

↑ ICP

⇓

can be ↓ by simultaneous hyperventilation

causes **isoelectric EEG** at **2 MAC**

COND" CAUSING EEG ACTIVATION

1) Subanaesthetic doses of inhalational agent < MAC
2) Low dose of Barbiturates
   Etomidate
   Benzodiazepines
3) N_2O
4) Ketamine
5) Sensory stimulation
6) mild Hypercapnoeia
7) early Hypoxia

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

COND' CAUSING EEG DEPRESSION

1) > MAC of inhalational agents
2) Normal dose of Barbiturates
   opoids
   Propofol
   Etomidate
3) Hypocapnea
4) Marked Hypercapnea
5) Hypothermia
6) Late hypoxia

- Isoflurane maintains Total hepatic blood flow
  × portal vein flow
- also maintains hepatic venous oxygenation.
  Doc for Liver Transplant Sx

C/I

1) Severe hypovolemia
2) malignant hyperthermia

DESFLURANE

→ **Most pungent** smelling ether

Desflurane > Iso > Sevo > Halothane

Desflurane: Most pungent

Halothane: most sweet smelling

→ It has lowest Blood Gas ⊖ coefficient among flourinated agents - 0.42

↓

Rapid induc" & recovery

→ causes airway irritation

1) Breath holding
2) ~~cutting~~ coughing
3) Salivation
4) Laryngospasm

→ So, not used for inhalational ⊖ induc" in CHILDREN.

→ has low B.P. 23°c & very high vapour pressure

→ Requires a special vapouriser → heated to a temp. of 39°c.

→ Sudden ↑ in desflurane conc^{n} causes sympathetic stimulation → HTN & Tachycardia

→ minimally metabolized < 0.1%

→ max. greenhouse effect among flourinated agents.

→ Reacts ₹ dry CO_2 absorbent. to form CO

→ cause Emergence Delirium in children.

C/I-

1) severe hypovolemia
2) Malignant Hyperthermia
3)

SEVO FLURANE

→ It is mildly sweet smelling ether

→ Max no. of flourine atoms → (7)

→ has low B:G coefficient ⇒ FAST Induc", recovery

Agent of choice for ① inhalational ~~agent~~ Induction

② Day care Sx

③ neuro Sx

↳ cause minimal cerebral vasodilatation so, ICP doesn't ↑.

Can cause emergence delirium in children

doesn't ₹ show hepatic toxicity since not metabolized to ₹ trifluoroacetic acid

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

→ Sevo flurone + Sodalime ⇒ Compound A

↓

nephrotoxic

→ Compound A formation can be prevented by using fresh gas flow rate >2L/minute

→ Sevo degraded by metal/ environment ⟶ HF (Hydrogen floride)

↓

acid burn of resp. mucosa

C/I -

1) severe hypovolemia

2) malignant hyperthermia

HELIUM

→ non-flourinated agent

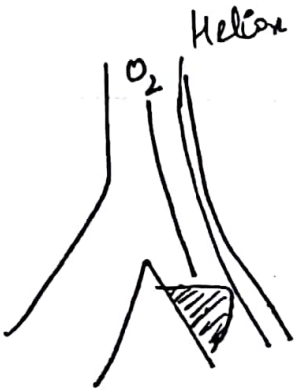
→ 79% Helium + 21% O_2 ⇒ HELIOX

↓

density is lighter than air

↓

% useful in Larger airway Obstruction



XENON

→ Weak anaesthetic like N_2O

→ MAC - 70%

→ Lowest B:G coefficient → 0.17%

→ Most closest to Ideal anaesthetic agent

→ Provides analgesia

Agent of choice for Liver Disease Patients

ADVANTAGE -

1) Minimal CVS & resp. effects

2) Rapid Induc + Recovery

3) Low B:G coefficient

4) Minimum metabolism

5) Is inert

6) doesn't react ~~c~~ sodalime

7) non-inflammable & non-explosive

8)

DISADVANTAGE

1) High cost

2) Low potency.

MUSCLE RELAXANTS

- CENTRALLY ACTING
  - DANTROLENE
  - BECLOFENE
- ACTING AT N-MJ^
  - Depolarising
    - Succinyl choline
    - Resembles Acetylcholine
    - (Non-competitive BLOCKADE)
  - Non-Depolarising (competitive Blockade)

→ M/s Relaxants used in anaesthesia act upon NMJ^.

DEPOLARISING BLOCK

→ Causes non-competitive Blockade

→ Causes muscular fasciculation

→ M/s remains un-responsive to other stimuli

→ Not reversed by Neostigmine

Neostigmine $\xrightarrow{\ominus}$ AChE

↓

↑ Ach.

→ Succinyl choline is ϕ

→ Potentiated by

Mg
Hypothermia
Resp. alkalosis
Isoflurane

Antagonised by

- Non-depolarising M/L relaxant
- Antagonist

- ~~Do not~~ No Fade on Train of Four
- Stored in Refrigerator - 2-5°C
- Once removed from refrigerator, it should be used in 2 weeks
- DOSE = 1-1.5 mg/kg
  Adults → 1. mg/kg
  children - 1.5 mg/kg
- If given in dose of 7-10 mg/kg B.W.
  ↓
  causes conformational changes in receptor
  ↓
  Block starts behaving like non-depolarising
  Block = PHASE 2 BLOCKADE
- Features of phase 2 Block are similar to non-depolarising Block

ONSET Time = 30sec — Last for 5-10min.

M/s Relaxant of choice for full stomach Pts.

⇒ Bradycardia especially in children. after 2nd dose

→ cause masseter m/s spasm in children

↓

These children are more prone to malignant Hyperthermia

→ (↑) → ICP
IOP
BP
Gastric Pressure
LE sphincter Tone

→ Metabolised by Plasma Pseudocholinesterase

↓

controlled by 2 set of genes

- If pt. is homozygous ⇒

→ Atypical Pseudocholiesterase

→ Prodn of pseudocholiesterase & Ab (N) is both genes are absent.

↓

c leads to ↑ duration of SCHOLINE APNDEA

Rx - Continue c mech. ventilation, FFP

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

DIBUCAINE NO.

% inhibition of Plasma pseudocholinesterase by dibucaine

(N) → 75-80%

Ab (N) < 30%

* Plasma pseudocholinesterase Def.n :-
  ↳ seen in Hepatic failure
  Renal failure
  Cancers
  malnutrition
  ♀
  Hypothyroidism

→ S. choline ↑ K by 0.5 meq/L
The ↑ occurs more after

a) Burns
b) Spinal cord injury
c) Stroke
d) GB syndrome
e) Prolonged ICU stay
f) sev. intra-abdominal infn
g) Tetanus

] Sch is C/I 48 hrs - 9 mnths after these Condn.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

→ S.Ch. caused muscular fasciculation.
& lead to post-op myalgias

⇓

Fasciculations can be ↓ by giving small dose of non-depolarising m/s relaxant before S.Ch

↳ Agent of choice = **ROCURONIUM.**

→ S.Ch is M/c triggering factor for malignant Hyperthermia.

C/I

1) muscular dystrophy
2) In Dystrophica myotonica → it causes sev. m/s rigidity preventing resp. & Intubation.

Mx of Pt. suffering from M/s Dystrophy

1) Sch C/I
2) Inhalational agents to be avoided
3) I.V. Induc" preferred

2) Sch causes Histamine release
" " Ganglionic stimulation

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

* COMMON FEATURES Bet DMR, NDMR^{80}

1) Drugs ⊆ can be used in renal failure:
   a) Atracurium
   b) Cis-atracurium
   c) Scholine
   d) Mivacurium

2) * Order of Paralysis by M/s Relaxant
   Ptosis → Diplopia → ~~fever~~ facial → Jaws → neck.
   → Limbs → **Diaphragm.**
   ↓
   1st M/s to recover from paralysis

3) Histamine releasing drugs.
   Atracurium
   Mivacurium
   Scholine
   D-Tubocurine — Max histamine Release

4) Sch caller → ganglionic stimulation
   D-Tubocurine → ganglionic Blokade

5) Vagolytic activity -
   Gallamine → MAX.
   Pancuronium

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Sympathetic stimulation occurs ε
→ Gallamine
→ Pancuronium

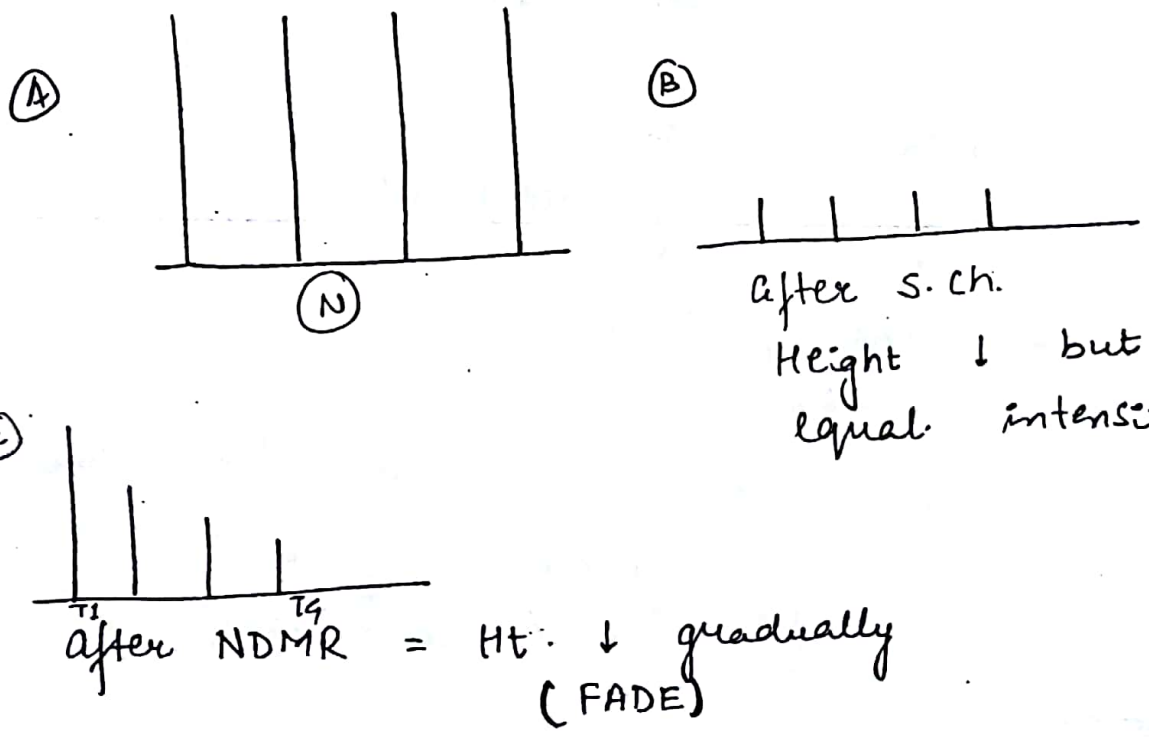
* N.M. MONITORING

→ M/c nerve used = ULNAR
→ M/c muscle used = ADDUCTOR POLLICIS M/c
→ M/c corresponds to Laryngeal paralysis
= Orbicularis oculi
→ M/c mode of NM ~~Train~~ Transmission = TRAIN OF Four

O O O O
←0.5sec→

4 stimulus → frequency of 2Hz
Duration bet 2 stimulus is 0.5sec

ToF measured at interval of 10sec



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

$\frac{T_4}{T_1}$ = TOF Ratio

NON- DEPOLARISING M/s RELAXANT

- BENZYL ISOQUINIDIUM
- AMINOSTEROIDS
- CHLOROFUMARATES

① BENZYL ISOQUINIDIUM

↓ ATRACURIUM

→ Intermediate acting

→ Metabolised → $\frac{1}{3}^{rd}$ by HOFFMAN DEGRADATION (Non-enzymatic, Temp. + PH dependent degradation)

$\frac{2}{3}^{rd}$ by Alkaline ester Hydrolysis

→ Produces metabolite LAUDONOSINE
↓
can cause convulsions

→ Causes histamine release

Doesn't require any reversal agent

→ DOC → renal failure
hepatic failure
Pts ⊂ atypical pseudocholinesterase
Pts ⊂ myasthenia gravis
[$\frac{1}{10}^{th}$ of ⓝ dose used]

CIS- ATRACURIUM

→ Isomer of atracurium
→ Metabolised 100% by HOFFMAN degradation
→ Laudanosine level are lower
→ Preferred over atracurium
→ ND histamine release

MIVACURIUM

→ Slow onset
→ short duration of action
→ Given by continuous infusion
→ M/s relaxant of choice for Day care Sx

D-TUBOCURINE

→ Long acting
→ mainly metabolised in Kidneys
→ causes ganglionic Blockade
Preferred in arterial Sx
→ Causes max. histamine release

DOXACURIUM

→ Most potent
→ Longest acting NR

(II) AMINO STEROIDS MR

VECURONIUM

- Intermediate Acting
- Mainly Hepatic metabolism
- Most cvs stable agent (MR)

ROCURONIUM

- Most Rapid onset among NDMR
- NDMR of choice for full stomach pts.
- causes pain on Injec.
- Less potent
- Specific Reversal Agent = SUGAMMADEX

RAPACURONIUM

- Rapid onset of action
- causes high incidence of Bronchospasm in Children → ∴ withdrawn.

PANCURONIUM

- Long acting
- Vagolytic
- causes Sympathetic stimulation So useful in SHOCK Pts.

should be avoided in Ischaemic Heart Disease pt.

GALLAMINE

→ only MR to cross PLACENTA → C/I in ♀

→ Least potent MR

→ Metabolised 100% by kidneys ⇒ C/I in Renal diseases.

→ Max. vagolytic activity

METOCURINE

→ Metabolised 100% by kidneys

→ Contains Iodine → C/I in Iodine sensitivity Pts

(III) CHLOROFUMARATES

CANTACURIUM

→ Ultra-short acting MR

→ Metabolised to CYSTIENE

→ Specific reversal agent : L-CYSTEINE

* FACTORS PROLONGING NM BLOCKADE :-

1) newborns
2) old age
3) Renal / Hepatic failure
4) Inhaled Anaesthetic agent
   - Max → Desflurane
   - Men → N_2O

5) Aminoglycoside, Polymyxins] → they themselve cause NM Blockade

6) Local anaesthetic

7) Hypokalemia

8) Hypocalcemia

DRUGS ANTAGONISING NM BLOCKADE

1) Phenytoin
2) Carbamazepine
3) Calcium

REVERSAL OF NM BLOCKADE :-

1) Neostigmine :-

↑ Ach by blocking AChE. enzyme

Advantage :- It is Quarternary ammonium Compound
∴ doesn't cause BBB
So no central effects seen

S/E- Bradycardia → may cause cardiac standstill
Bronchospasm
↑ Bladder tone
↑ secretion
↑ Peristalsis
Meosis

Neostigmine always combined ē Atropine or Glycopyrrolate.

2) Pyridostigmine

3) Edrophonium

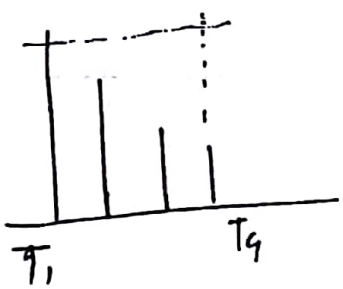
4) Suggamadex → for Rocuronium

5) L-cysteine → for Cantacurium.

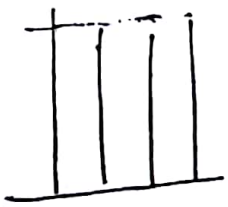
* SIGNS OF ADEQUATE REVERSAL

1) Spontaneous limb movement
2) Able to follow command
3) Able to show tongue
4) Spontaneous help ī adequate Tidal volume
5) BEST SIGN → Head Lift > 5 sec.

BEST OVERALL SIGN = T.OF RATIO > 0.9



T_4 ī 90% of T_1.



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Pt Divided Into 2 GROUPS

ELECTIVE

NPO.

Preoxy + (3min) MR. + I.V. ind" +

100% O_2

Ventilate ⊽ Bag, Mask

Intubate the pt.

EMERGENCY

Full stomach

Preoxygenate | 100% O_2 | for 3min.

+ I.V. Induction

+ MR. having faster action Such Rocuronium

NO IPPV

Bag, Mask

↓

Pressure applied on cricoid cartilage (SELLICK's MANAUVERE)

↓

Intubate ⊽ cuff tube

Rapid Sequence Induction

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

LOCAL ANAESTHETIC AGENT

Weak bases

N/V FIBRES – (A) (B) (C)

(A) → Largest

(B) → Myelinated

(C) → smallest → unmyelinated

Aα ← Efferent to M/s → Mediate motor func"

Aβ ← Afferent from skin & Joints → mediate Tactile proprioception

Aγ ← Efferent to m/s Spindle → mediate M/s tone

Aδ ← Afferent to sensory n/vs → mediate temp. & pain. touch sensation

Myelinated → Autonomic preganglionic fibres → ANS

Unmyelinated → Autonomic postganglionic fibres → ANS

Unmyelinated → Dorsal root → Pain & Touch

Sensitivity to LA :- (Peripheral n/vs)

$A\gamma > A\delta > A\beta = A\alpha > B > C$

Sensitivity to Hypoxia

$\boxed{B > A > C}$

Sensitivity to Pressure

$\boxed{A > B > C}$

Order of Blockade :

Autonomic → Sensory → Motor

↓

Temp.

↓

Pain

↓

Touch

↓

Pressure

↓

Proprioception

Recovery in reverse order

L.A.

AMINO ESTERS	AMINO AMIDES
- Metabolised by Plasma Pseudo cholinesterase	In Liver
- except cocaine	
→ Unstable sol^n	Stable
→ metabolised to PABA ↓ → Responsible for high incidence of allergic Rxn	Less incidence of allergic Rxn.

SEQUENCE OF ALLERGIC RXNS –

MR > Later products > Antibiotics

SHORTEST acting LA ⇒ CHLORPROCAINE

INTERMEDIATE " " ⇒ LIGNOCAINE
COCAINE

LONG Acting " ⇒ BUPIVACAINE
ROPIVACAINE.

single i in spelling = ester

double i in " = amide

PHARMACOKINETICS

1) ABSORPTION -

Depends on.

a) Site of Injec^{n} -

more vascular site = faster absorption
= shorter duration of action.

Order of absorp^{n} -

I.V. (I.A.) > Tracheal > Intercostal > Paracervical > epidural > Brachial plexus > Sciatic > ~~femoral~~ Subcutaneous.

b) Dose :-

Higher dose : Longer blockade
Lower dose : shorter blockade

c) Addition of vasoconstrictor

Adrenaline
↓
↓ absorption
↓
Longer duration of action.

d) pharmacological profile of drug

short acting ← Intermediate → long acting

MOA of LA

→ Acts upon nodes of Ranvéer

→ LA enter axons in undissociated form.

↓

devide into axons

↙ ionic part ↓ Blocks Na+ channel

↘ Non-ionic part

→ pH at ≤ 50% of drug is ionic, 50% non-ionic

k/n/a → pKa

→ Drug having pKa value closer to physiological pH = faster acting than other drugs.

Lignocaine 7.8 ⇒ faster acting

Bupivacaine 8.1 ⇒ slower "

→ Differential sensory Blockade :-

↳ shown by BUPIVACAINE + ROPIVACAINE

ⓐ Low conc" ⇒ only cause Sensory Block

ⓑ High conc" ⇒ Ⓑ sensory + Motor Block

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

It is used in LABOUR ANALGESIA.

EFFECT OF ADDITION OF OTHER AGENTS

1) ADRENALINE :-

Lignocaine + Adrenaline = ↑ motor Block + ↑ sensory Block

Bupivacaine + Adrenaline = ↑ sensory Block

Adrenaline used in conc^{n} of 1:200000

2) PHENYLEPHRINE :- (1:20,000)

↳ causes less tachycardia

3) SODA BICARB :-

Leads to faster onset

Longer duration of action.

Less subcutaneous pain

Better Quality

TOXICITY OF L.A.

1) **CNS TOXICITY**

a) Circum oral numbness

b) paraesthesia of tongue

c) light-headedness

d) dizziness —F/B→ auditory, visual c) disturbances

f) m/s twitching

g) tremors

h) convulsions

R_x → small dose of Thiopentone or Propofol
secure airway
BZDs
Anticonvulsants

2> **CNS TOXICITY**

→ Bupivacaine forms irreversible complexes ī Receptors of Heart → ∴ should never be given as I.V. Injec^n.

→ R_x = 20% Intralipid emulsion [TPN].
Prolonged CPR
Adrenaline ,
Amiodarone

3> **METHGLOBINEMIA**
Seen ī large doses of Prilocaine & Benzocaine

R_x → Methylene Blue

LA + Adrenaline ⇒ shouldn't be used for Ring blockade of
Finger
Toe
Penis
Pinna
→ contain end arteries

1) **LIGNOCAINE**

→ M/cly used LA

→ Conc" used are 5% heavy for spinal anaesthesia
4% topical
2% epidural
1% n/v block.
5% IVRA
2% Jelly for urethral procedures

Max. Safe Dose = 4.5mg/kg ī but adrenaline
7mg/kg ī adrenaline

BUPIVACAINE

- Long acting
- Never to be used I.V.
- Conc" used are 0.5% heavy for spinal
0.0625 - 0.125% - painless Labour
0.25% → n/v Blocks

Max. safe dose = 3mg/kg Body wt

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

BENZOCAINE

→ 20% topical agent for endoscopy / Bronchoscopy
→ can cause Methglobinemia

COCAINE

→ C/I ī adrenaline
→ used as 4% topical anaesthesia of eye

PROCAINE

→ L.A. of choice for pts. c̄ H/o Malignant Hyperthermia

CHLORPROCAINE

→ Fastest acting
→ C/I for spinal anaesthesia → causes neurotoxicity

TETRACAINE

0.5% for spinal anaesthesia
4% for topical anaesthesia

EMLA

→ Eutectic mixture of L.A.
→ Combination of 2.5% Lignocaine + 2.5% Prilocaine
→ to ↓ needle phobia

can also be used for skin grafting circumscion.

shouldn't be applied on cut surface mucous membrane

BIER'S BLOCK / I.V.R.A.

→ Used for Upper Limb & Lower Limb Sx

→ 2 Tourniquets are applied

→ DOC → Lignocaine 0.5%
Prilocaine 0.5%
Bupivacaine → C/I

C/I to Block –

1) sickle cell Disease
2) Scleroderma
3) Raynaud's Disease

CELIAC PLEXUS BLOCK

- Given for Pain relief of
Pancreatic Ca
Gastric Ca

→ causes blockade of Lumbar sympathetic chain

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

S/E-

→ Hypotension, Diarrhoea - M/c

BRACHIAL PLEXUS BLOCK

4 PLACES

1> Interscalene Block

↳ Bet^n scalenus medius & scalenus Ant. M/s

→ Shoulder Sx can bed done

→ Ulnar n/v is spared

→ Below shoulder, Sx can't be done

Comp^n-

1) Phrenic N/v Blockade - 10% cases

C/I in C/L Hemidiaphragmatic Paralysis

2) HORNERS SYNDROME

3) Vertebral artery Inj^n

4) Spinal/epidural anaesthesia

5) RLN Block → hoarseness of voice

6) pneumothorax

2) SUPRA CLAVICULAR BLOCK.

→ Given just lateral to subclavian artery

→ **Below shoulder Sx** can be performed

→ **Axillary + suprascapular n/v are spared**

Comp^n -

1) Phrenic n/v Blockade - 50% case

2) pneumothorax - 2-3% of case

3) vascular Injec^n.

3> INFRA CLAVICULAR BLOCK

Below elbow Sx can be performed

Intercostobrachial n/v is spared

Comp^n -

1) pneumothorax

2) vascular puncture

4> AXILLARY BLOCK.

→ Given in axillary sheath

→ Transarterial

→ **Musculocutaneous n/v is spared**

→ Comp^n -

vascular puncture

STELLATE GANGLION BLOCK

CERVICOTHORACIC BLOCK

→ It is used for pain relief of upper limb (UL) + Vasospastic disorder of UL

→ Given at Transverse process of C_6 vertebrae

– Paratracheal

→ Succesful stellate ganglion Block accompanied by HORNER SYNDROME -

→ Comp^n -

1) RLN Block → hoarseness of voice
2) Spinal/ epidural Inj^n
3) vascular puncture
4) Mediastinitis if oesophageal puncture occurs.

SPINAL ANAESTHESIA

SUBARACHNOID BLOCK / CENTRAL NEUROAXIAL BLOCKADE

CSF lies betn arachnoid & Pia

Spinal cord ends at Lower border of L_1 Or upper border of L_2

↓

∴ spinal anaesthesia is given L_{2-3} to L_5S_1 space

STRUCTURES PUNCTURED DURING SPINAL ANAESTHESIA

1) Skin
2) subcutaneous tissue
3) ~~Supraspinous~~ lig. supraspinous
4) ~~Interspinous~~ lig Interspinous
5) Ligamentum flavum
6) Dura
7) Arachnoid.

⇒ Highest point of iliac crest corresponds to L_{4-5} space

POSITION OF ~~SPINAL~~ PATIENT

1) Sitting
2) Lateral
3) Prone / Taylor approach.

SITE

1) **Midline**
2) **Paramedian**
   ↓
   Bypass supraspinous & Interspinous lig. ∴ may get calcified in old age patient

DRUGS USED

1) Lignocaine 5% heavy - 1-1.5 mL or 50-75 mg
2) Bupivacaine 0.5% heavy - 2-3 mL or 10-15 mg
   → Made heavy by addition of dextrose
   → Heavy means specific gravity is more than that of CSF.

NEEDLES USED

1) **Pencil tip needle**
   or
2) Atraumatic needle
   ↓
   Less incidence of post spinal headache
   H/ely used size = 25 Gauge

2) **Non Pencil Tip needle**
   [Drug port is at the tip of needle].

FACTORS AFFECTING HT. OF SPINAL ANAESTHESIA

1) DOSE → Most Imp factor
   ↑ Dose → high spinal
   ↓ Dose → low spinal

2) VOLUME-
   ↑ Volume → ↑ Dose
   ↓ Volume → ↓ Dose

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

3> BARICITY

It is sp. gravity of drug to CSF

4> POSITION OF PATIENT-

Head down → High Blockade

5> PATIENT FACTORS-

i> age:-

old age pts. ligaments are calcified

↓

Space around cord ↓

↓

Pressure inside cord ↑

↓

Hence, Drug dosage ∞ is ↓ in old age pt.

ii> Height:-

Taller person requires more volume

shorter " less volume

iii> ♀:-

†

In ♀ → there is pressure upon IVC.

↓

Epidural plexus engorged

↓

Space around cord ↓

↓

Pressure inside cord ↑

↓

∴ Drug Dosage is ↓ in ♀.

In ♀, n/v endings become more sensitive to local anaesthetic agent.

iv) Abdominal Tumours:-
similar to ♀, no hormonal effect.

FACTORS ⊆ DO NOT AFFECT HT. OF SPINAL ANAESTHESIA

1) Sex
2) Weight
3) Direction of needle
4) speed of injection
5) Barbotage
   ↳ mixing of CSF ⊼ local anaesthetic syringe
   obselete now
6) addition of adrenaline.

SYSTEMIC EFFECT OF SPINAL ANAESTHESIA

1) CVS → vasodilatation of LL vessels
↓
↓ venous return
↓
fall in BP + ↑ HR

Spinal anaesthesia cause hypotension + Tachycardia
→ Cardiac Sympathetic supply = $T_1 - T_4$
→ High spinal may cause blockade of cardiac Sympathetic supply ⇒ Hypotension + Bradycardia

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

* causes of hypotension during spinal

1) ↓ VR
2) Bradycardia → ↓ CO
3) Blockade of adrenal gland
4) Local anaesthetic toxicity

* While giving spinal anaesthesia, pt. can have

Hypotension ± Bradycardia

↓

may become unconscious due to

vasovagal

Severe Hypotension + Bradycardia may also occur due to BEZOLD-JARISCH REFLEX

2) **CVS**

Autonomic

↑ 2 seg. above

Sensory

↓ 2 seg. below.

Motor

3) **Resp**

all parameters of resp. remain unaffected except Max Breathing Capacity ↓ due to Active exhalation → paralysis of Intercostal M/s.

Hegh spinal → can cause Phrenic n/v Blockade

↓

Apnoea.

℞ of apnoea-
Bag + mask ventilation.

* CAUSES OF APNOEA DURING SPINAL ANAESTHESIA

1) Hypotension leading to ↓ in Blood supply of Brain stem
2) Hegh spinal anaesthesia
3) Total spinal anaesthesia
4) Local anaesthetic toxicity

4) GIT
↑ Peristalsis + relaxation of sphincter
⇓
small contracted Gut

5) Temp
↑ heat loss due to vasodilatation
↓
Pt compensates by shivering

6) Genitourinary
→ Urinary retention due to ↓ blockade of detrusor m/s

COMP^{n} OF SPINAL ANAESTHESIA

1) **Hypotension** — M/c comp^{n}

2. Can be prevented by preloading pt c
   1 - 1.5L of colloid / crystalloid

   Rx → fast fluids
   - lower head end
   - vasopressors
     - include
       a) Phenylephrine — vasopressor of choice for LSCS
       b) ephedrine
       c) Mephentramine

2) Bradycardia
   Rx = Atropine

3) Resp. Insufficiency / Apnoea
   Rx = IPPV c Bag + mask + correc^{n} of hypotension.

4) Post spinal headache / Post dural puncture headache
- occurs due to leakage of CSF from dural puncture site
- starts 12 - 24 hrs after spinal anaesthesia
- Lasts for 7 days

→ Occipital headache usually but may be frontal

→ Low-pressure headache

→ Headache can be prevented
  1) By using pencil tip needle
  2) By " higher gauze needle
  3) By adequate hydration.

R_x = Analgesic
  Correct of dehydration
  Na coffee Benzoate
  Most definitive R_x = Epidural Blood Patch.

PREDISPOSING FACTORS FOR HEADACHE –

1) ♀ > ♂
2) young > old
3) ♀ > non ♀
4) multiple punctures > single puncture
5) Bevel ⊥ to needle fibres > Bevel to parallel fibres.
6) Timing of ambulation doesn't affect onset of headache
   Spinal catheter doesn't affect onset of headache

Headache ⓣ → sitting
Standing
ⓛ → lying down position

5) Epidural Haematoma
It can cause paraplegia

6) Paralysis of cranial n/v - 1, 9, 10th n/v are never involved
6th M/cly involved
↓
Pt. complain of diplopia

7) Meningitis

8) Ant Spinal artery Syndrome

9) Backache

ABSOLUTE C/I OF SPINAL ANAESTHESIA

1) ↑sed. ICT
2) Refusal of pt.
3) Severe hypovolemia
4) Sev. MS / AS
5) Infec" at local site
6) coagulopathy
↳ High INR, Low platelet count

for spinal, INR < 1.5
platelet > 80,000

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

SADDLE ANAESTHESIA

When spinal anaesthesia is given in sitting position & Pt. allowed to sit for 8-10 min

↓

effect comes in form of saddle

All perineal Sx can be done under saddle

EPIDURAL ANAESTHESIA

EXTRADURAL "

CENTRAL NEUROAXIAL BLOCKADE

- Epidural space lies 4-5cm from skin.
- continous ⊂ thoracic cavity
- ∴ a -ve pressure space
- Broadest in Lumbar Region - 0.5cm

NEEDLE - 16-18 Gauge (TUOHY'S NEEDLE)

Lignocaine 2% plain
Bupivacaine 0.125% plain
15-20ML

SITE - N/V ROOTS. (Both in spinal + epidural)

ONSET TIME - 15-20 min

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

IDENTIFICATION OF EPIDURAL SPACE

1) sudden loss of resistance
2) Hangeng drop technique
   ↳ sudden sucking of drop into epidural space
3) DURAN SIGN
   rapid inje" into epidural space
   ↓
   ↑ rate , depth of Breathing
4) WESTPAL SIGN
   -nce of knee jerk after epidural anaesthesia
5) Mc intosh Indicator

ADVANTAGE OF EPIDURAL OVER SPINAL

1) gradual hypotension
2) Any duration Sx can be performed
3) Post op pain relief
4) NO post spinal headache

DISADVANTAGE OF EPIDURAL

1) Delayed onset
2) Patchy effect → septa in epidural space

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

3) Technically more difficult
4) expensive
5) Total spinal anaesthesia

COMBINED SPINAL EPIDURAL ANAESTHESIA

(B) spinal + epidural catheter
↓ faster onset ↓ Long term effect

CAUDAL ANAESTHESIA

→ Blockade of sacral epidural space
→ Used for pain relief of infra umbilical S$_x$ in children

MISCELLANEOUS POINTS

1) CVS Disorder in ♀ ⇒ epidural anaesthesia
2) 1st stage of Labour: T_{10} - L_1 Blockade reqd.
epidural can be given @ 4-5 cm of dilatation
3) 2nd stage of Labour = Pudendal N/v Block $S_{2,3,4}$
4) Forceps Delivery: SADDLE BLOCK
5) LSCS → T_4 to S_5 reqd.
6) M/c cause of Mortality of LSCS in under Spinal Anaesthesia: High spinal anaesthesia

S|E OF SPINAL OPOIDS

1) delayed Gastric emptying
2) Pruritus
3) nausea & vomiting
4) urinary retention
5) Sedation
6) ~~delayed~~ delayed resp. depression.

Ramifentanyl is C/I for spinal anaesthesia
It contains glycine → cause neurotoxicity

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

MALIGNANT HYPERTHERMIA

→ Syndrome of rapidly rising temp & occurs due to Ab Ⓝ of Ryanodine Ⓡ

↓

∴ cause massive release of calcium

↓

sustained muscular contraction.

* TRIGGERING FACTORS-

1) S. Choline – 50% of case
2) Ether
3) Methoxyflurane
4) All flourinated inhalational agents

* C/F–

1) Most initial sign - Masseter M/s SPASM.
2) Tachycardia
3) Rise in ET CO_2
4) Metabolic acidosis
5) Cyanosis
6) Hyperkalemia
7) Hypernatremia
8) Hyperphosphotemia
9) Myoglobinuria

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

10) Rise In Temp → Late sign.

11) Renal failure

℞-

1) Stop all anaesthetic agents

2) Hyperventilate ĉ 100% O_2

3) Inj^{n} DANTROLENE - 2mg/kg B.W. every 5min
Max 10mg/kg

4) $NaHCO_3$ → for metabolic alidosis

5) Cooling of body

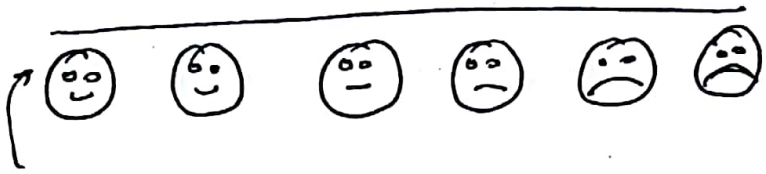
6) other symptomatic Rx.

BEST SCREENING TEST → Creatine kinase

Δstic TEST → Halothane caffeine
Contracture test

ASSESMENT OF PAIN

1) VISUAL ANALAG SCALE →



2) WONG BAKER FACES

Used for children 1-3yrs of age

Best Rating method

3) Children Hospital Estern Ontario Scale (CHOPS

→ 1-7yrs of age children

→ consist of cry

Facial

verbal

Torso

Legs

Touch.

4) Magill Questionaire

→ For minor Sx In children → PCM suppository is sufficient

→ for major Sx - Low dose narcotic infusion is used

PCA (Pt. Controlled Analgesia)

Route - I.V.

Drugs - Fentanyl or Morphine

FLUID REQUIREMENT DURING ANAESTHESIA

4 : 2 : 1

1st ~~Day~~ 10 kg → 4mL/kg

10-20 kg → 2mL/kg

> 20 kg → 1mL/kg

60 kg = 10 × 4 + 10 × 2 + 40 × 1

= 40 + 20 + 40

= 100mL

No. of fasting hours = n

100 × n = 100 n

50% - 1st hr

25% - 2nd hr

25% - 3rd hr

TYPES OF FLUID

HYPOTONIC

5% Dextrose

1/2 NS

used to correct Hypernatremia

ISOTONIC

RL - Intra op

NS - ~~Intra op~~ neuro Sx

5% D + 1/4 NS

Plasmalyte.

HYPERTONIC

3% Saline

5% Saline

used to correct hyponatremia

* ↑ ICP

7.5% $NaHCO_3$

5% Dex + 1/2 NS

DNS

CPR

It is done when Pulse = Absent

SEQUENCE - C ⟶ A ⟶ B

COMPRESSION

Adult → **100/min**

Compression & Relp = 30:2

Depth - 2 inches

Children / Infant = **> 100/min**

Comp. : Relp = 30:2 - single person

= 15:2 - double person

Intubation → RR = 8-10/min

Depth : $\frac{1}{3}$rd of A-P Diameter or atleast 1.5 inches

Neonates

Rate of comp. - **90/min**

C:R. = 3:1

Route of neonatal resuscitation = Umbilical vein

DOC for CPR = Adrenaline

IV - 1:10,000

1mg every 3-5 min.

For Anaphylexis - DOC = Adrenaline I.M. 1:1000

For Anaphylactic Shock. DOC = Adrenaline I.V. 1:10,000.

Atropine, Ca, vasopressin → not part of routine CPR

Dextrose - not used in CPR as they worsen outcome of ischaemic neurological injury

M/c Rib # during CPR = 3,4,5 (L) side.

* DRUGS ∠ CAN BE SAFELY GIVEN ~~FR~~ THROUGH TRACHEAL ROUTE

Naloxone
Atropine
Epinephrine
Vasopressin
Lignocaine

Dose = 2-2.5 × I.V. DOSE

* DRUGS CAN'T BE GIVEN THROUGH TRACHEAL

NaHCO3 Noradrenaline
Calcium salts
Bretylium

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

MODES OF VENTILATION

only Positive pressure ventilation are used

1) CMV [controlled Mech. Ventilation]

- → TV & RR are fixed
- → No spontaneous breathing allowed
- → Minimal work of Breathing
- → ↑ level of sedation + MR reqd.
- → used to ↓ ICP in head injury pts.

2) IMV [Intermittent Mandatory Ventilation]

- → Pt. is allowed to breath spontaneously Between mandatory breaths
- → ↑ level of sedation reqd.
- → No synchronisation bet" patient + ventilatory effort
- → ↑ TV breaths can be delivered Now withdrawn due to volume Injury

3) SIMV [Synchronised Intermittent Mandatory Ventilation]

Pt allowed to breath spontaneously between mandatory breaths ī synchronisation.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

mod. level of sedation reqd.
↑ work of breathing

4) PSV [Pressure Support Ventilation]

→ It is used to ↑ TV in spontaneously breathing pts.

→ No mandatory breaths are given.

→ Min. sedation is reqd

5) High Frequency ventilation

3 TYPES

a) High Frequency PPV

Rate = 60 - 120 /min

b) HF Jet ventilation

120 – 180/min

c) HF Oscillation. - 600 - 3000 /min.

USE – Broncho pleural fistula
Tracheo esophageal fistula
Bronchoscopy
Emergency ventilation through cricothyroid
Bronchial Sx.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

6) IRV (Inverse Ratio ventilation)

1:3 (N)

Here Inspiration is longer than Exp.

1:1, 2:1 ,, 3:1

7) APRV (Airway Pressure Release ventilation)

→ used for ARDS

⇒ MODES FOR SPONTANEOUS VENTILATION –

IMV

SIMV

PCV

HPV

APRV

⇒ WEANING MODES (gradual withdrawal of ventilatory)

IMV

SIMV

PSV

⇒ PEEP (Positive End Expiratory Pressure)

→ it prevents alveoli from collapsing.

→ it recruits alveoli

Recruitement Pressure = 10–12 cm H_2O.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

INDICATIONS OF PEEP

→ Physiological PEEP
→ Pul. oedema
→ ARDS
→ Cardiothoracic Sx

S/E of PEEP

(1) ↓ VR → ↓ BP → (2) ↑ RV afterload
(3) ↑ ICP
(4) ↑ mediastinal pressure
(5) ↑ intrapleural pressure
(6) ↑ Dead space → 2mL/kg (N)

FACTORS

↑ Dead SPACE

1) Upright position
2) Neck extension
3) ↑ age
4) +ve PPV
5) Anticholinergic drug like atropine
6) P. Embolism
7) Emphysema

↓ Dead space

1) Supine Position
2) Neck flexion
3) artificial airway

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Dermatology

Handwritten Note

MBBS Help

http://mbbshelp.com

http://www.youtube.com/mbbshelp

http://www.facebook.com/mbbshelp.com

Name: _____

Subject: **Dermatology**

MBBSHELP.COM

Dermatology

- Dr Saurabh Jindal

MBBSHELP.COM

MBBSHELP.COM

3 Parts of Skin

1) Epidermis → ← DEJ (Dermo-epidermal Jn)

2) Derma → ← Lobules, septa

3) Fat (panniculus)

EPIDERMIS

4 Layers

1) STRATUM CORNEUM

Thickest Layer

Max. Keratin

Corneum → means Keratin.

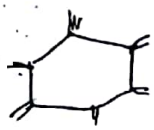
2) STRATUM GRANULOSUM

↳ granule

↓

Keratohyaline granule

Thinnest Layer

3) STRATUM SPINOSUM (SS)  ← Desmosome

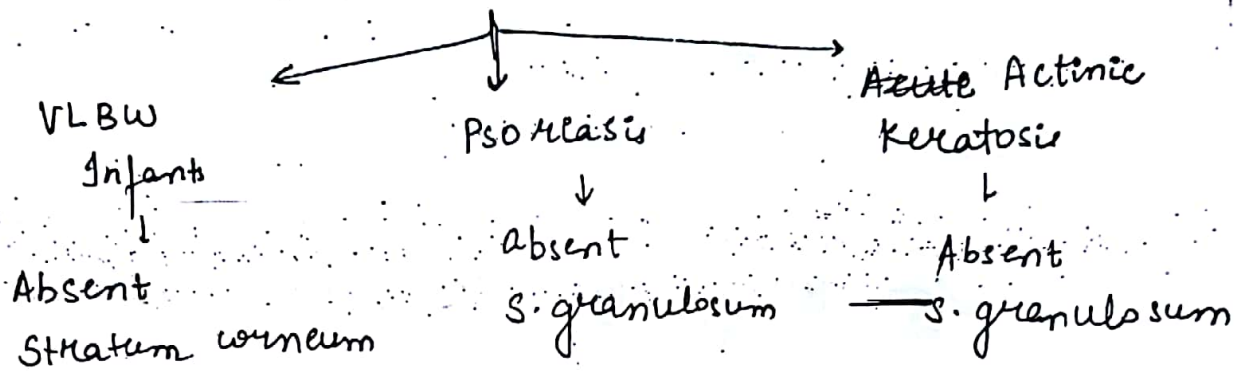
Spinous projection coming out

Max. Desmosome are present in SS AIIMS

4) BASAL LAYER

For Division

SITUATIONS For 3 LAYERS



5 LAYERS → palm + sole

- S corneum
- S. Lucidum ⇒ non nucleated layer
  - ? compression
  - ? artefact
- S. granulosum
- S. spinosum
- S. Basal

pressure (trauma)

Keratinisation of epidermal cells

- SC → 1000 mg
- SG → 100 mg
- SS → 10 mg Keratin
- S. Basal → 1 mg Keratin

lots of pressure

SC - 1000 mg Keratin (thick SC)

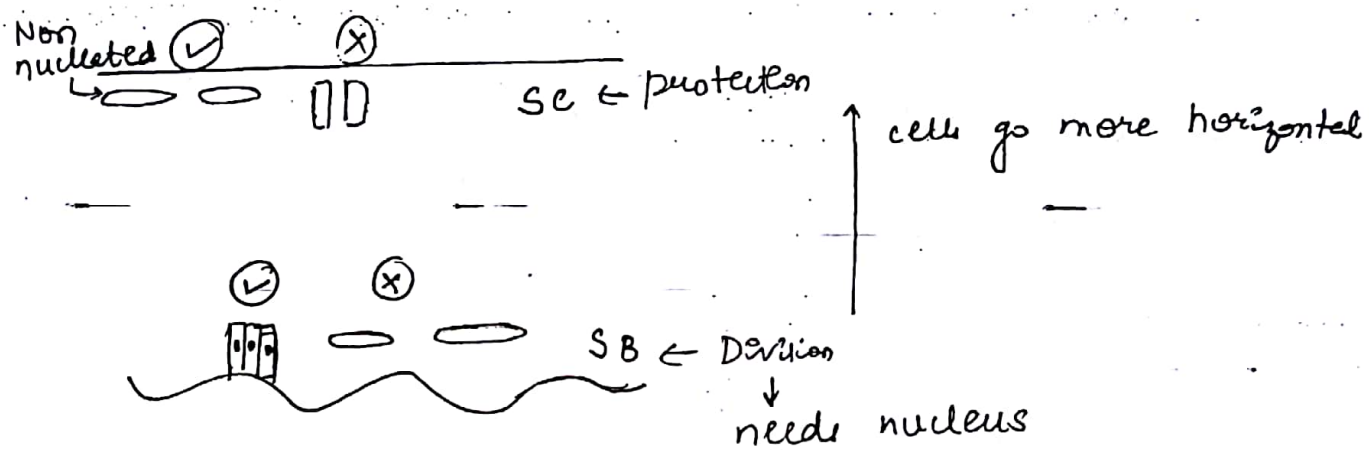
↓

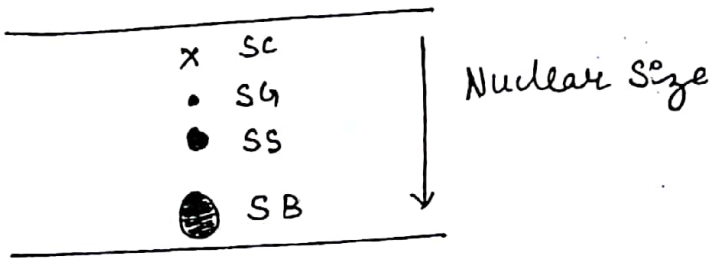
Hyperkeratosis

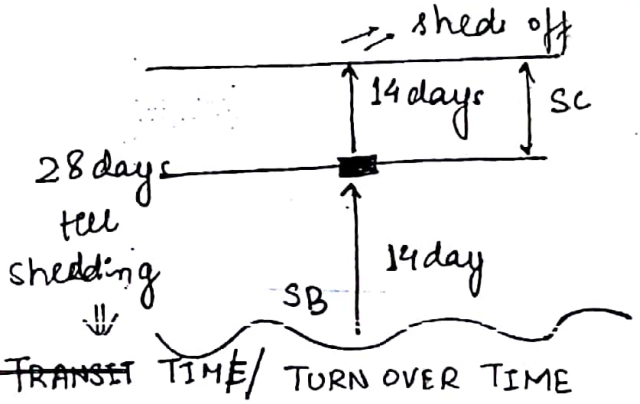
Thick SG ⇒ Hypergranulosis
↓
Seen in LICHEN PLANUS.

Thick SS ⇒ Acanthosis
↓
Seen in LICHEN PLANUS
PSORIASIS
ECZEMA

SS + SB = Malphigian Layer

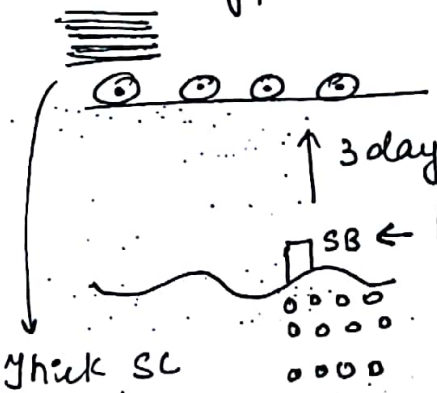






Psoriasis

Hyperdivision of SB Layer.



Nucleated SC -- Less time to shed off

↓

PARAKERATOSIS

3 days

SB ← Reduce Div. of SB Layer = DNA Inhibitor
↳ Methotrexate

T cell stimulates SB cell to divide.

Thick SC

↓

HYPERKERATOSIS

↓

Keratolytic Drug

Retinoid

/ ↓

vit A like

Remove T cells

1) Methotrexate
2) Cyclosporine
3) Biological drugs

EPIDERMAL CELLS

1) 95% ⇒ has keratin, cell are called

KERATINOCYTES

- Func":- 1) Protection
  2) Immunological Role → secretion of cytokines → Innate Immunity
- Derived from ectoderm.

2> Rest 5%

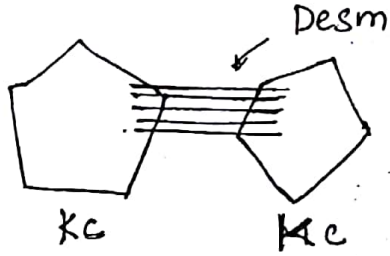
MELANOCYTES (MC) → Make melanin → UV light protection → derived from Neural crest

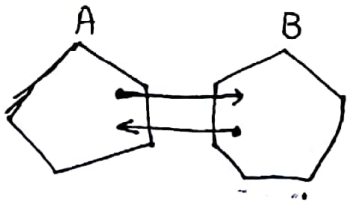
LANGERHANS CELL (LC) → Ag presenting cells → from Bone marrow

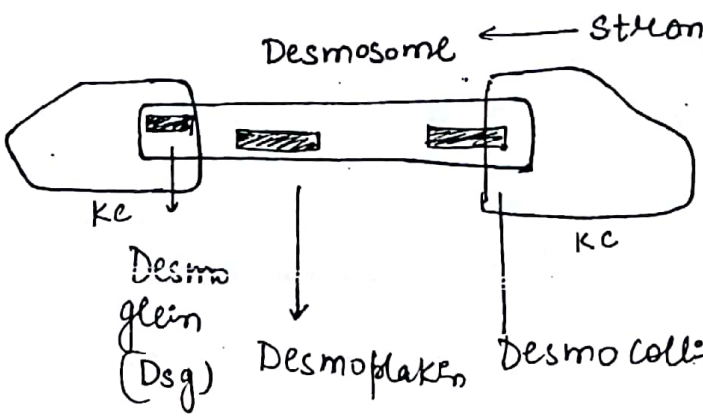
MERKEL DISC → touch Receptors → either from ectoderm or Neural crest

Keratinocyte : Merkel's cell have Desmosome on their surface.

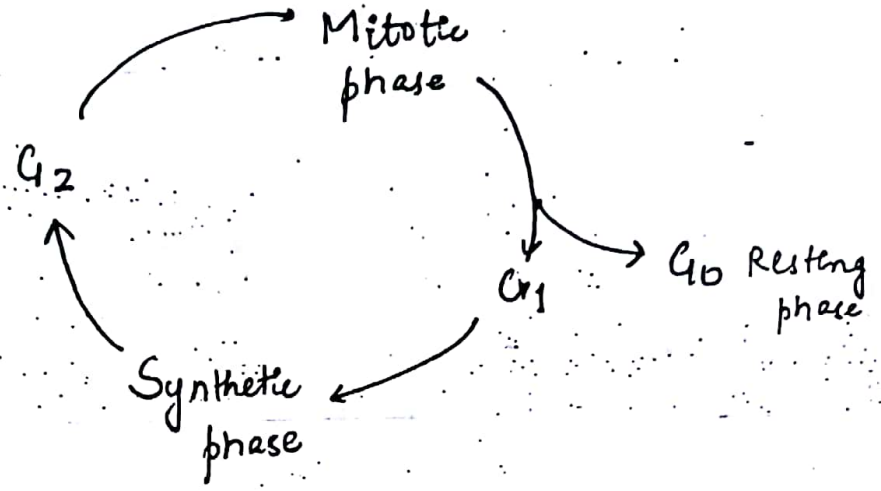
Melanocyte : Langerhans cell do not have Desmosome







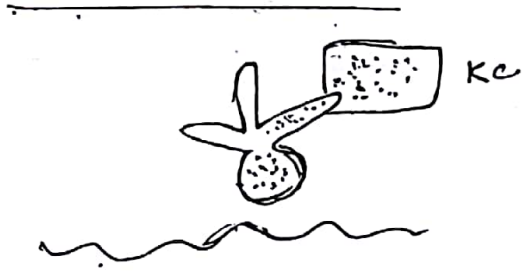
Keratinocyte cell cycle Time = 311 hrs



In Psoriasis ⇒ cell cycle time is ↓ to 36 hours.

MELANOCYTES

Melanocytes are Dendritic cells
They make melanin & transports it via dendritic processes into KC [~~Desmo~~ Epidermal melanin unit = 1:36]



Indians have Type 5 skin (Brown skin)
Less melanin (fair skin) or No melanin (albinism)

↓

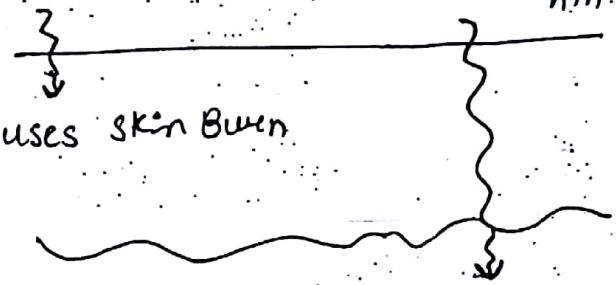
Chronic DNA damage

↓

Premalignant → Malignancy (SCC, Bcc, Melanoma)

Photo carcinogenesis
↓
Ch. sun damage
[cumulative or light]

UVB - 290-320 nm UVA - 320-400 nm



Faiver skin
↳ More Burning

Darker skin
↳ More Tanning

PREMALIGNANT SKIN DISEASES

(A) SUN EXPOSURE

eg. ACTINIC KERATOSIS
↓
means sun
↓
Lead to SCC

(B) May or May not be SUN Induced

1) Bowen's Disease -
SCC - In - Situ
↓
Restricted to epidermis

2) ~~Oral leukoplakia~~

3) Oral erythroplakia

4) Oral submucous fibrosis
5) Oral ulcerative lichen planus

MALIGNANT SKIN DISEASES

1) **BCC**

H/C Skin Cancer

H/C type of BCC ⇒ NODULO-ULCERATIVE (Rodent Ulcer)

Locally aggressive skin cancer
Metastasis is rare

C/F:-

1) Nodules ± ulcerate on sun-exposed sites
2) Ulcers have
   - Beaded
   - Rolled
   - Pearly

   } edge
3) Telangectasia on its surface

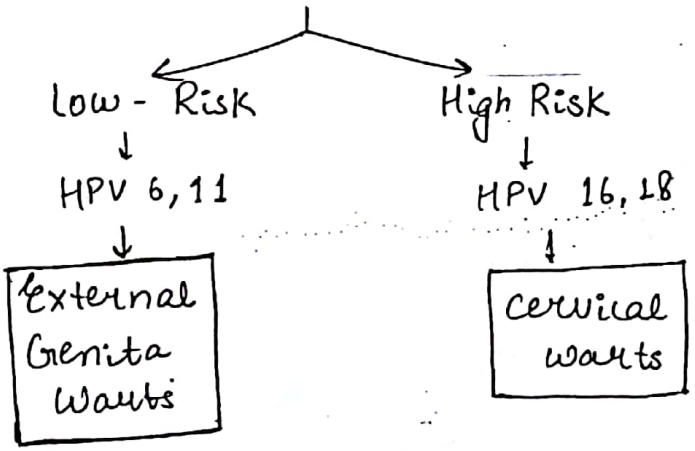
Rx:- Moh's microsurgery
↓
pathology controlled dissec^{n}.

(II) SCC

H/c in organ transplant pts.
↓
due to immunosuppression.

ETIOLOGY

1) Sun
2) Immunocompromised
3) HPV - DNA virus
   ↳ onchogenic virus
   Integrates its DNA into KC gene & divides along ē it.



C/F

a) Cauliflower masses

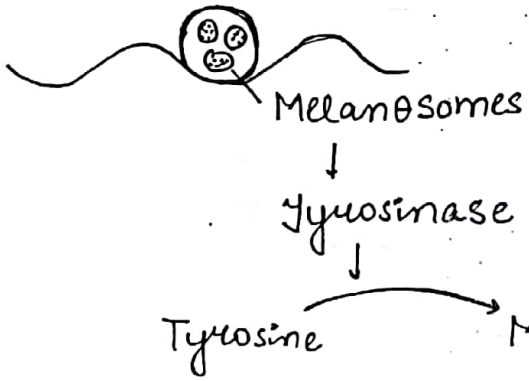
b) Hyperkeratotic plaques
c) ulcers
d) metastasis

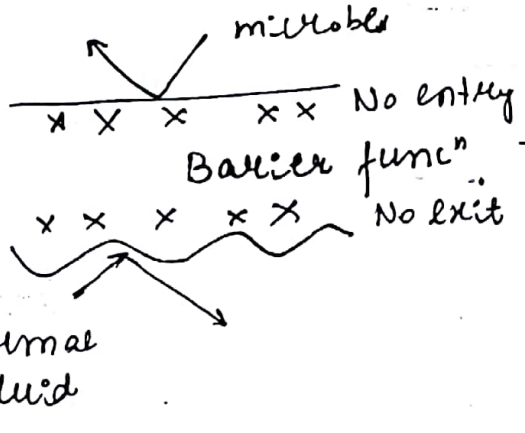
(III) Melanoma – Later.

* COLOUR OF SKIN depends on :-

1) Melanin production
2) Transfer of melanin to KC
3) No. of melanosomes

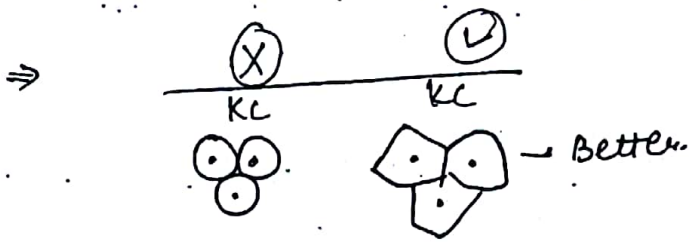
Not the no. of melanocytes

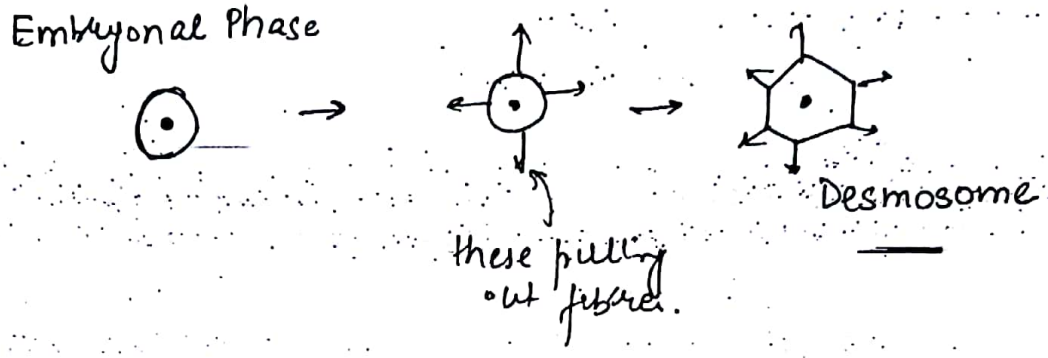




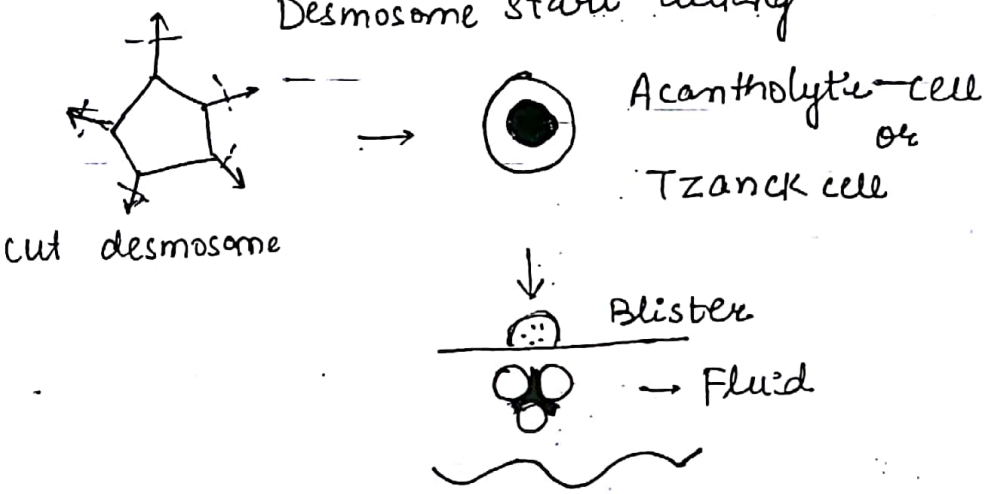
→ Gets altered where epidermis is damaged

a) Burn
b) wound.



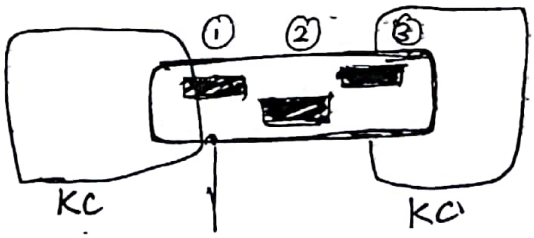


PEMPHIGUS



"pemphis" means Blister ⇒ Intercellular Disease

Y Desmosomes BREAK ?



IgG Ab formed against Desmoglein.

↓

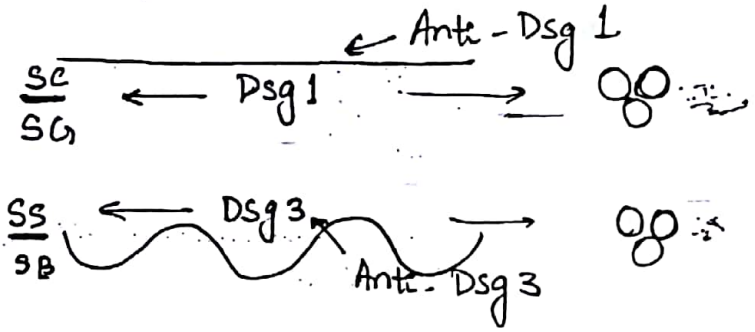
Weak Desmosome

TARGET → Desmoglein
Ab → Ante-Desmoglein (IgG)] IgG PEMPHIGUS

TARGET → Desmocollin
Ab → Ante-Desmocollin (IgA)] IgA PEMPHIGUS

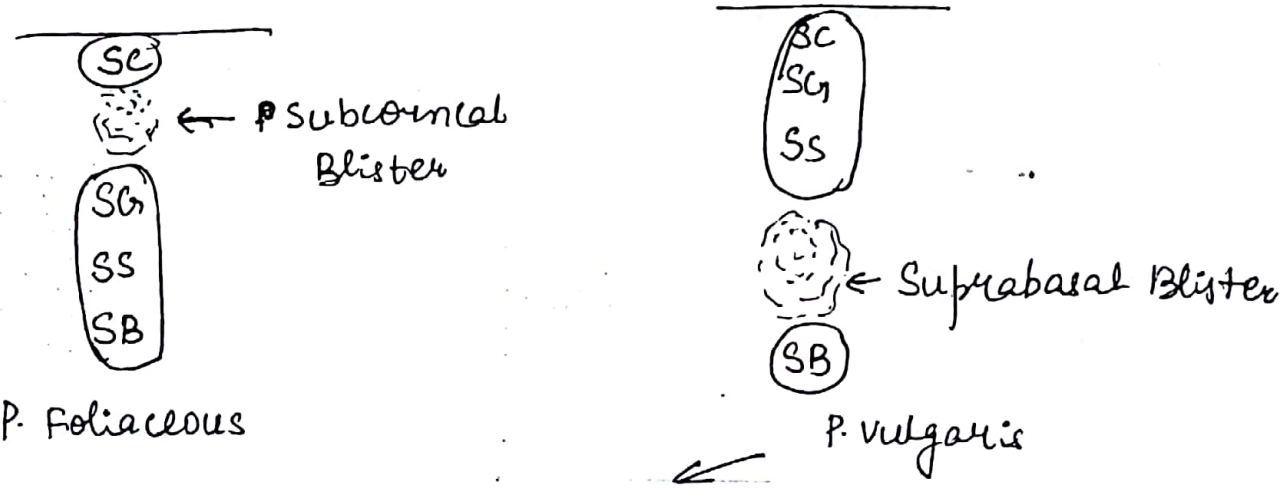
TARGET → Desmoplakin
Ab → Ante-Desmoplakin (IgA/IgG/IgM)] Paraneoplastic Pemphigus

IgG PEMPHIGUS



Subcorneal Blister = P. foliaceous

Suprabasal Blister = P. Vulgaris - common

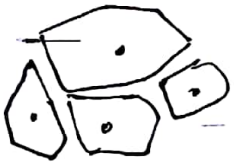


INTERCELLULAR CEMENT

← Intercellular cement (Lipids)
like a glue

make the glue
Lamellar Body (Max. in granular Layer)
Odland Body

ECZEMA/DERMATITIS



Defective cement

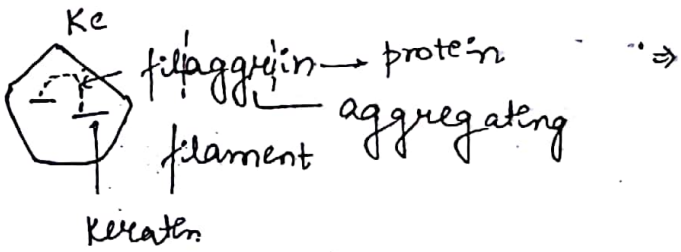
Intercellular edema (spongiosis)

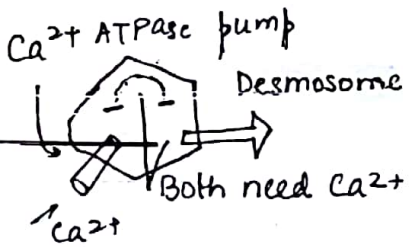
Desmosomes are (N)

Oedema or H_2O is more in Pemphigus

Oozing is a sign of acute eczema

CONGENITAL EPIDERMAL BLISTERS





DARIER's DISEASE (DD) & HAILEY-HAILEY DISEASE (HHD)

↓

mutation in Ca-ATPase pump ∴ birth

↓

weak KC

circular KC (Acantholytic cell)

DD

Keratosis Follicularis

↓ correct → there is hyperkeratosis → circular weak KC

↓ Incorrect word → No follicular involvement → Compensatory ↑ of keratin synthesis → circular strong KC

C/F :-

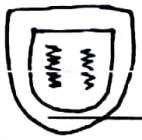
Hyperkeratotic spiny sharp papules on skin

↓

More in seborrhoeic areas

NAILS :- 1) V shaped nicking of nails

2) ~~Red/white~~ longitudinal nail lines



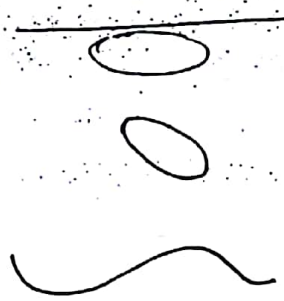
PALM- Palmar Pit

R_x = Retinoids.

DARIER'S DISEASE

Dyskeratotic cells in
SC = CORPS GRAIN

Dyskeratotic cells in
SG, CORPS ROND



SC → 100000
SG → 10000
SS → 1000
SB → 1mg

Hyperkeratosis

Premature Keratenisaton = Dyskeratosis

OTHER CAUSES FOR DYSKERATOSIS

1) Premalignant skin Disease
2) Malignant Skin Disease

HHD :- No compensatory hyperkeratose
Hence presents ∴ Blisters

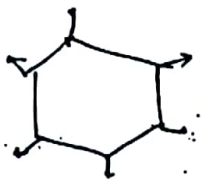
- GENE MUTATION :-

HHD
Ca ATPase 2C1 gene

Daviers
Ca ATPase 2A2 gene

EPIDERMOLYSIS BULLOSA SIMPLEX.

Trauma induced Blisters



No Keratin 5,14 since Birth.

Ⓝ Desmosome

Fragile basal Keratenocytes.

↓ TRAUMA

No acantholysis

Blister in basal layer

3 TYPES OF EPIDERMOLYSIS BULLOSA

EB SIMPLEX	EB JUNCTIONAL	EB DYSTROPHICA
S. Basal.	On DEJ"	in Dermis.

DIRECT IMMUNO FLOURESCENCE

Picks up Antibodies in Blistering Disorders

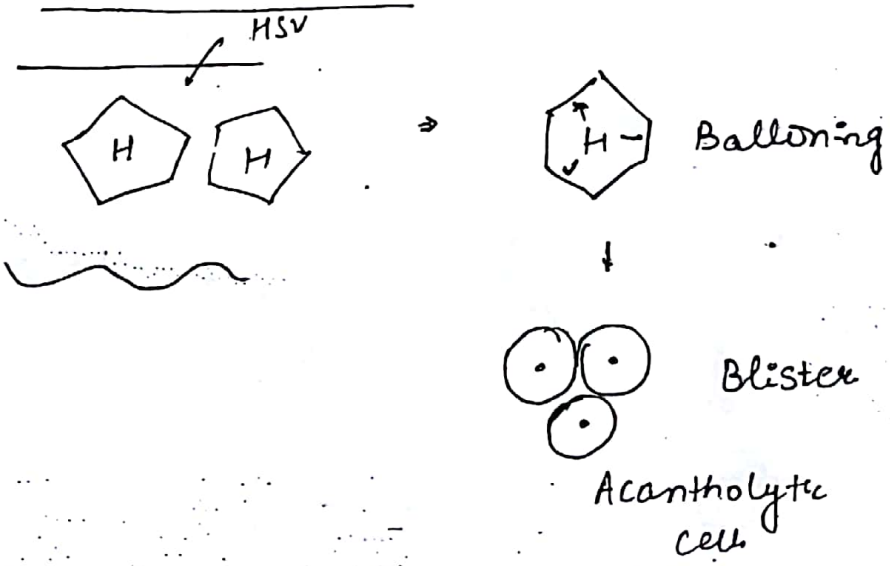
Pemphigus ⟶ DIF ⊕

DD/ HHD/ EBS | EBJ/ EBD ⟶ DIF ⊖

ACANTHOLYSIS

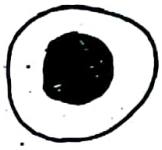
1° (Pulling Problem)	2° (Pushing Problem)
1) Pemphigus	1) HSV - Herpes Simplex
2) Darier's Disease	
3) HHD	
4) Bullous Impetigo	
5) Staphylococcal scalded skin Syndrome (SSSS)	

2° ACANTHOLYSIS

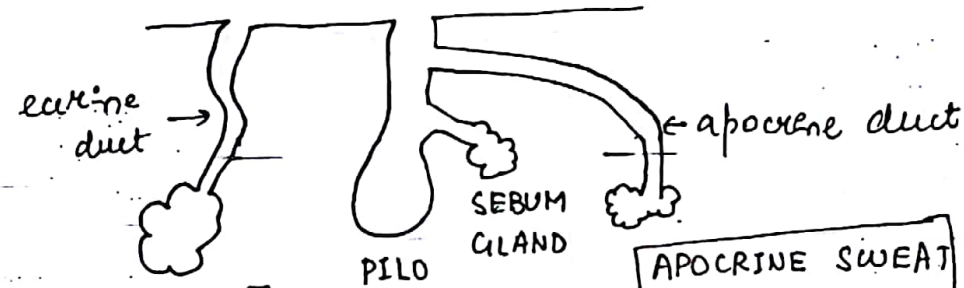


ACANTHOLYTIC CELL

1) Circular
2) Large nucleus
3) Narrow cytoplasm
4) Prominent nucleoli



APPENDAGE / ADNEXA

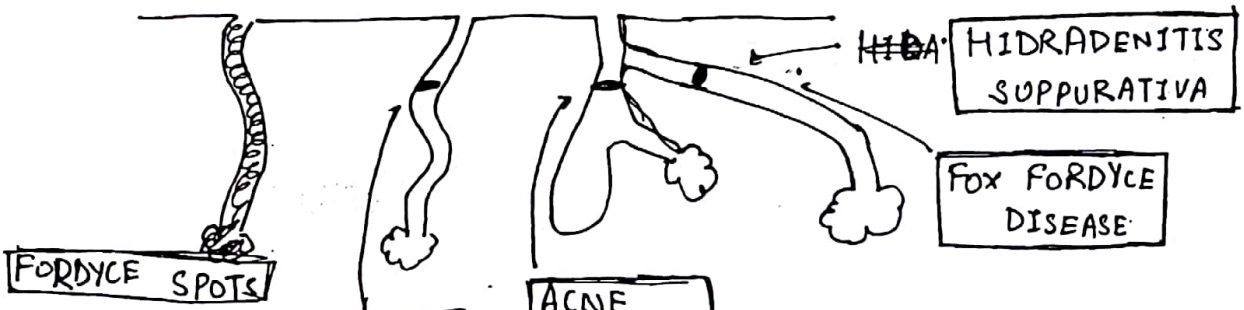


→ Everywhere else

Supplied by Cholinergic Nerves

→ Axilla
→ Perineum
→ Areola

Supplied by Adrenergic Nerves



Ectopic sebaceous glands

(occlusion due to S. epidermidis)

① ACNE VULGARIS

PATHOGENESIS:-

1) Keratenisation of follicular epithelium
2) Proliferation of propionibacterium acnes
3) ↑ Sebum produc" in seborrhoeic area
4) Dermal inflammation.

Pathogenesis of comedone :-

Comedone

(Hyperkeratenisation of follicular epithelium)

STAGE - 1 ACNE

2 TYPES

BLACK COMEDONE
(open comedone)
Black Head

WHITE COMEDONE
(closed)
White head

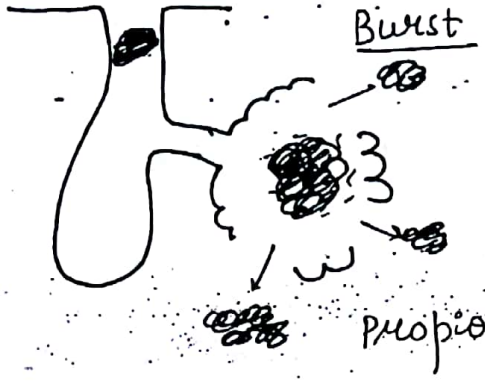
℞ = Topical Retinoids (Adapalene/ Tretinoin)

S/E → skin irritation
→ ~~photosensitivity~~
↳ hence applied at night

STAGE-2 = Inflammation

↓

[Red
Elevation] (Papule)
Pain



Stage 2 = (Stage 1 + papule)

R_x = Topical Retinoids + Topical Antibiotics
- clindamycin ✓
- clarithromycin ✓
- Dapsone. ✓

STAGE-3

Stage 2 + Pustule.

R_x = Topical retinoids + oral Doxy
Azithromycin
Minocycline → Most effective

More S/E
1) Hepatotoxic
2) Bluish skin pigment on long term use
   - nail
   - Acne scars

[redacted] / DRUG RESISTANT ACNE

1) Topical Benzoyl Perboxide
   - Safe in ♀.
   - release nascent [O] on skin surface
   - [Bactericidal]

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

2⇒ Topical Azelaic Acid

- Bactericidal
- Tyrosinase Inhibitor → reduces post acne pigmentation.

STAGE 4 (stage 3 + Nodule / cysts)

Acne has polymorphic Lesions

Rx = Oral Retinoids

- Acitretin = Keratolytic → used in psoriasis
- Isotretinoin = Keratolytic + Sebolytic (AIIMS, NOV 15)

STAGE 5 (ACNE CONGLOBATA)

STAGE 4 + Severe Inflammation →
- discharging sinuses
- Fever

Chest / back

Rx = Oral isotretinoin + anti inflammatory (steroids)

Recalcitrant Pustular Acne → Isotretinoin
↑ Not responding

ACNEIFORM ERUPTIONS :-

Drug induced Acne

Monomorphic Lesions on chest & check. (papule)

Causes :-

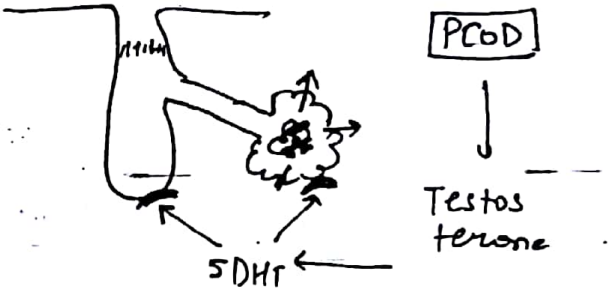
1) oral & topical steroids ✓
2) Anabolic steroids ✓
3) INH, Rifampicin ✓
4) Phenytoin, Phenobarbitone ✓

HORMONAL ACNE

eg. PCOD

presents as
- Acne
- Androgenetic Alopecia on scalp
- Hirsutism on face
- Irregular menses

R_x = Androgen (R) Blocker
- Cyproterone acetate
- Drospirinone



H/C SIDE EFFECT of Isotretinoin
= DRY LIPS (cheilitis)

Other S/E :-

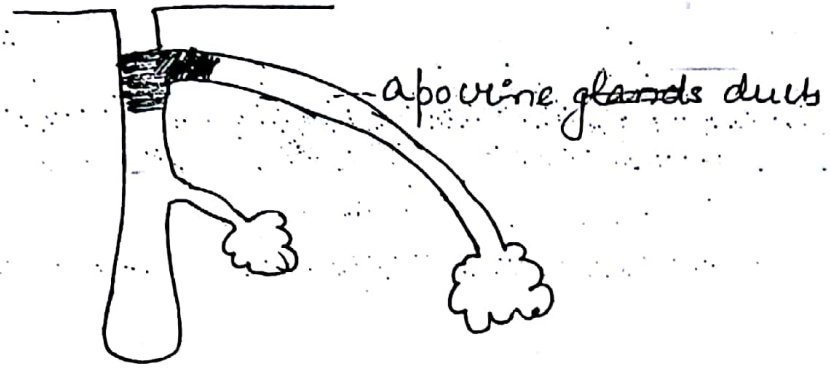
1) Hyperlipidemia
2) ♀ category 'X'
3) Period of contraception after stopping
   Isotretinoin → 1 month.
   Acitretin → 2 month.

② HIDRADENITIS SUPPURATIVA

water → sweat

gland → inflammation

pus → Discharge sinus



Keratin obstruction of apocrine ducts extending into hair follicles

↓

Lesions similar to Acne but in APOCRINE Areas.

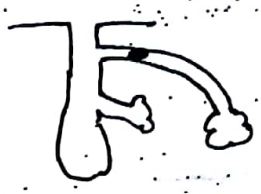
hence called INVERSE ACNE

2° Infection ⊂ S.Aureus ⇒ ✓ Creates Abscesses +
✓ Draining sinuses in apocrine areas.

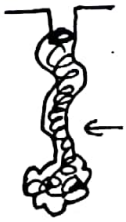
R_x = Retinoids + Broad spectrum oral Antibiotics,
Surgical debridement of pus.

(III) FOX FORDYCE DISEASE

- Lesser keratin obstruc° as compared to hidradenitis
- Only Inflammatory papules in apocrine areas
- No comedons seen.



(IV) FORDYCE SPOTS



← ectopic ~~fordy~~ sweat gland

Ectopic sebaceous gland on upper lip or Buccal mucosa
asymptomatic
No Rx required

LANGERHANS CELL

Derived from Bone Marrow
Picks up Ag in epidermis
↓
Sends to Local L.N. for processing

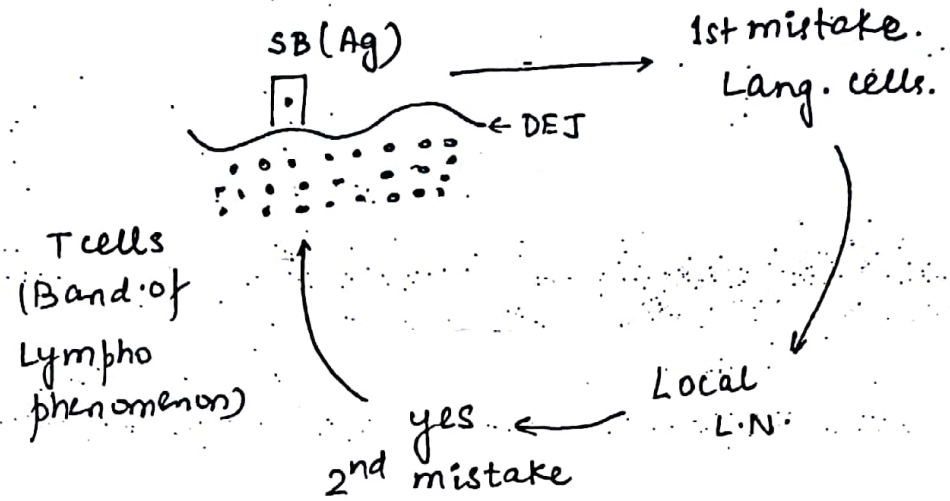
TH_1 response → (T cell)

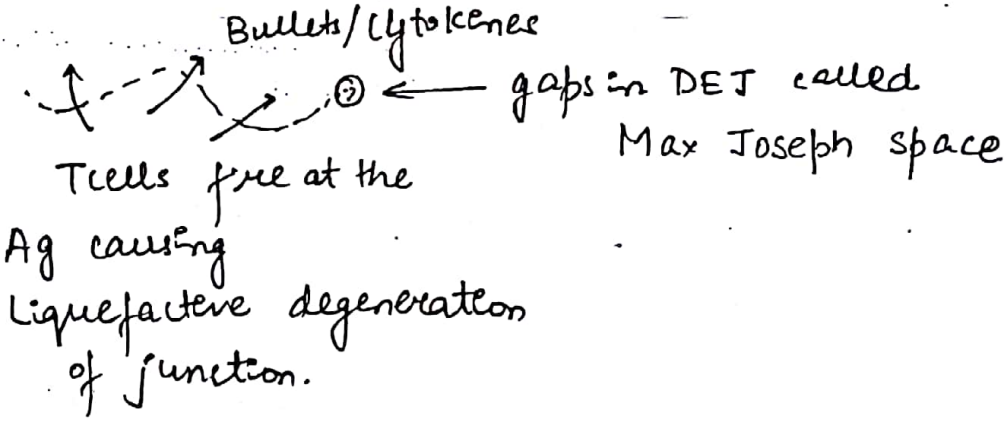
TH_2 response → (B cell)

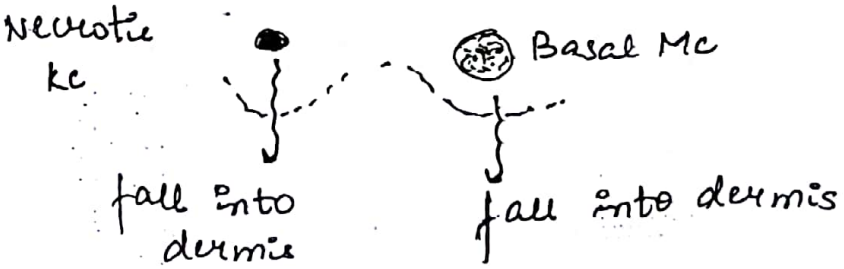
HPV puts Langerhans cell to sleep & create infec° in ~~epidermis~~.

Hence Rx for warts is Langerhans cell stimulation [Topical Imiquimod]

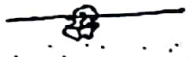
LICHEN PLANUS







Civatte bodies
or
Colloid bodies
or
cytoid bodies)

Melanin colour	Clinical skin colour
	BLACK
	BROWN
	PURPLE
	BLUE / GREY

Other changes seen in LP:-

→ Hyperkeratosis
→ Hypergranulosis
→ Pigment incontenance
→ Acanthosis (thickened spinous layer)

Band of Lymphocyte + Basal cell degeneration
= Interface Dermatitis

↙ Basal cell degeneration. (Most distinctive histology feature)

OTHER CAUSES OF INTERFACE DERMATITIS

→ Fixed Drug Eruption
→ Erythema multiforme
→ Graft vs Host Disease

MELASMA

Disorder of Pigmentation (Hyperfunctioning melanocytes)

TRIGGER FACTORS:-

1) Sun exposure
2) OCPs
3) ♀ (Chloasma)

♀ > ♂

C/F:-

1) Brown hyperpigmented patches at cheek, nose & photosensitivity.
2) Chronic disease

Rx:-

1) Sunscreen
2) Tyrosinase Inhibitors eg. 1) Kojic acid
   2) Hydroquinone (2-4%) [gold std]
   3) Azelaic acid
   4) Arbutin
3) Topical Retinoid
4) Topical Steroid (melanocyte inhibitors)

KLIGMAN REGIMEN

Topical hydroquinone
+
Topical Retinoid
+
Topical Steroid

SLE

Presents are persistent erythema on Malar area
i. photosensitivity
Rash is in a butterfly pattern.

ROSACEA

⇒ TRIGGER FACTOR
1) Sun
2) Alcohol
3) Hot spicy food
4) Emotional upset
5) Demodex mite
6) Exercise

⇒ STAGES
1) Telangectasia • Intermittent flushing (episodic flushing)
2) Papule • Pustules
3) Rhinophyma (Potato Nose)

⇒ Rx: avoid triggers
Topical steroids (C/I) ⇒ bcoz they cause telangectasia

Orally Doxycycline - Doc
↳ acts by anti-inflammatory effect

Topical Metronidazole or Clindamycin
(anti-inflammatory drugs)

ACANTHOSIS NIGRICANS → misnomer

Black velvety areas in flexures

PATHOLOGY :-

Insulin Resistance

↓

ILGF (Insulin like growth factor)

↓

thick skin.

CAUSES :-

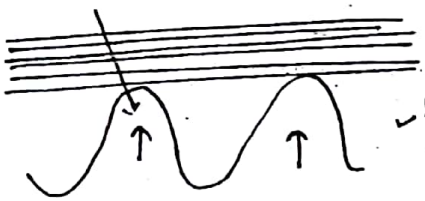
1) obesity Q
2) DM
3) PCOD
4) Drugs (systemic steroids, nicotinic acid)
5) Gastric AdenoCa → Rarest cause Q.

Not a melanin disease

ON BIOPSY :-

PAPILLOMATOSIS Q

HYPERKERATOSIS Q.



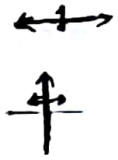
→ papilla touches the SC

CLASSIFICATION OF SKIN LESIONS

1° 2°

PRIMARY LESIONS

	Less than 0.5cm	0.5cm – 1cm	More than 1cm
FLAT	MACULE		PATCH
PUS	PUSTULE		PUSTULE
FLUID	VESICLE		BULLA
SOLID ELEVATION	PAPULE		PLAQUE / NODULE



LEVEL OF BLISTERS

EPIDERMAL	DERMAL / DEJ"
Flaccid	Tense
Ruptures by itself	Doesn't rupture by itself
Doesn't heal ī scarring	Heals ī scarring, milia
Heals ī hyperpigmentation	Heals ī hypopigmentation

SECONDARY LESIONS

1) SCALE
   - visible exfoliation of skin
   - SILVERY SCALES :- Psoriasis
   - POWDERY » :- Pityriasis Versicolor
   - COLLARETTE » :- Pityriasis Rosea → Hanging Curtain sign
   - Small

P LEAF LIKE SCALES - Pemphigus folliaceous

More fluid ○ PF → always ruptures
Less fluid ○ PV

Raw

↓

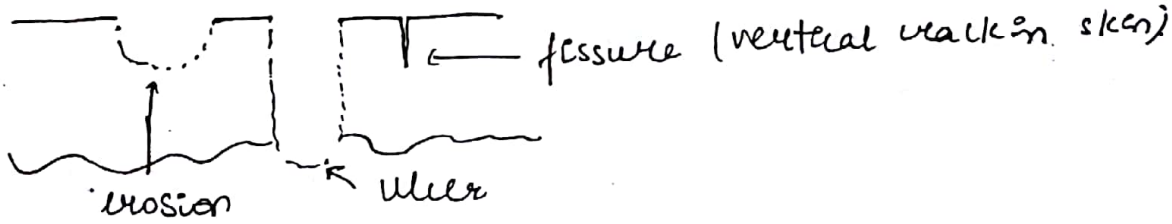
ruptures, fluid released
forms scale on raw surface

PF

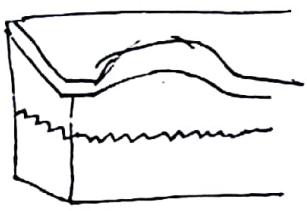
Dsg I → Seborrhoeic areas
→ mucosa → absent

2> CRUST :-
Dried exudate
Usually Black in colour

3> EROSION, ULCER, FISSURE :-



4> LICHEN SIMPLX CHRONICUS (Lichenification)



Thickening
Increased Hyperpigmentation
Skin marking

S/o Chronic itchy skin Disease

HAIRS

HAIRS 2 TYPES

TERMINAL	VELLUS
↓	↓
Thick	Thin

Terminal —miniaturisation→ vellus

Called as

ANDROGENETIC ALOPECIA (AGA)

MALE AGA

- → Starts ⇆ hair Line Recession
- → followed by frontal + vertex balding
- → Lateral + Post Density Ⓝ

Rx = 5% Minoxidil
oral finasteride 1mg/day

Male AGA GRADED from
1 ⟶ 7
Least most

Norwood-Hamilton Grading Scale

FEMALE AGA

No hair Line recession
Widening of central parting

Rx = 2% Minoxidil
Androgen Ⓡ Blocker

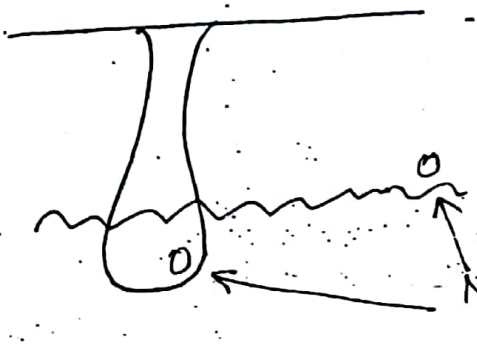
1 ⟶ 3

Ludwig Greading scale

DISORDERS OF MELANIN

(I) DISORDES of HYPO / DEPIGMENTATION

(A) ALBINISM



Tyrosine
↓
Tyrosinase X at birth
↓
Melanin

Neural crest (N)

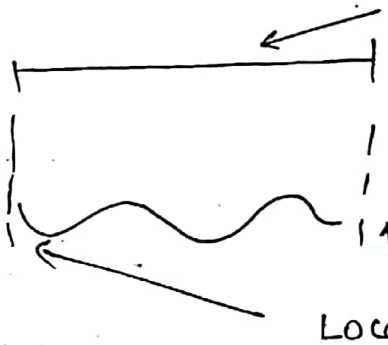
Melanocytes +nt
Melanin absent

Congenital

Diffuse white skin & white hair

No iris Pigmentation

(B) PIEBALDISM



Localised white patch

Localised neural crest dysfunc

NO Melanocytes
NO melanin

Congenital

* Areas of skin without white patch
* White forelock
  - ↓ front
  - ↓ lock of hair

WAARDENBERG SYNDROME

Piebaldism + Deafness + ↑ Inter pupillary Distance

(C) NEVUS DEPIGMENTOSUS / NEVUS ACHROMICUS :-

↓ Birth mark

No colour

Localised white patch since birth.

Pathology :-

Melanocyte ↓

Melanin transfer to keratinocytes ↓

(D) NEVUS ANEMICUS :-

Vascular Ab (N)

Faint hypopigmented patch since birth

Not a melanin disorder

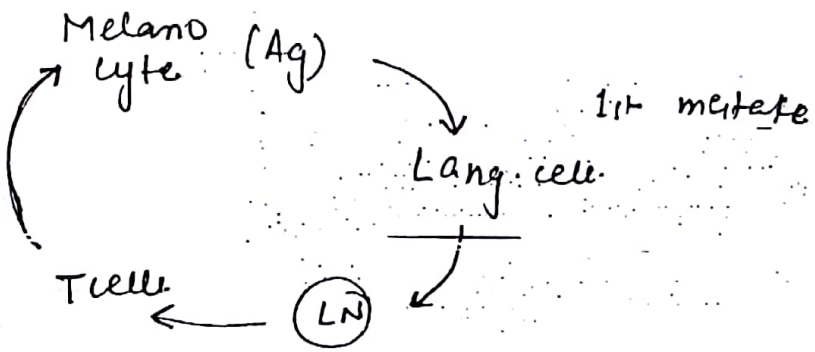
(E) VITILIGO :-

Acquired, not congenital

Autoimmune Disorder

Depigmented Lesion

Mc underlying Disease : Thyroid Disease



H/P :-

No melanocyte

No melanin.

T cells → Skin

T cells → Hair

Depigmented skin

Black Hair.

Depigmented skin → Hair → Leuco-Trichia

* POOR PROGNOSTIC FACTORS :-

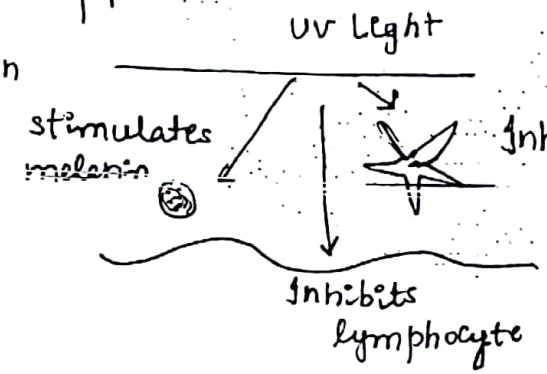
1) On Bony prominences
2) Leucotrichia
3) Lip-Tip
4) Thyroid Disease

CLASSIFICATION OF VITILIGO

LOCALISED	GENERALISED
Focal	Acrofacial
Segmental	Vitiligo vulgaris (M/c)
Mucosal	Universal
Lip-Tip	

Rx = Immunosuppresives

Phototherapy In Vitiligo



UVA Phototherapy

Needs a sensitiser called 'PSORALEN'

- Topical (localised cases)
- Oral (generalised cases)

↓

Wait for 1-2 hours

↓

give UVA light

↓

[PUVA Therapy]

- Psoralen
- UVA

UVB Phototherapy

UVB (290-320nm)

No need for PSORALEN

- Broad Band UVB (290-320nm)
- Narrow Band UVB (311nm) → Best Therapy

For Localised cases:-

Topical immunosuppressives

- Steroid
- Tacrolimus

For Generalised case:-

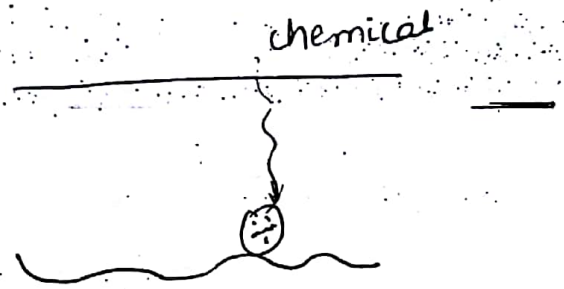
Systemic immunosuppresives

- Steroid
- Azathioprine
- Methotrexate

Surgical (Done ~~for~~ only for stable vitiligo)
↓
No new lesions
∵ past 2 years.

↳ Split skin Graft

(F) CONTACT LEUCODERMA



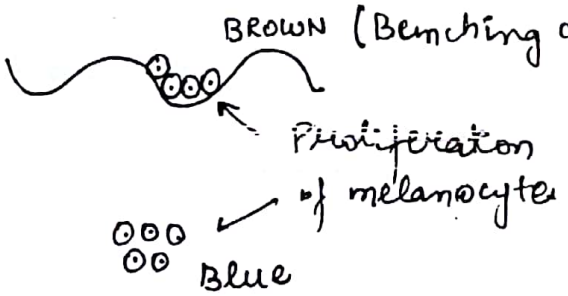
Agents causing Leucoderma

1) Bindi (commonest)
   - Para tertiary Butyl Phenol (PTBP)

2) Footwear / plastic
   - Monobenzyl ether of hydroquinone (MBEH)
     ↓ Most potent agent
     ↓
     useful in universal vitiligo - to depigment ⊗ Remaining skin

(II) DISORDERS OF HYPERPIGMENTATION

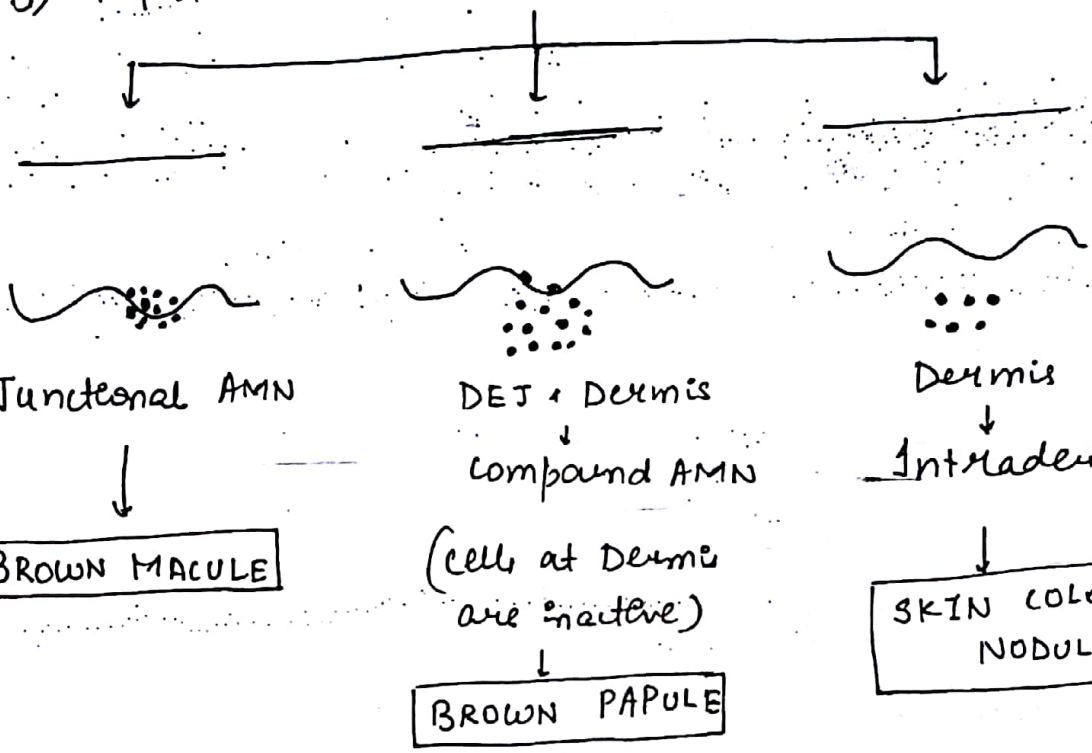
(A) MELANOCYTIC NEVUS (common mole)



1) CONGENITAL MELANOCYTIC NEVUS (CMN)

Giant Nevus (>20cm) has risk for malignancy
↓
Melanoma

B) ACQUIRED MELANOCYTIC NEVUS (AMN)



C) NEVUS OF OTA AIIMS MAY 2015

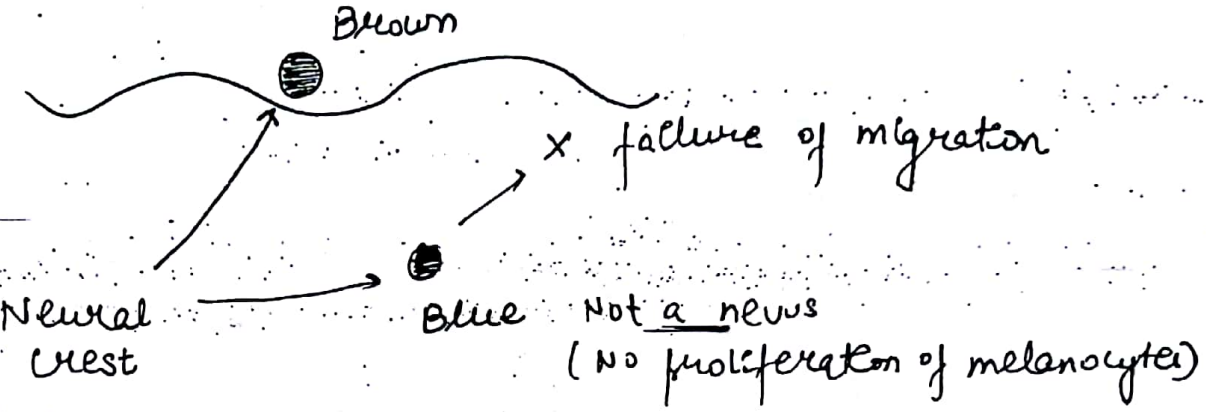
- Dermal melanocytic nevus
- Blue in colour
- along Trigeminal N/V
- U/L
- Congenital
- along ± Blue Sclera on same side

D) NEVUS OF ITO (similar to nevus of ota)

- Shoulder
- ~~Upper Back~~
- clavicular area

✓ Supraclavicular & Lateral Brachial N/Vs

E) MONGOLIAN SPOT



Site :- Lumbosacral area

Self resolving by puberty

F) BECKER's NEVUS Q.

→ Epidermal melanocytic nevus

↓

Hence Brown in colour

- On Shoulder, Chest & Upper Back
- ♂ > ♀
- → Onset → Adolescents
- → Due to androgen sensitivity causing hypertrichosis & Acne inside the Brown patch.

Rx = LASER.

G) MALIGNANT MELANOMA

R/F :- 1) Fair skin

2) Giant CMN

3) Atypical / Dysplastic Nevus

4) Family H/o.

5) Xeroderma Pigmentosum
(DNA. Repair disorder)

6)

CRITERIA

A → ASymmetry

B → Border (irregular)

C → Colour (multiple)

D → Diameter > 6mm

E → Evolution.

TYPES

1) **LENTIGO MALIGNA** (melanoma in Situ)

Brown — Horizontal phase → cells travel in single line along basal layer

Best Prognosis

2) **LENTIGO MALIGNA MELANOMA**

10-15yrs

develops a vertical phase

Not very good

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

3) SUPERFICIAL SPREADING MELANOMA

H/C type in world

early vertical phase

4) NODULAR MELANOMA

only vertical

POOREST PROGNOSIS

5) AMELANOTIC MELANOMA

→ Non pigmented

→ Variant of ~~xxx~~ nodular melanoma

6) ACRAL MELANOMA

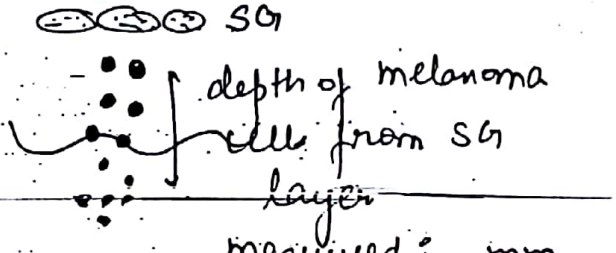
↓

extremity

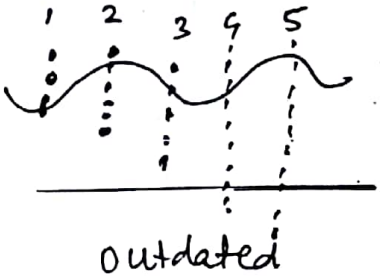
IOC :- Excisional Skin Biopsy

Histological Grading

BRESLOW ← → CLARKE



measured in mm



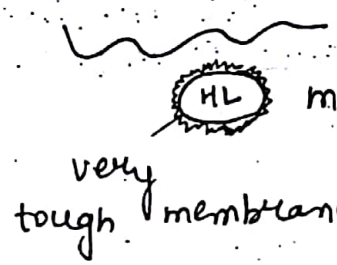
outdated

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

R_x = Surgical excision.

MAST CELL DISORDERS

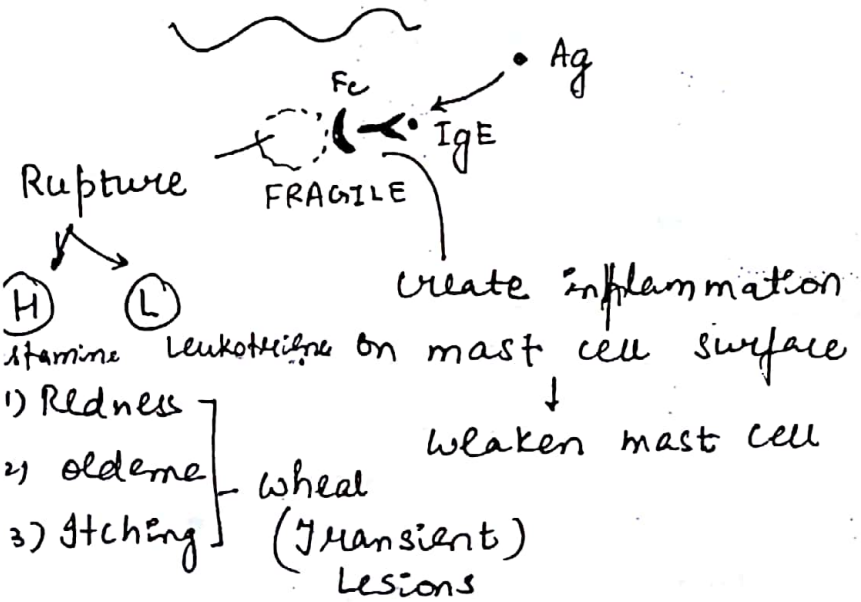
(HL) mast cells ✗



(A) URTICARIA (HIVE)

Disease of fragile mast cell membrane

Depth is ok



TRIGGERS FOR MAST CELL RUPTURE

(A) Acute Triggers

↓

Acute urticaria (< 6 week)

→ Food

→ Drugs

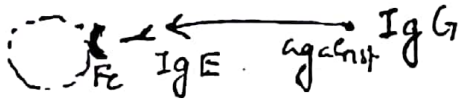
→ Infections

(B) Chronic Triggers

↓

Chronic urticaria (> 6 weeks)

1) Autoimmune urticaria



A/c autoimmune thyroiditis.

2) Idiopathic Urticaria

Trigger is unknown.

3) Physical urticaria

↘ Trigger is physical

eg. cold → cold urticaria

sun → solar urticaria

sweat (eccrine) – cholinergic urticaria

scratch – Dermographism

↓ to skin ↓ to write

water → Acquagenic urticaria

Rx

Acute cases - Remove Ag

Chronic cases - Ag. Removal difficults

▷ Anti-H_1 antihistamines

1st gen
↓
More sedative
eg. Hydroxyzine

2nd gen
↓
Less ~~sedative~~
eg. Levocitrezine
Fexofenadene
Loratidene
↓
preferred

2) Anti-H_2 Antihistamines
eg. → Ranitedine
→ Cimetidene

3) Anti-Leukotriene
eg. → montelukast

4) For Autoimmune urticaria
↓
Immunosuppresives
eg. → steroids
→ cyclosporine
→ Azathioprene
→ Methotrexate

5) Omalizumab ⇒ Anti IgE drug
↓ Ab
monoclonal

(B) ANGIOEDEMA

also called as **QUINCKE'S EDEMA**

Rupture of mast cells in subcutaneous **fat**

↓

Fat doesn't have itch n/vs.

No redness

But oedema is very prominent

Because fat is a loose tenue

↓

eyelids/lips

a/e resp. oedema → sudden death.

Rx = If lips, eyes involved → Inj Hydrocortisone

If resp. → Inj adrenaline

HEREDITARY ANGIOEDEMA

C_1 esterase inhibitor

↓ ⊖

Bradykinin

In HAE → C_1 esterase ~~enzyme~~ inhibitor enzyme deficiency

↓

Hence **Kinin Levels ↑**

↓

Triggering angioedema

AD inheritance

Low complement (C_4) :- Screening Test

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

TYPES

1 → Reduced amount of enzyme

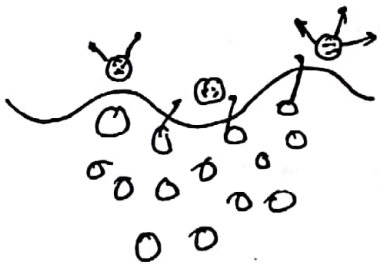
2 → Amount (N), inactive enzyme

(C) MASTOCYTOSIS (URTICARIA PIGMENTOSA)

2nd: mast cells ↑ no.

1st: on rubbing

Brown.



producing melanin ←

Mast cell Proliferation → stimulate basal melanocytes

Presents as BROWN Hyperpigmented patches, plaques or nodules. on TRUNK of a CHILD

Scratching on Brown patch

↓

mast cell rupture (superficial)

↓

Urticaria (red, elevated, itchy)

DARIER's sign ⊖.

↓

Other causes:-

1) xanthogranuloma
2) Histiocytosis
3) Leukemia

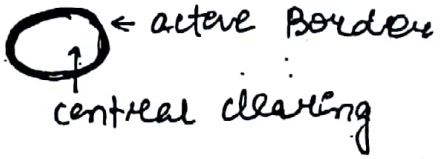
~~Pseudo-Darier's Sign~~

Smooth M/s Hamartoma.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

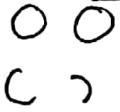
SHAPES OF SKIN LESION

1> ANNULAR (Ring)



eg. a) Tinea [Ring worm]
b) BB Hansen
c) Herald Patch of Pityriasis Rosea

2) CIRCINATE
multiple circles



eg. Circinate Balanitis (Reiter's Disease)

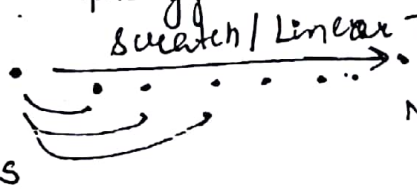
3) LINEAR NODULES , discharging sinuses along lymphatics

Causes

Sporotrichosis :- caused by sporothrix schenkii

FISH TANK GRANULOMA / SWIMMING POOL GRANULOMA
caused by Mycobacterium marinum.

4) ISOMORPHIC or KOEBNER's PHENOMENON
same morphology



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

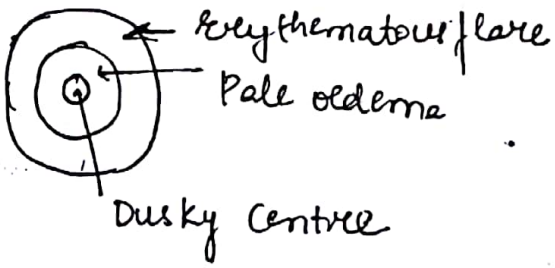
TYPES of KOEBNER's PHENOMENON

TRUE (autoimmune)	FALSE (Viral)	RARE
Psoriasis	Wart (verruca vulgaris)	Darier's Disease
Lichen planus	Molluscum	HHD
Vitiligo	Due to auto-inoculation while scratching.	Erythema multiforme
		Kaposi's sarcoma
		Lichen sclerosis
		Lichen nitedus

REVERSE KOEBNER -
Psoriasis

5> TARGET LESION/ BULL's EYE /IRIS LESION

Eg. Erythema Multiforme.
Erythema Chronicum Migrans



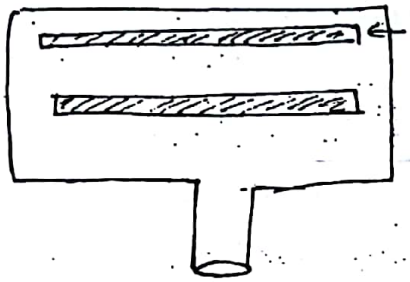
TESTS IN DERMATOLOGY

A) Wood's Lamp
B) Histopathology

WOOD'S LAMP

→ 365nm

→ Composition – Barium silicate + 9% nickel oxide



Use

1) **Tinea Capitis** →

Fungal (Dermatophyte)

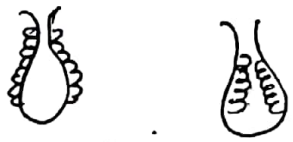
3 species

Trichophyton | Epidermophyton | Microsporum

Keratophilic fungus

↓

Nail, Hairs.



Ectothrix

↓

Usually by Microsporum

↓

⊕ on Wood lamp

Bluish Green fluorescence

endothrix

↓

By Trichophyton.

↓

⊖ on wood's lamp

2) Erythrasma -
caused by Corynebacterium minutissimum
Red pathes → in groin & axilla
Asymptomatic
On Wood's Lamp :- "CORAL RED FLOURESCENCE"

3) Pityriasis Versicolor -
Fungal infection by Malassezia
On WOOD's LAMP. YELLOW FLOURESCENCE

4) Burrow of Scabies -
on wood's lamp - GREEN.

5) Urine In Porphyria -
or Blister fluid
on Wood's lamp - PINK / RED

6) Vitiligo :-
WHITE

7) ASH LEAF MACULE.
WHITE & more prominent on Wood's

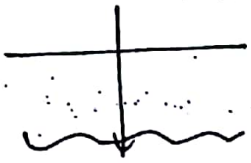
8)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

PORPHYRIA

Ⓝ

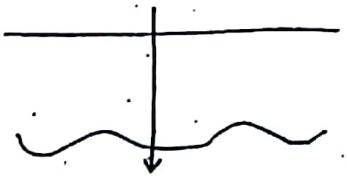
visible light



Neutralised by Ⓝ Porphyrins in dermis

PORPHYRIA

visible soret light



Ab Ⓝ Dermal porphyrin

↓

No neutralisation of light

↓

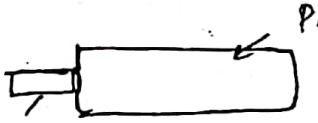
Dermal Damage

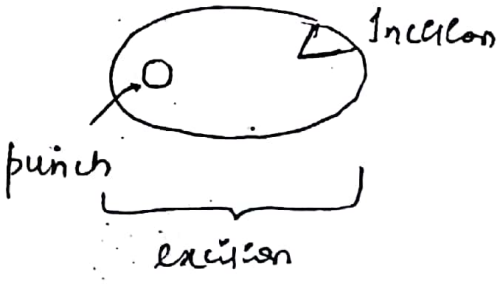
↓

Dermal tense bleister in light exposed areas

B) HISTOPATHOLOGY-

1) By Punch Biopsy Instrument





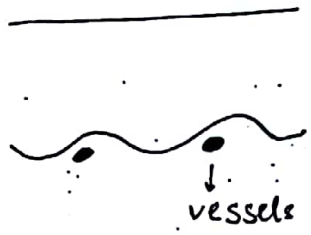
2) Incision Biopsy

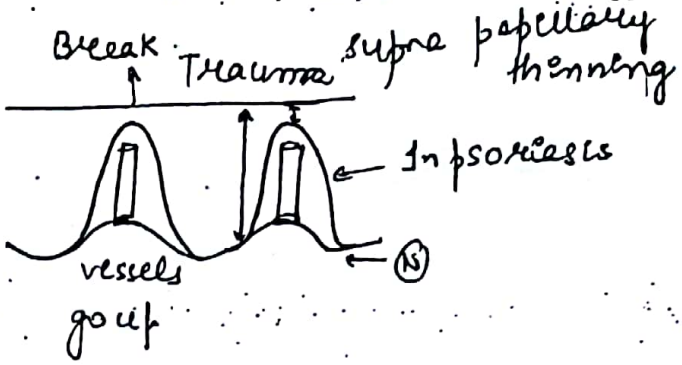
3) Excision Biopsy

4) Shave Biopsy ** (JIPMER)

Superficial Removal of skin ⊂ horizontal movement of Blade used for superficial elevation Lesions

1) Psoriasis :-





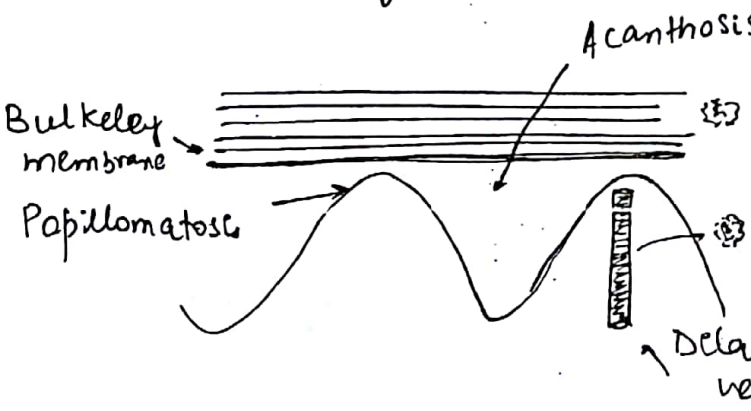
Intermittent pen point Bleed
= AUSPITZ SIGN.

Auspitz sign is demonstrated after GRATTAGE TEST (scraping)

↓

on scraping, candle wax like scales are dislodged

Bulkeley membrane is a thin membrane at the lower part of corneum & need to be dislodged to see bleeding points.



Munroe's microabscess (s. corneum)
S. granulosum → absent
Spongiform pustule of Kogoj (s. spinosum)
↑ neutrophils

Less neutrophils in corneum ⇒ MICROABSCESS.
not a macroabscess

More neutrophils in corneum ⇒ MICROABSCESS + MACROABSCESS
↓
Pustular Psoriasis
↓
sterile pustule.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

2> DERMATITIS HERPETIFORMIS:-

Papillary tip neutrophils

" " microabscess

Not ~~macro~~abscess

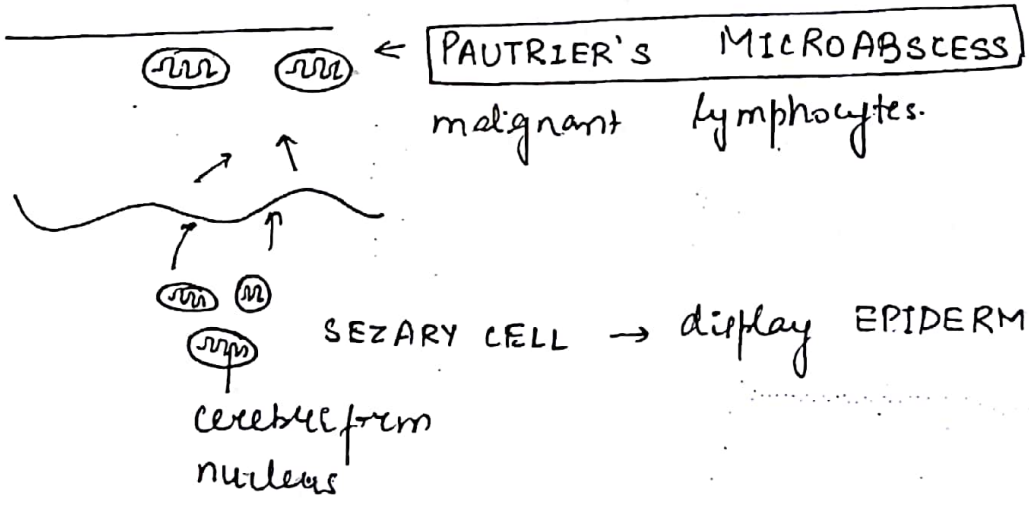
3) MYCOSIS FUNGOIDES (MF)

Misnomer.

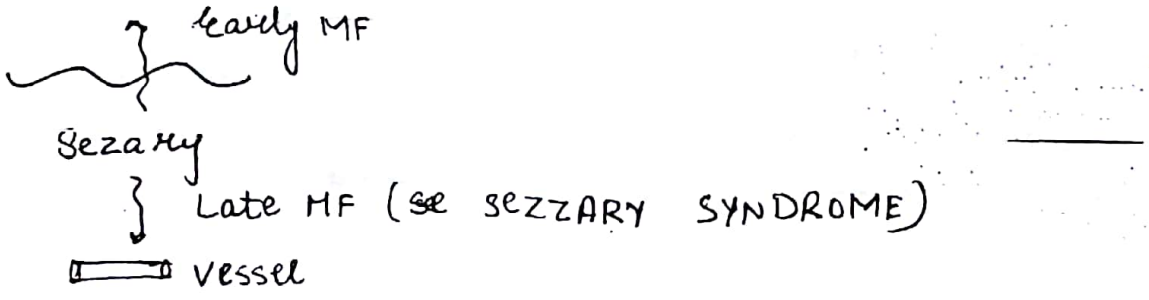
No fungus.

A type of CTCL (Cutaneous T. cell Lymphoma)

CD_4 ⊕ malignant dermal T cell.



When sezary cell go up ⇒ Early MF



FEATURES OF SEZZARY SYNDROME :-

1). Sezzary cells in Blood

2) Generalised Lymphadenopathy

3) Erythroderma/ Exfoliative Dermatitis

4) means > 90% Body surface area involvement

Erythro - Red

Exfoliative - Scaly/ falling off

4/F - Red scaly skin in > 90% Body surface

STAGES of MF :-

1) (I) → patch stage MF

(II) → plaque stage MF

(III) → Tumour

(IV) → Erythroderma stage

Rx of MF :-

1) EARLY :-

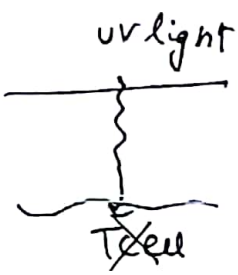
Rx from outside

Skin Directed Therapy (SDT)

a) Topical steroid

b) Phototherapy

c) Electron Beam Therapy (EBT)

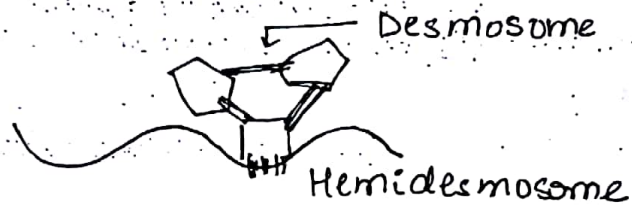


2) LATE :-

Rx from inside.

Chemotherapy

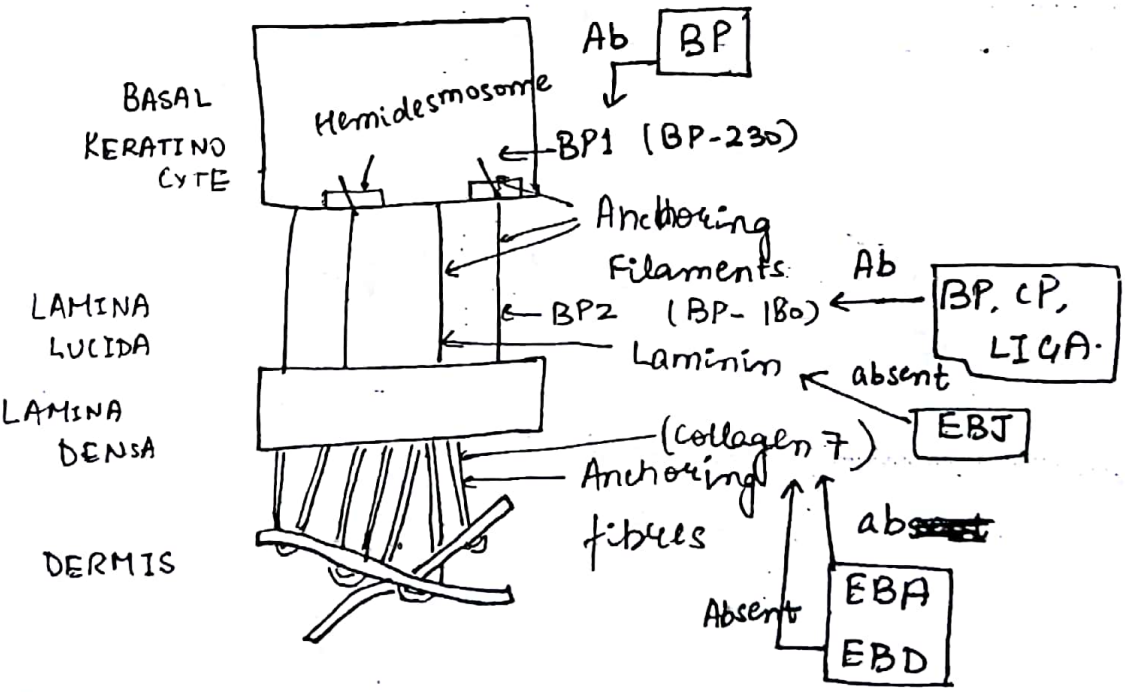
DERMO-EPIDERMAL JUNCTION (DEJ)



↓

contains Protein called

BP-1 (BP-230)



BP → Bullous Pemphigoid

CP → Cicatricial "

LIGA → Linear IgA disease

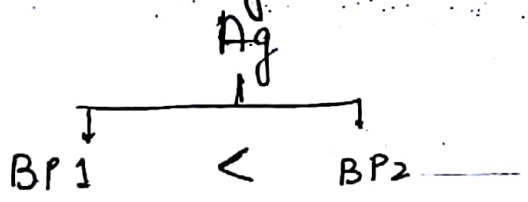
EBA → Epidermolysis Bullosa Acquisita

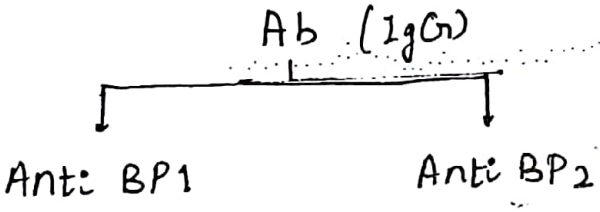
SALT SPLIT TECHNIQUE

Splitting of skin @ Junc' of Lucida & Dense on putting the skin in saturated sol' of salt

Roof Blisters	Floor Blisters
↓	
BP, CP, LIGA; EBJ	EBA, EBD

(I) Bullous Pemphigoid





Level of Blister = Lucida (Acquired)

DIF ⊕

(II) Cicatricial Pemphigoid

Ag → BP2

Ab → Anti BP2 (Ig G)

Level of Blister = Lucida (Acquired)

DIF ⊕

(III) LIGA

Ag = BP2

Ab = Anti BP2 (IgA)

Level = Lucida

DIF ⊕

(IV) EBJ

Ag = Nil

Ab = Nil

Absent Laminin since Birth

Level = Lucida

DIF = ⊖

(V) EBD

Ag = Nil

Ab = Nil (absent collagen 7 since Birth)

Level = Dermis

DIF = ⊖

(VI) EBA

Ag = Collagen 7

Ab = Anti collagen 7 (IgG)

Level = Dermis

DIF = ⊕

DIF

Sample is skin Biopsy from Perilesional skin for DIF. while for routine H & E Lesional Biopsy is taken

Pemphigus Foliaceus ◇◇◇] IgG, C_3 in fishnet intercellular pattern

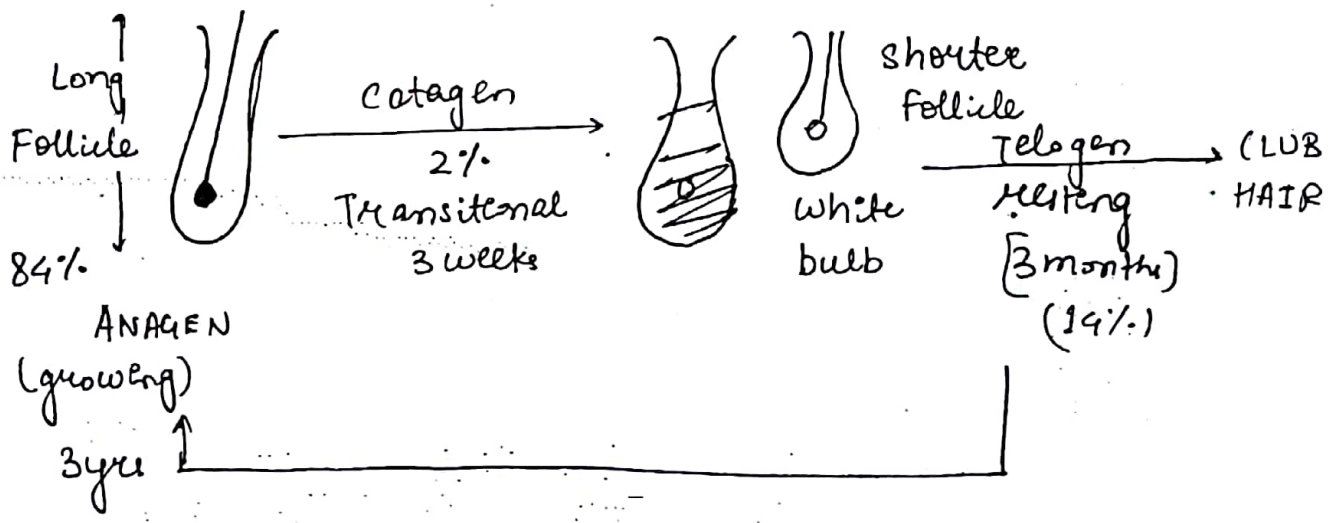
Pemphigus vulgaris ◇◇◇]

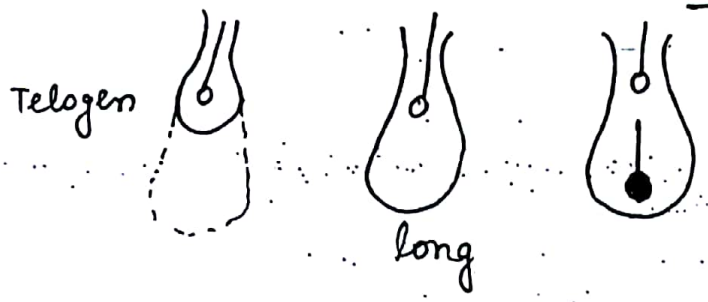
Linear IgG, C_3 → BP/CP/EBA

Linear IgA = LIGA.

I Dermosome (Dsg-1) green. ⟷ IgG Ab green ⟷ Anti-Anti IgG green

SCALP HAIR CYCLE





→ Anagen pushes out the telogen.
↓
telogen loss
100 hairs/day

EFFLUVIUM (Abn falling of Hair)

TELOGEN	ANAGEN
>100 hairs/day	1 hair/day
↓	↓
Telogen effluvium	Anagen effluvium
	eg. Hair Loss in chemotherapy

- ACUTE TELOGEN EFFLUVIUN

Hair loss occurs acutely after 3 months of an acute Metabolic Insult to the body

eg Severe Fever
Labour

No Rx Required, only Counseling.

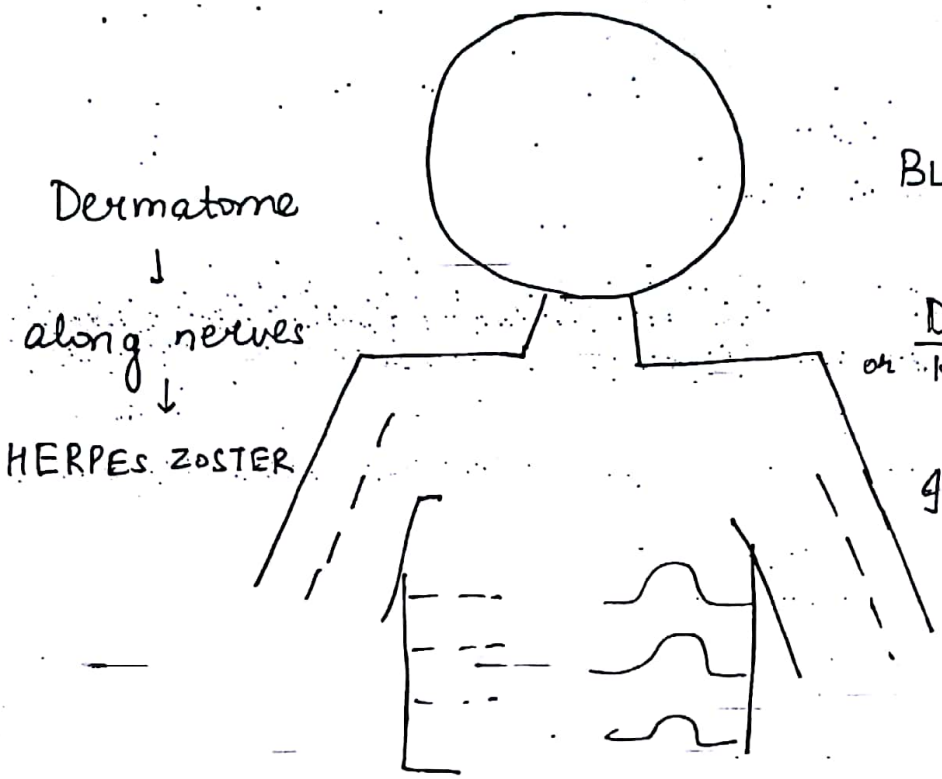
CHRONIC TELOGEN EFFLUVIUM

Hair Loss occurs chronically after chronic stressors

eg. Hypothyroidism
Anaemia
Nutritional Deficiency

Cause need to be Rx.

BLASCHKO LINES



Dermatome
↓
along nerves
↓
HERPES ZOSTER

BLASCHKO LINES
↓
Developmental Lines
or Keratinocyte Migration Line
↓
Incontinentia Pigmenti
Linear verrucous epidermal nevus

INCONTINENTIA PIGMENTI (AIIMS)

~~AR~~ ~~Dis~~ X-Linked Dominant Disorder

4 stages
Blister
↓
Verrucous (cauliflower like)
↓
Hyperpigmentation
↓
Hypopigmentation

LINEAR VERRUCOUS EPIDERMAL NEVUS [AIIMS]

Along BLASHCKO cauliflower epidermis since birth

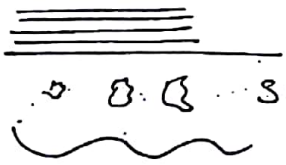
Presents as cauliflower like masses along Blaschko line since birth. ↓ persists throughout life.

Histopath:-

Epidermolytic Hyperkeratosis

↓ Inepidermis ↓ Breakdown.

In Stratum Granulosum.



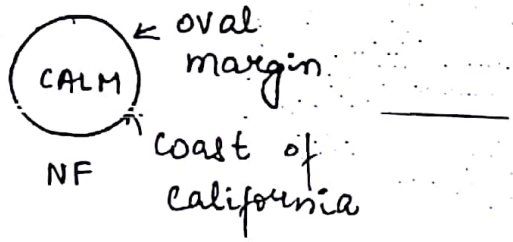
NEUROFIBROMATOSIS

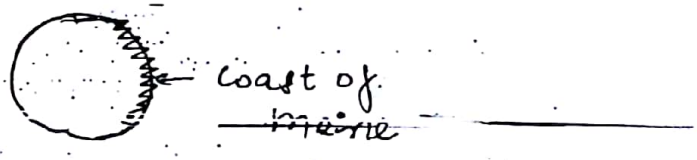
Skin Features :-

NF 1 → also called Von Recklinghausen Disease

1> AXILLARY FRECKLES (pathognomic)
↳ CROWE'S SIGN

2> CAFE-AU-LAIT MACULES (CALM)
↳ also seen in
a> Tuberous sclerosis
b> (N) people
c) Mc-Cune Albright Syndrome
d) Fanconi anemia





Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

3) NEUROFIBROMA - BUTTON HOLE SIGN ?

On pressing a blunt object on neurofebroma resistant is not felt in derma due to a dermal defect.

TUBEROUS SCLEROSIS / EPILOIA

Skin features :-

Tuber → potato like tumours in CNS.

Epi → epilepsy

Lol → Low

Io → IQ.

A → Adenoma sebacea.

1) ASH LEAF MACULE

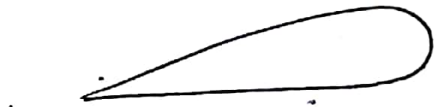
Earliest

M/c sign

tnt at birth.

Hypopigmented patch.

Becomes more visible on wood's lamp.



pointed oval.

> 3 is significant

2) CONFETTI MACULE

↓

small circular.

hypo

→ small hypopigmented Macule like confetti

3) ADENOMA SEBACEUM

minomer

No sebum relation

Skin coloured papules on face.

Onset - 2-5yrs of age

Histopath → Angiofibroma.

4) **SHAGREEN PATCH/PLAQUE**

Shark skin → rough.

Roughened plaques on LS Region

H/P → collagenoma

5) **KOENEN'S TUMOUR**

→ periungual fibroma

→ at puberty

CONNECTIVE TISSUE DISEASE

(I) LUPUS ERYTHEMATOSIS

- SKIN → **DLE**
  - → Discoid (coin like)
    - periphery Active
    - centre inactive
  - → Nummular
- SKIN + SYSTEMIC → **SLE**
  - Cause (B)
    - cicatricial alopecia
    - non cicatricial alopecia.

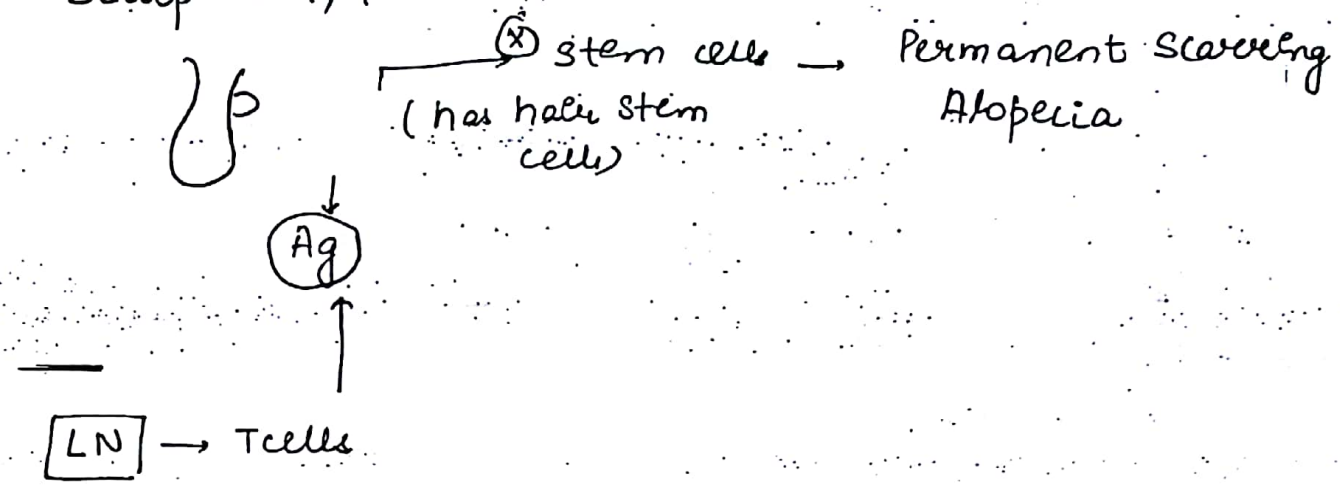
DLE :- → only cicatricial alopecia

Photosensitive

Autoimmune

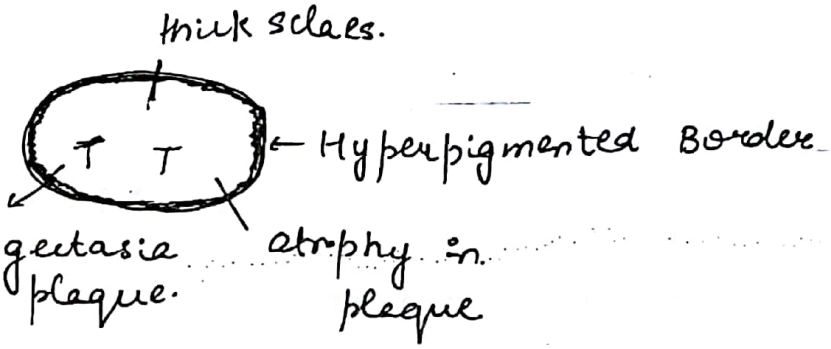
Hair follicle Disorder

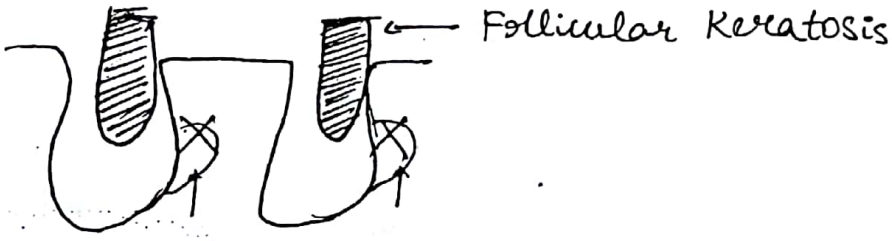
Scalp Hair/ Facial Hair :-

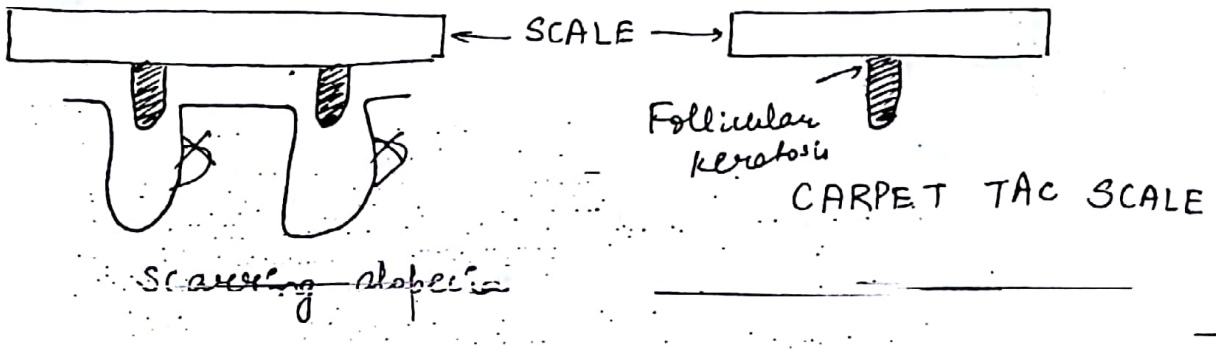


C/F :-

Discoid plaque





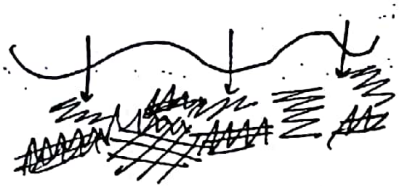


SLE

SLE pt's sometimes have thin / fragile / easily broken hair
↳ [LUPUS HAIR]

(II) SCLERODERMA

excess collagen ↕ unpinchable / Hard Bound Down skin.



- only SKIN → MORPHEA
  - M/c site = Trunk
  - Linear morphea on scalp causes Linear areas of cicatricial Hair Loss resembling cut ē sickle.
  - ⇓
  - en-coup-d-sabre
    - a
    - cut
    - ē
    - sickle
- SKIN + SYSTEMIC
  - Few systems → LIMITED SYSTEMIC SCLEROSIS
  - Many systems → DIFFUSE SYSTEMIC SCLEROSIS

CREST SYNDROME

- C = Calcinosis
- R = Raynaud's phenomenon
- E = Esophageal dysmotility
- S = sclerodactyly
- T = Telangectasia

SYSTEMIC SCLEROSIS

CRITERIA for Diffuse

MAJOR	MINOR
Essential	2 or 3
• Scleroderma proximal to the metacarpophalangeal Jt.	• Sclerodactyly • Digital pitted scars • Bibasilar pulmonary fibrosis

SKIN FEATURES -

1) Mask like face due to facial tightening
2) Purse string mouth / microstomia
3) Peri-oral Rhagades
4) Frequent Raynaud's phenomenon
5) Salt & Pepper Pigmentation

(III) DERMATO MYOSITIS

Skin — Proximal M/s weakness

↓

(A) Lilac/Purple Colour

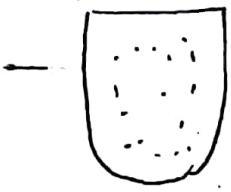
- around eyes ⊖ photosensitivity → Heliotrope Rash.
- in shawl area → SHAWL SIGN
- on Interphalangeal or Metacarpophalangeal Jts → GOTTRON's PAPULE

Ⓑ Mechanics Hand.
↳ Rough Hand due to palmar Hyperkeratosis

NAIL DISORDER

1) PITING DISEASE.

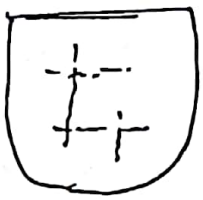
Due to involvement of proximal nail matrix.



RIDL

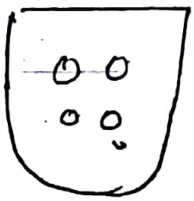
Random
Irregular.
Deep
Large

Psoriasis



Superficial
Regular
Geometric

Alopecia areata



Coarse large pits.

Eczema

H/c sign of ~~ps~~ nail psoriasis.

2) NAIL PSORIASIS

a) pitting is the H/c sign but not specific to psoriasis
Having pits → ↑ chance of getting jt involvement in psoriasis pt.

b) Salmon Patch / Oil Drop sign :- ~~(Pathognomic of psoriasis)~~
Red faint

3) Subungual hyperkeratosis
4) Onycholysis
5) Splinter heamorrhage.

3> NAIL LICHEN PLANUS (JIPMER)

Longitudinal Ridge
Pitted nail
Thinning of nail plate
Dorsal Pterygium (extension of proximal nail fold to nail bed.)

2o Nail Dystrophy. (Trachyonychia) JIPMER
or Sand Paper nail
↓
Also seen in psoriasis
& alopecia areata

~~Inverse~~

4> INVERSE (VENTRAL) PTERYGIUM Q.

Skin from nail bed fuses with the undersurface of nail bed seen in scleroderma.

5> HALF & HALF NAIL

Seen in Chronic Renal Failure
Reversible on hemodialysis.

due to anemia
↓
Proximal 50% white

Distal 50% Brown.
↓
due to melanin deposits on nail bed
⋮
due to ↑MSH secretion in CRF

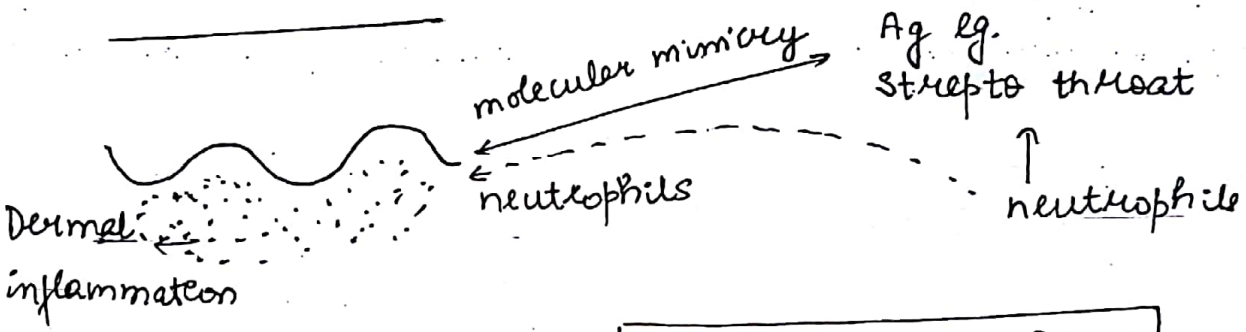
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

6) BEAU'S LINE

Horizontal groove on the nail plate.
Due to temporary suppression of nail growth due to past fever or Local nail fold trauma
No Rx Required.

NEUTROPHILIC DERMATOSIS

Neutrophilic accumulation in Dermis



Rx = Antigen Removal + Anti-Neutrophilic Drug

1) DAPSONE
2) COLCHICINE
3) STERDIDS - oral

Dermatitis Herpetiformis → DOC :- Dapsone
Behcet Syndrome
Sweets syndrome
Pyoderma Gangrenosum
} DOC : steroids

PYODERMA GANGRENOSUM

No pyoderma, no gangrene
Present as Very Painful leg ulcer ~ Purple Margin around it
ulcer → undermined

Associated c
- IBD
- Haematological malignancy

SWEET SYNDROME / ACUTE FEBRILE NEUTROPHILIC DERMATOSIS.

Presents acutely c red, oedematous, painful plaque on extremities c fever & Jt pains.

Resembles cellulitis.

DOC :- Steroids.

Associated c
— Strepto (H/c)
others — AML, Drugs ♀

Histopath :-
Plenty of neutrophils on dermis

Beh

BEHCET'S DISEASE

MAJOR

Recurrent aphthous ulcers
↓
Superficial, round/oval, painful c a red margin around it.

MINOR (any 2)

+ Recurrent genital aphthous ulcers
→ Eye Lesions (Panuveitis)
→ Skin Lesions (Erythema nodosum, pustules)
→ ⊕ Pathergy test

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

PATHERGY TEST :-

Inflammatory Papule or Pustule at the site of intradermal Inj^n on the forearm. (after 48 hrs)

Seen in-

1) Behcet's
2) Pyoderma Gangreenosum
3) Sweet's syndrome (rarely)
4) RA.
5) IBD

CUTANEOUS TB

A) EXOGENOUS TB

1) TB chancre
   ↳ means ulcer.

Flask shaped.
undermined

2) TB verrucosa cutis (TBVC)
   ↓ cauliflower ↓ skin.

3) LUPUS VULGARIS
   ↳ H/c typ of cut. TB in adults.

sputum
TB
47

Previous exposure to TB
↓
Post 1°
↓
High immunity
TBVC
(paucibacillary)

No previous exposure to TB
(TB naive, patients)
↓
1° TB
↓
Pt. has low immunity to TB
↓

TB chancre
MULTIBACILLARY (MB)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

LUPUS VULGARIS ✪ AIIMS.

Healing ⊂ central scarring

Progressive Lesions

Buttocks.

DIAGNOSIS :- 1) DIASCOPY

Pressing ⊂ a glass slide

↓

— Yellow Brown Nodules visible

(APPLE JELLY NODULES)

↳ also seen in

Sarcoidosis

Leishmaniasis

2) SKIN BIOPSY

Non-caseating tuberculoid Granuloma

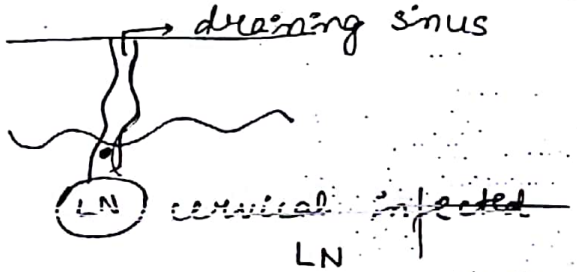
Lupus vulgaris ⇒ paucibacillary

Central clearing	Central scarring	Central crusting
↓	↓	↓
Tinea	Lupus vulgaris	Leishmaniasis

(B) ENDOGENEOUS TB

1) SCROFULODERMA → M/C in children.

2) PERI-ORIFICIAL



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Perf oral + Perf anal ulcer ⇒ severe int. TB.

(C) TUBERCULID → daughter Lesion
↓
mother Lesion.

* Daughter Lesions initiate Hypersensitivity in skin causing inflammation also leading to fragmented bacilli in skin & can't be cultured

Mantoux test is strongly positive in Tuberculid.

3 TYPES (Depending on size of daughter Lesions)

Daughter is very tiny (micropapule size)

Micropapular Tuberculid or Lichen scrofulosorum

C/F- Grouped micropapules on trunk

H/p- Perifollicular non-caseating TB granuloma

Daughter is small

Papulo-necrotic Tuberculid

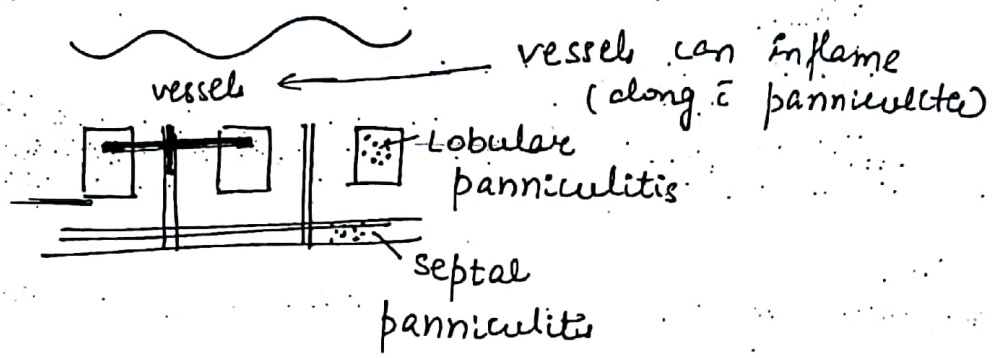
Daughter is Large

- Nodular tuberculid Erythema ~~ne~~ induratum
- Bazin's Disease

C/F- Red, tender, nodule on calf & ulcerates

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

PANNICULITIS



SEPTAL PANNICULITIS

- ī vasculitis
- ī out vasculitis
  - eg. Erythema Nodosum

LOBULAR PANNICULITIS

- ī vasculitis
  - eg. Nodular
    Tuberculoid
- ī out vasculitis
  - eg. 1> Pancreatic Panniculitis
    (Acute/chr. pancreatitis/ Cancer)
  - 2> Post steroid panniculitis
  - 3> Lupus panniculitis
  - 4> Subcutaneous fat necrosis of newborn

ERYTHEMO NODOSUM

Red, Tender nodules on **shin** & **never ulcerate**

CAUSES

NO - No cause, Neutrophilic Dermatoses
(Behcet's Disease, sweet syndrome)

D - Drugs (iodides, bromides, sulfonamides

O - OCP

S - Sarcoidosis

U - Ulcerative Colitis (also Crohn's)

M - Microbes (strepto)
Maternity • Malignancy (Hematological)

FEATURES	EN	ENL	SWEETS SYNDROME
Neutrophils	+	+	⊕
Histiocytes	+	+	⊖
Vasculitis	−	⊕	⊖

Rx of EN:-

1) Bed Rest
2) Neutrophil Removal Drugs (steroids), Dapsone, colchicine)
3) Removal of cause

HANSENS DISEASE

M. Leprae
↳ grows in (cool) areas
- Skin
- n/v (superficia)

Nerve 1st —then→ Skin.
(thicken the n/v)

Nerve involved but doesn't involve skin = **Pure neural Leprosy**

H/c peripheral n/v involved (UL) = **Ulnar**
LL = **Post Tibial**

H/c deformity = **CLAW HAND**

M/c cranial n/v = **FACIAL N/V**
↳ Lagophthalmos

Biopsy taken from Radial cut > Sural n/v

Commonest Hansen in India = BT HANSEN

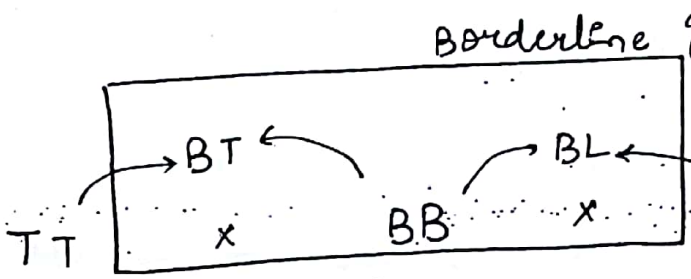
Commonest Int. Organ Involved = Testis (bcoz it has low temp)

Organ never involved in HANSEN = uterus → ♀
CNS → ♂

Earliest sensation lost = Hot & cold differentiation >
Cold > Hot > light touch > pain > crude touch

Sensation never Lost = Proprioception, vibration.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp



Good Immunity — Intermediate Immunity — Poor Immunity

Tuberculoid — Borderline — Lepromatous

Tuberculoid — Borderline (mid Borderline) — Lepromatous

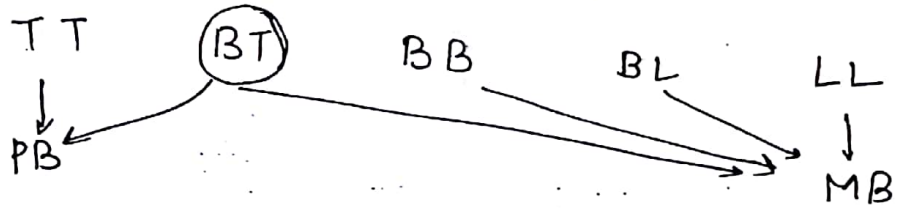
RIDLEY JOPLING CLASSIFICATION

Based on.

1) Clinical
2) Bacteriological (slit skin smear - SSS)
3) Histological (skin Biopsy)
4) Immunological (Lepromin testing)

If there are >10,000 Bacilli/gm of skin → MULTIBACILLARY HANSEN

If there is <10,000 Bacilli/gm of skin → PAUCIBACILLARY HANSEN.



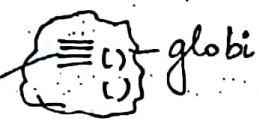
TT → Immunologically stable

BT → BB → BL → LL

Downgrading [cout ✗]

TT Hansen on Biopsy shows Perivascular, Pericadneral neural Granuloma

LL on Biopsy shows: Foam cell, Virchow cell, Lepra cells (Dermal macrophage full of leprosy Bacilli) —



cigarette shaped

Special stain

1) Zn Stain

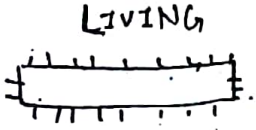
2) Fite Stain. → Image
[Blue background
Red Bacilli.]

Entry of Organism
↓
sent to LN

Th 1 (T cells) → Toward TT

Th 2 (B cells) → Toward LL.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp



MDT →

$10 cm^2$ Ag
↑
10 units of immunity

$100 cm^2$ of Ag
100 units of immunity
(Hypersensitivity)

T cell	B cell
Upgrading/Type 1 Lepra Reaⁿ/ Reversal Reaⁿ	Type 2 Lepra Reaⁿ

Hypersensitivity Towards TT side = TYPE IV
Presents as Neuritis
& Nerve Abscess
↓
also called TYPE 1 LEPRA RxN of N/V.

Rx for Neuritis ⇒ MDT + Oral steroids.
Rx for N/V Abscess ⇒ I & D.

Hypersensitivity toward LL Side = TYPE III
Presents as vasculitis
Called as TYPE -2 LEPRA Rxn. or Erythema Nodosum Leprosum

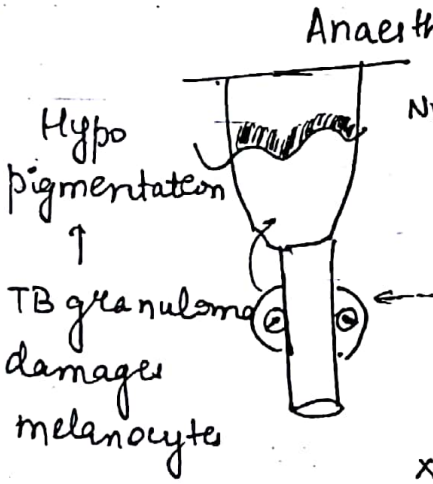
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Effect of MDT on-

TT	BT	BB	BL	BB LL
↓	↓	↓	↙ ↘	↓
T cell hyper	T cell hyper	T cell hyper	T cell hyper	B cell hyper
↓	↓	↓	↓	↓
Type 1 Lepra	Type 1 Lepra	Type 1 Lepra	Type 1 Lepra	Type 2 Lepra

B cell hyper
↓
Type 2 Lepra

TT HANSEN :-



⇒ 1 thickened N/V + 1 skin Lesion (saucer Morphology)

INDETERMINANT HANSEN :-

Presents as Hypopigmented patch on cheek in children.
(N) sensation (N) sweating

D/D of Hypopigmented Patch on cheek in child

- ± fine Scaling → Pityriasis alba
- Non scaly, atrophic from endemic area → Indeterminate Hansen.

FATE

Most pts. upgrade ← IH → some downgrade

N TT

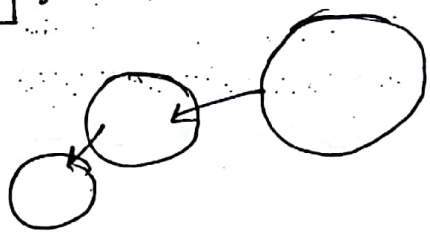
Histopath :-

Perivascular or Periadnexal Lymphocytes

Bacillus not seen.

p **BT HANSEN** :-

Satellite Lesions (3-10)



few thickened n/vs

Original BT ○ → on MDT BT in type 1 Lepra

← ← ← ← ← Slow upgrade No clinical Type I

Fast upgrade Clinical Type I.

BB HANSEN :-

1) Inverted saucer
2) Punched out
3) Annular (AIIMS).
4) Swiss-cheese

(10-30 Lesions)

TT

Granuloma size ↓, Hence
Sensations improve
Sweating "
Dry Lesions become shiny Lesions
Hypopigmentation ↓
Symmetry of patches ↓ N/Vs ↑
Patches ↑ in no. but ↓ in size

LL

BL HANSEN

Many, almost symmetrical Lesions · almost symmetrical n/vs

Inverted saucer / punched out Lesions

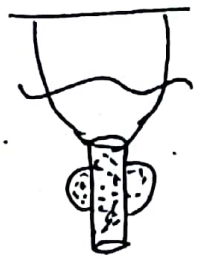
Uncomfortable Lesions.

LL HANSEN

Diffuse infilteration of skin · Peripheral N/vs

1) (N) sensations (N) sweating, ill defined Borders
2) Ear Lobe infilteration
3) Lateral Madarosis
4) Gynaecomastia due to testicular involvement
5) Saddle nose - collapse of bridge of nose
6) Nasal septal Perforation
7) B/L lagophthalmose - ← due to facial n/v involvement [corneal ulcer]
8) Groove Syndactyly Anaesthesia ← ~~due to peripheral~~ neuropathy

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp



Bil symmetrical n/v involvement

Thickening of n/v in LL is due to invasion.

EARLY SIGNS:-

Nasal stuffiness

Epistaxis (JIPMER 2014)

Leg oedema

Nodular LL = LEONINE

↳ painless nodules

Due to unequal invasion of by bacilli

• site of Biopsy:-

Non nodular LL = LUCIO

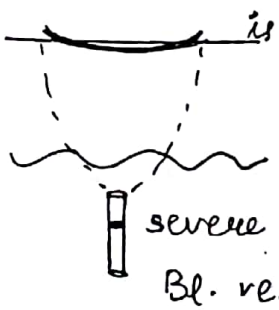
↓

means Beautiful (mexican)

also called BEAUTIFUL LEPROSY (Lepra Bonita)

wrinkle less/ shiny skin, look younger] due to subcutaneous invasion by bacilli thus stretching skin

LUCIO REACTION:-



↳ vessels becoming thrombosed.

HISTOID LEPROSY:- Q.

type of LL ↓ dapsone ~~resistance~~

(N) skin along ↓ Papulo-nodules

ERYTHEMA NODOSUM LEPROSY

Red — Nodule

Tender Nodule on extremities (New Lesions)

SYSTEMIC FEATURES

Immune Complex Deposit →
- Fever ✓
- It Pain ✓
- Uveitis ✓
- GN ✓
- Orchitis ✓
- Hepatitis ✓

Cytokine Involved in ENL = **TNF α**

Hence TNFα Inhibitors (**Thalidomide**) is given in **ENL**

TYPE 1	TYPE 2
NSAIDS	NSAIDS
Oral Steroids - Doc	Oral Steroid - Doc
Chloroquine	Chloroquine
Azathioprine	Azathioprine
Cyclosporine	Thalidomide
	Clofazimine

RECURRENT ENL

Step 1 - Prednisolone 3 months + Clofazimine
- 1mg/kg/day
- 100 mg TDS - 3 months

↓

Step 2 - only clofazimine 100mg BD - 3 months

↓

Step 3 - ~~clofazimine~~ 100 mg OD - 3 months

HISTOPATH OF LL

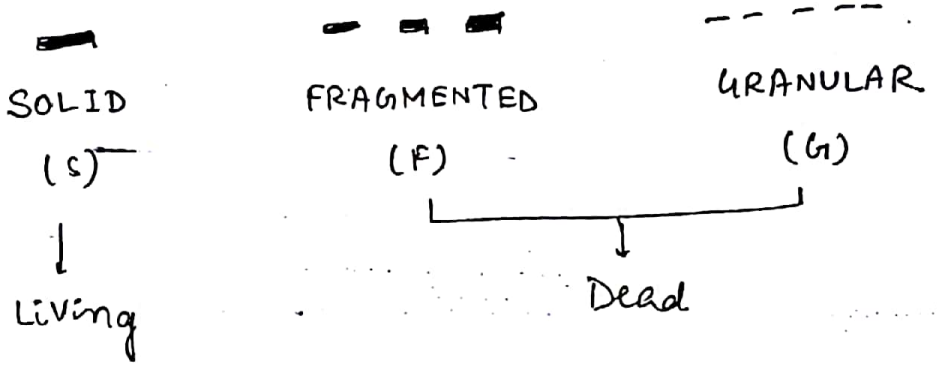
GRENZ ZONE

zone of sparing in upper dermis ~ cut foam cells. This may be a zone of better immunity in the dermis

Slit Skin Smear

Sites : Skin Lesions > Ear Lobe → Best site

3 type of staining Pattern



S + F + G = Bacteriological Index (BI)

S = Morphological Index (MI)

BI remains +ve even after Rx [↓ by 1+ every year on Rx]

BI is measured from 1+ to 6+

eg. BI = 3+ before MDT

↓ ← Rx eg for 1 yr

(2+) ← stop Rx

↓

1+ automatically after 1 yr

↓

0 " " "

MI becomes -ve after Rx

RELAPSE

BI ↑ by 2+ over the previous value
clinically by new skin lesions + new thickened n/vs

SSS is +ve if u have more than 10,000 bacilli/gm (Multibacillary) of tissue.

SSS is -ve if less than 10,000 bacilli/gm of tenue (Paucibacillary)

SS is -ve in ~~there in~~ -

TT
BT
Indeterminate Hansen
Pure neural Hansen

SS is +ve in -

BT
BB
BL
LL

LEPROMIN SKIN TEST

Intradermal ~~sts~~ test for immune status in Leprosy

⊕ ← → ⊖

⊕ Towards TT side
⊖ Towards LL side

↳ Normal People

Not a diagnostic test but a prognostic test

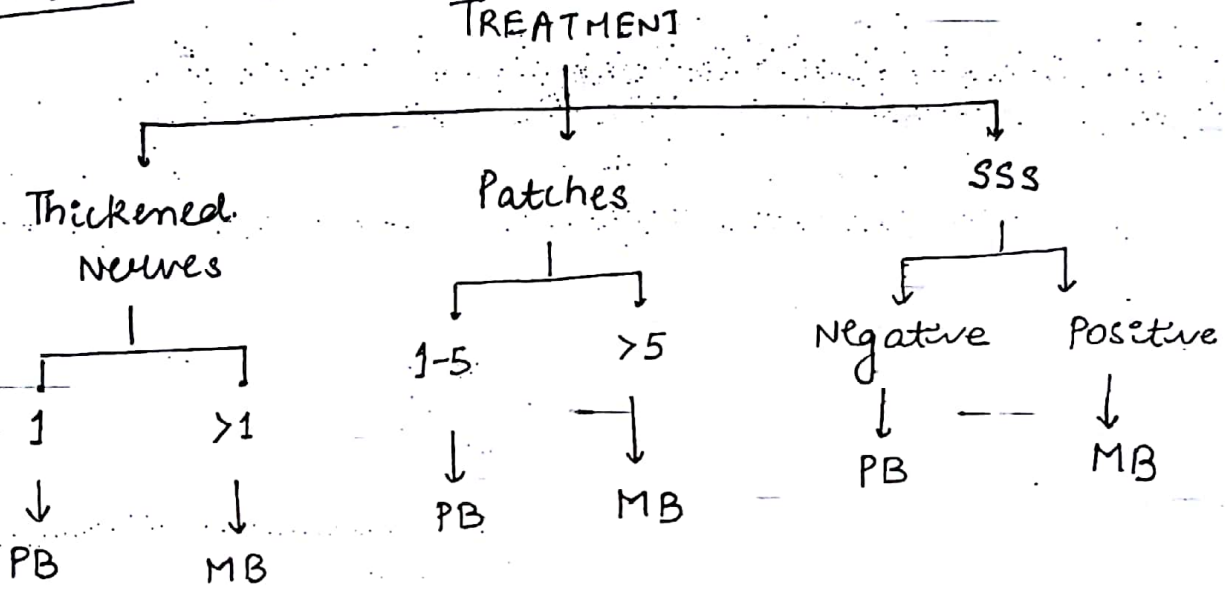
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Reading of Lepromin

1) Early response
↓
wheat at 48 hrs
↓
FERNANDEZ Rxn

2) Late response at 4 wks
↓
MITSUDA Rxn
(Better indicator of CMI)

SLIDE 1



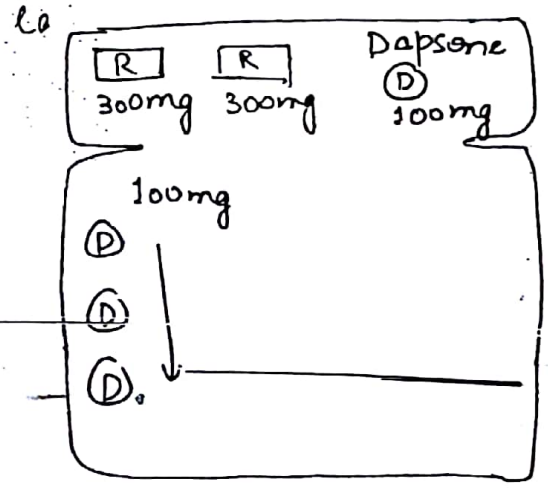
From a programme perspective only clinical Δ is enough to classify PB & MB

ROM = Rifampicin + ofloxacin + Minocycline is discontinued

SLIDE-2

PB PACKET – GREEN

each packet = 28 days
Finish 6 pack max in 9 months

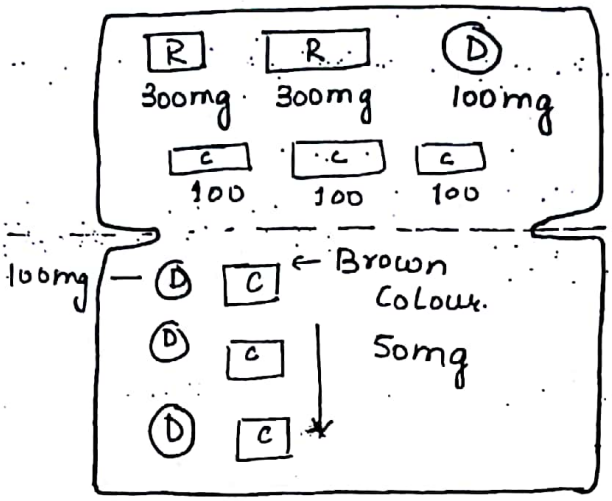


5 supervised monthly

Daily unsupervised

SLIDE - 3 MB - Red

12 packets max in 18 months.
Each pack = 28 Days



- Lesions often remain the same even after completion of MDT.

2nd LINE DRUGS

1) Quinolones
   Moxi/ Spar/ ofloxacin
2) Clarithromycin
3) Minocycline
4) Rifapentene

S/E of CLOFAZIMINE

Q Pigmentation - M/c
Ichthyosis (Dry Skin)
~~Intestinal obstruction~~

S/E of DAPSONE

1) Hemolytic anaemia
2) Peripheral neuropathy
3) **Dapsone Syndrome** (5th WEEK SYNDROME)
   - Skin Rash
   - Hepatitis
   } after 5 weeks of taking Dapsone

STD

GENITAL ULCER DISEASES

① SYPHILIS

T. pallidum - Spirochete ∴ "cork-screw" motility

∿∿∿

↓

enters Genitals

(1° chancre) I.P. - 9-90 days

↓

ulcer.

Extragenital chancre = H/C site = **LIP**

SLIDE-4

1° chancre
(Hard - Hard chancre)
painless
- Button like ⚲
- Round / oval
- Single
- Regular edges

I.P. = 9-90 days

IOC in 1° chancre - Smear from ulcer
↓ followed by
Dark Ground Illumination (DGI)
↓
MOST SENSITIVE & MOST SPECIFIC TEST IN 1° SYPHILIS

DGI can't be done from extragenital Lip chancre due to salivary contamination ∵ commensal Treponemes.

SLIDES

Blood Test In 1° chancre

at 3 wks → EIA (Enzyme Immuno assay)
| most sensitive screening test

at 3 wks → FTA-Abs → outdated.

4 wks → VDRL

4-6 wks → TPPA / TPHA

(b) → Ing. L.N. ⟶ move into Blood (2° syphilis)
enlarged
painless
Rubbery
Shotty
IOC = VDRL

1° chancre self heals

SLIDE-6

Rash
Non-Itchy
M/c sign
Great imitator
No blister
Papules/plaques, scales
Palm, sole involved

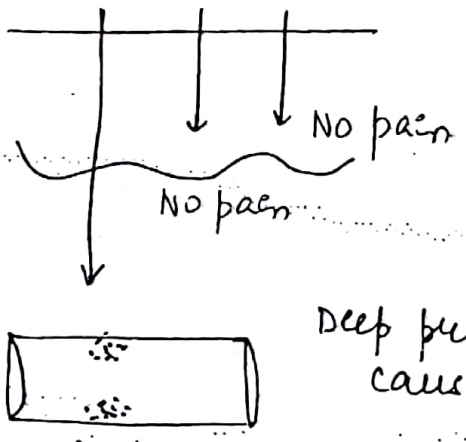
Condyloma Lata
(Flat, moist plaques - anal/groin)

2° syphilis

Mucosal involvement
(Snail track ulcers)

gen. Lymphadenopathy

Deep Dermal Tenderness/ Buchke-Ollendorf sign
On deep pressure ⊽ a blunt object on Palm, sole
Lesion → there is deep tenderness



Deep pressure on palm, sole causes tenderness

End arteritis Obliterans

Condyloma Lata is full of Spirochete
↳ Hence DGI sample can be ✓ taken from it

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

MOTH-EATEN ALOPECIA

non-scarring alopecia → also seen in
- → alopecia areata
- → trichotillomania

2° syphilis ⟶ spirochetes stay in blood but become inactive.

(Pts → asymptomatic)

LATENT SYPHILIS → EARLY LATENT
LATENT SYPHILIS → LATE LATENT

↓

Spirochetes go into deep tissue.

[TERTIARY SYPHILIS]

3 types

- Into skin → Gummatous Syphilis
- ↓ CNS → Cardiovascular
- CNS → Neurosyphilis

IOC of neurosyphilis = CSF VDRL

SLIDE 7

EARY SYPHILIS <2yrs	1° 2° Early Latent	Inj^{n} Benzathine Penicillen 2.4MU IM Single dose
LATE SYPHILIS >2yrs	Late Latent 3°	Inj^{n} Benzathine Penicillen 2.4MU IM 3 doses at weekly intervals Neurosyphilis → I.V. aqueous crystalline penicillin

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

JARISCH- HERXHEIMER Rxn

Inflammation, Fever, ↑ of Lesions after Rx in syphilis is max. in 2° syphilis.

Rx In Penicillin Allergy:-

Doxycycline (14 days - early syphilis
Incompliance ↓ 28 days - Late syphilis)

Chancre (Redux)

Recurrent syphilis
Relapsing

Rx Pregnancy:-

→ Same as in non-pregnant pts.
→ If allergic to penicillin → Desensitize

VDRL - used to monitor response to therapy
↓
titre reduces 4 fold ī in 6 months of Rx.

1:64
↓ Rx
1:16 ī in 6 months

Specific Treponemal Tests (TPPA, TPHA) remain +ve even after ~~therapy often~~ life long

So, can't be used for prognostic purpose

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

CONGENITAL SYPHILIS

Early (1st 2yrs) — like adult 2° syphilis

Late (>2yrs) — like adult 3° syphilis

SLIDE-8

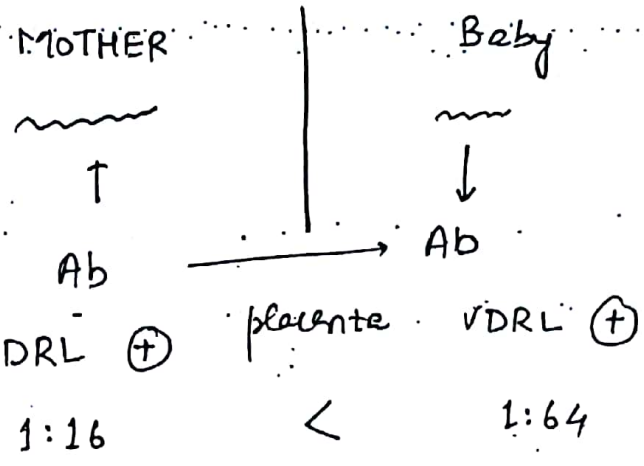
EARLY CONG.	LATE CONG.
1) Snuffles (Rhinitis) earliest & M/C sign	1) Clutton's Joint - Painless knee swelling
2) BLISTERS @. (syphilitic pemphigus)	2) Sabre Tibia (Ant. bowing of tibia)
3) Epiphysitis	3) Olympian's Brow - frontal Bossing
4@) osteochondritis cause pseudoparalysis	4) SADDLE NOSE
4) Condyloma Lata	

HUTCHNISON TRIAD of LATE CONG. SYPHILIS

Interstitial Keratitis

8th n/v disease — Hutchinson's tooth

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp



⇒ VDRL is +ve in Baby at birth.

But if titre is more than mother
↳ Baby has syphilis

Δ = VDRL of Baby 4times > mother's titre

DG1 from nasal secretions . blister fluid

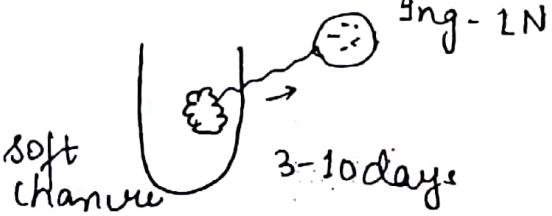
(II) CHANCROID

H. Ducreyi - extracellular gram -ve organism.
θθ
I.P. = 3 - 10 days.

Chancr|oid
↙ ↘
chancre like.

⇒ completely unlike chancre.

SLIDE-9



painful
Multiple
~~irregular~~ edges
Bleeds on touch

Inflammation
↓
Bubo (ipsilateral, may suppurate)

In chancroid, kissing ulcers are seen due to autoinoculation.

Δ =

1> Gram stain on smear ⇒ Gram -ve

School of fish
Rail road track
extracellular

2> Intradermal test - ito test
outdated

3> PCR on skin Biopsy or smear.

Rx -

Azithromycin 1gm stat
or
Inj^n ceftriaxone 250 mg im stat

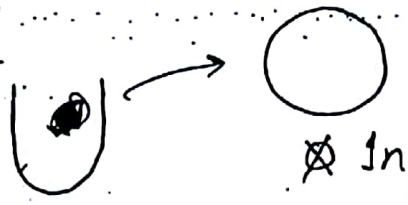
(III) DONOVANOSIS

INTRACELLULAR

Calymmatobacterium granulomatis (Klebsella granulomatis)
I.P. = 8-80 Days.

→ Hypertrophic granulation tissue on ulcer floor
→ Beefy Red colour
→ Bleeds on touch
→ Painless

SLIDE - 10



Granuloma - pseudobubo

⊗ Ing. L-N.

Granuloma Inguenale

Crush smear.

↓

Giemsa stain

DONOVAN BODIES

Histocytes (closed safety Pin) arrangement

† AIIMS Nov 15, May 2017

Ⓟ Organism is intracellular

Rx = Azithromycin 1gm/week (preferred) } Till ulcer heals

or

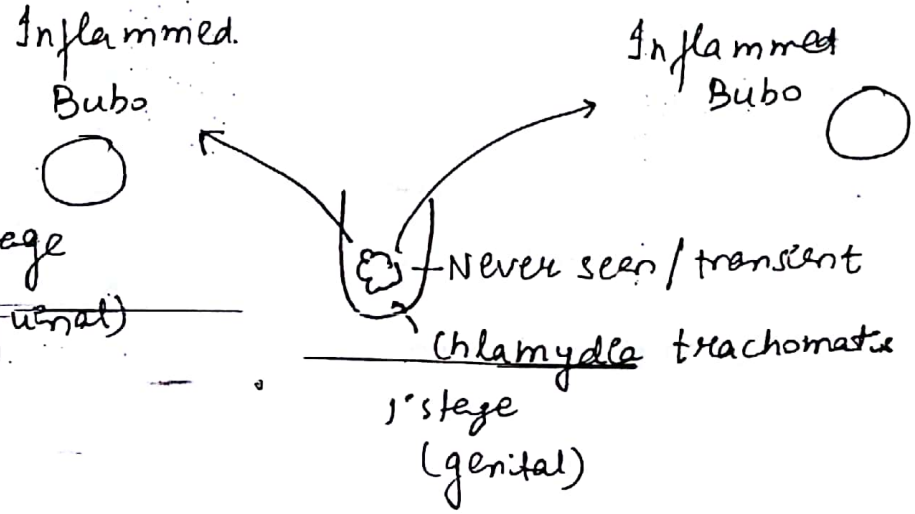
Doxy 100 mg BD

IV LGV

Chlamydia Trachomatis

I.P - 10 - 30 days.

SLIDE - 11



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

BuBos

U/L B/L

ing Bubo → Inguinal Legament (GROOVE)

Femoral Bubo

Also seen in

a) MONDOR's Disease

b) Eosinophilis fascitis

3° Stage of LGV

Elephantiasis due to Lymph oedema

RAMS HORN PENIS / SAXOPHONE

S shaped penile deformity

LYMPHANGIECTASIA

Bubbles of lymph on skin surface

LYMPHORRHOEA

oozing of lymph

ESTHIOMENE

(Lymphangiectasia + overlying ulceration)

Δ of LGV = 1> Frei test → outdated

2> PCR for chlamydia by NAAT ← Best Test

Most commonly done 3> CFT (complement fixation Test)

4> MIFT (micro immuno flouresent test)

1) fissure
2) fistula
3) Sinuses
4) Strictures.

Rx of LGV -
Doxy 100 mg BD for 21 days

V HERPES GENITALIS

HSV-2 > HSV-1.

Recurrent Blister + Ulcers (Painful, grouped) along ± painful inguinal Bubo always recurrent

Rx = Acyclovir group of Drugs.

URETHRAL DISCHARGE

Pathology = URETHRITIS

GONOCOCCUS

Gram -ve intracellular diplococcus

♂
often symptomatic
↓
Urethritis
(urethral discharge)

♀
↓
1) often asymptomatic (carrier)
↓
In cervix
2) cervical discharge

Presumptive Partner Treatment (PPT)
is done in STDs to prevent recurrence in index STD pt.

SLIDE-12

GONOCOCCAL	NON-GONOCOCCAL
N. gonorrhoea	Chlamydia/Trichomonas/ mycoplasma/ureaplasma
~~IP~~ 2-8 days	1-3 weeks
Thick purulent urethral D/C	Thin mucopurulent D/C
Rx	Rx
→ Inj ceftriaxone 250mg IM stat + Azithromycin 1gm stat (preferred)	Tab. azithromycin 1gm stat (preferred)
→ Tab cefixime 400mg stat + Azithromycin 1gm stat	Doxy 100mg BD for 7 days

SYNDROMIC APPROACHES

URETHRAL DISCHARGE

GONORRHOEA → CEFIXIME

CHLAMYDIA → AZITHRO

GREY PACKET

NACO KIT-1
AZITHRO + CEFIXIME

VAGINAL DISCHARGE

CANDIDA
White creamy
minimal D/c
Itching

TRICHOMONIASIS
Green frothy D/c
Profuse D/c
Strawberry Cx
Itching

BACTERIAL VAGINOSIS
Foul smelling D/c
H/c cause
No Itch
No Inflammation

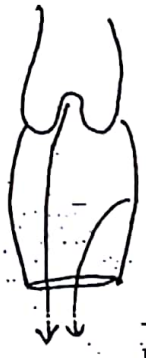
Candida → Tab. FLUCONAZOLE 150mg stat

Trichomonas, Gardenella → Tab Metronidazole 2g stat
or Tab Tinidazole 2g stat
or Tab Secnidazole 2g stat

NACO
KIT-2
SECNIDAZOLE
+
FLUCONAZOLE
green packet

CERVICAL D/C

GONORRHOEA → GREY KIT
CHLAMYDIA → GREY KIT



green kit
(for vaginal D/c)

Speculum Examn

BACTERIAL VAGINOSIS Q.

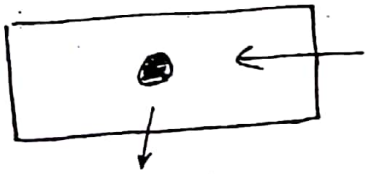
→ GARDENELLA VAGINALIS
→ Anaerobic Bacteria (Bacteroides, Peptococcus)
→ Mycoplasma

AMSEL CRITERIA Q.

1> Thin homogeneous white adherent D/c
2> Vaginal fluid pH > 4.5
3> Fishy amine odour (WHIFF TEST)
4> Clue cells ≥20%

Clue cells on wet mount / GRAM.

Organism epithelial cell



Amine / Fishy odour.
(whiff test)

INGUINAL BUBO

CHANCROID → AZITHRO 1g ① stat

LGV → DOXY (100) BD 21 days

BLACK PACKET

NACO KIT 7

DOXY 100mg BD for 21 days + AZITHRO 1gm stat

GENITAL ULCER

↓

VESICLES

(+) → HERPES → Acyclovir [RED KIT]

(−) → LGV, DONO, SYPH, CHAN

SYPH → BENZ. PENICILLIN + AZITHRO

CHAN → AZITHRO

WHITE ~~BLUE~~ KIT

↓

Allergic (DOXY) + AZITHRO 14 days

BLUE KIT

NO PARTNER T/T REQUIRED IN ♀

GARDENELLA

HERPES

CANDIDA [If partner is symptomatic et same time Rx partner]

M/C - WORLD (WHO - 2015)

STD (overall) - HSV2

Viral - HSV 2 > HSV 1

Bacterial - chlamydia > Gonorrhoea

Protozoal - Trichomonas

BLANK

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

PSORIASIS

→ Autoimmune Disease

→ TH1 & TH17 mediated inflammation (T cells)

→ IL-(12), IL-(17), IL-(23) → are secreted by T cells. initiating inflammation

→ Associated ⊂ HLA-CW6

R_x = Immunosuppresives [systemic steroid is C/I]

STABLE

↓ ← Exacerbating factors

UNSTABLE

(- sudden many new Lesions
- pustular psoriasis
- erythrodermic psoriasis)

* Exacerbating Factors :-

✓ Sudden withdrawal of systemic steroids

✓ ⑥ ♀

✓ Infn - streptococcus

✓ Drugs - (β blockers, Lithium, Chloroquine, NSAIDS, ACEI

TYPES

I> Ps. VULGARIS
↓
M/C type

on extensors silvery scales
itchy
chronic plaque form - M/C.

II> GUTTATE Ps.
↓
Raindrop

∴ associated ī streptococcal Pharyngitis
R_x - includes Antibiotic against strepto

III> ERYTHRODERMIC Ps. / EXFOLIATIVE DERMATITIS
↓ ↓
Red scaly

C/F- Red scaly plaques all over body (>90% of BSA)

R_x - 1st Line = Methotrexate
2nd " = ACITRETIN

IV> FLEXURAL PSORIASIS -
(inverse)
No scaling
~~sbr~~ erythematous shiny plaque in skin folds
(Inframammary area, groin) as scales get dislodged

V) SEBOPSORIASIS :
Silvery plaques on scalp
Thick scales

Seborrhoeic Dermatitis (SD)

↳ caused by MALASSEZIA.

↓

- yellow greasy scales
- thin scales

VI) GEN. PUSTULAR PSORIASIS (GPP)

C/F Diffuse pus all over body

severe inflammation

Fever

"Sheet of pus"

"Lake of pus"

→ separate pustules on periphery

all pustules fuse together in centre to form "sheet of pus".

GPP

Non-Preg ↓ VON-ZUMBUSCH TYPE ↓

Rx - 1st Line = Acitretin

2nd Line = Mtx

♀ ↓ IMPETIGO HERPETIFORMIS ↓

Doc = Syst. steroids

If ♀ is also diabetic ↓

Doc = Cyclosporin

VII) PSORIATIC ARTHRITIS

→ 5-30% of pts.

→ HLA B27, HLA B7

→ Nail psoriasis pt have ↑ risk of developing arthritis

→ Dactylitis, enthesitis

→ usually skin involvement preceder joint involvement

classical jt involvement = DIP.

DOC - Methotrexate (except ARTHRITIS MUTILANS)
↓ DOC
[Etanercept]

SLIDE-14

Rx

<10%	10-30%	>30%
1st Line Topical steroids Topical calcipotriol (vit D derivative) ↳ DOC 2nd Line - coaltar - Salicylic acid coalter is anti-division drug Salicylic acid is Keratolytic	1st Line · Narrow band · UVB 2nd Line · PUVA	1st Line · Methotrexate · Acitretin 2nd Line · Cyclosporin · Fumaric acid ester · Biologics. (Etarnercept Infliximab, Adalimumab)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

OLD REGIMENS

INGRAM

UV

↓

ANTHRALIN

GOECKERMAN

UV

↓

COALTAR

WORONOFF'S RING -

- Hypopigmented Ring around psoriasis Lesions indicating healing of Lesions
- Due to inhibition of PG synthesis
  ↓ resulting
  — **Vasoconstriction**

REITER'S DISEASE

REACTIVE

M/c cause

entry of **Chlamydia** through sexual route

entry of Salmonella Shigella Yersenia Campylobacter → DIARRHOEA

↓

URETHRITIS

↓

3 common symptoms afterwards

- **ARTHRITIS**
  - in wt bearing jts (large)
  - HLA-B27
  - enthesitis, dactylitis
- **RED EYE**
  - Conj^{n} / Uveitis
- **SKIN LESIONS**
  - Circinate Balanitis
  - Keratoderma blenorrhagica (AIIMS, 08)

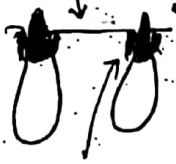
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Keratoderma blenorrhagica
↓ skin ↓ pus → oozing.
hyperkeratosis
↓
on sole

PITYRIASIS RUBRA PILARIS

↓ Red ↓ Hair

(N) skin between follicle →



← Follicular keratosis
↳ very sharp on palpation
↓
Feels like a "Nutmeg - grater" on palpation

red/orange colour around hair

(N) skin bet follicle = Island of sparing

→ Palmo- Plantar Hyperkeratosis
→ Erythroderma
→ Keratotic ~~spo~~ sandal → thick plantar keraten appearing like sandal of keraten.

LICHEN PLANUS

autoimmune disease

5Ps → PAPULES
PURPLE
POLYGONAL
PRURITIC
PLANE-TOPPED

NO scale
Flexural areas (H/c- wrist flexure)

H/c HCV, ~~HBV~~

Usually healing ⊂ hyperpigmentation.

← mineral oil

White criss-cross marks
(Wickham's striae)

↓

is due to **HYPERGRANULOSIS**

TYPES OF LP

1) **ORAL LP**

- White criss cross (Lacy/ Reticular) pattern
- Buccal mucosa, tongue
- Associated ⊂ **Dental Amalgam** → contains Mercury
  - B/L ↳ U/L or B/L
  - have symptoms

AIIMS nov 15 (Image)

[Leukoplakia is U/L, not criss-cross, asymptomatic] –

* Risk of malignant pot" in oral LP :-

Lacy pattern doesn't have Risk

Ulcerative oral LP and LP on tongue have risk of 1-5%

2) ACUTE WIDESPREAD LP

Sudden eruption of multiple Lesions

DOC- systemic steroids

3> LICHEN PLANUS PIGMENTOSUS

Pigmentation in sun exposed areas (No itching)

4> LP PILARIS / PSEUDOPELADE

hair ← T cells

Bulge (stem cells)

↑ Bulge is Ag

↓

Scarring alopecia

- ✓ patchy scarring alopecia
- ✓ perifollicular blue-grey macules
- ✓ "foot print in snow appearance"

Perifollicular Blue-grey macule

5> ACTINIC LP

- → Sun induced LP
- → Itch
- → Hyperpigmented macule surrounded by a hypopigmented ring on sun exposed areas

6> HYPERTROPHIC LP

Hypertrophic plaques on lower legs

(thick, flat elevated)

Rx of LP

Oral LP
LP Pigmentosus → CHRONIC Dz.
LP Pilaris

⇒ **Localised LP** → Topical Rx
↓
Steroids
Calcipotriol
Tacrolimus

⇒ **Generalised LP** → Systemic Rx
→ Steroids
→ Non-steroidal immunosuppressive
Cyclosporine ← → Mtx
Phototherapy
Mycophenolate
Azathioprine mofetil

⇒ **For hypertrophic LP** → Acitretin (keratolytic)

ALOPECIA AREATA

autoimmune ds of hair

Ag :- melanin in hair bulb.

Bulge → (N)

T cells

↓

destroy bulb

↓

pathy alopecia → NO WRINKLING

H/c - scalp. ⇒ NON-SCARRING ALOPECIA

always sparing of white/ grey hair in alopecia path.

Rx :- LOCALISED PATCH

↳ Topical steroids

Minoxidil

Intralesional steroids - most effective

POOR PROGNOSTIC FACTORS

1) OPHIASIS

↳ areata at the hair line margin.

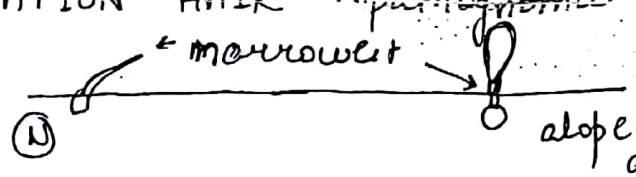
2) ALOPECIA TOTALIS

↳ loss of complete hair of scalp

3) ALOPECIA UNIVERSALIS.

↳ loss of total body hair

4) EXCLAMATION HAIR ~~pathognomic~~



! exclamation mark

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

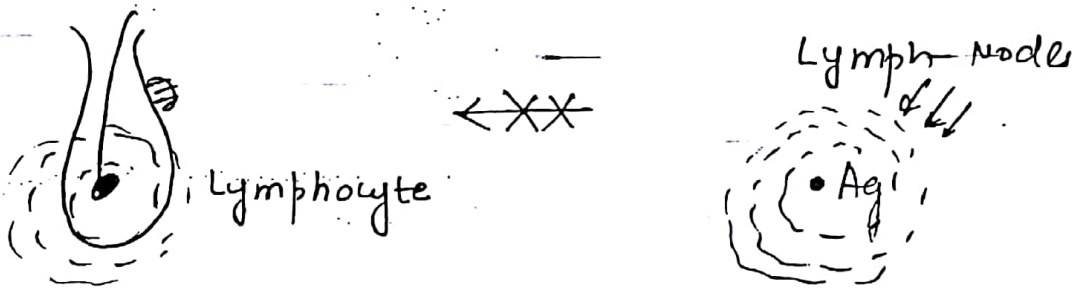
5) PRESENCE OF ATOPY

6) NAIL CHANGES (Regular pitting)

TOTALIS/ UNIVERSALIS

Contact Sensitizer

- Di Nitro chloro Benzene (DNCB)
- Di-Phen Cyprone (DPC)
- Squaric Acid Di-Butyl-Ester (SADBE)



TRICHOTILLOMANIA

AIIMS MAY 2017

→ Obsessive compulsive Disorder of hair pulling

→ Patchy Hair Loss i hairs of varying length in patch more on vertex & Dominant Hand side

→ TONSURE/ FRAIR TUCK SIGN:-
Loss of VERTEX & sparing of side

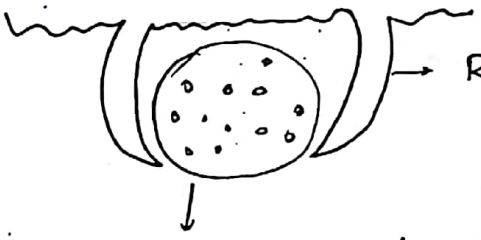
– HISTOPATH :- follicular H'ge

LICHEN NITIDUS AIIMS May 15

- Pin point papule on dorsum of hand + genitals
- asymptomatic
- self resolving

HISTOPATH

CLAW + BALL appearance
Clutching the ball +



→ Rete go down + curve inwards like a claw.

↓ Lymphocytes look like Ball

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

FUNGAL DISEASES

1) PITYRIASIS VERSICOLOR

- powdery scale
- various color

caused by Malassezia furfur
Now Malassezia globosa

Both are commensal around hair follicle in the seborrhoeic areas.

↓

Chest
Back
Face

↓ overgrowth of malassezia

↓

release Azelic Acid [Tyrosinase Inhibitor]

↓

Perifollicular Hypopigmentation

↓

Later fuse to form Large Patches [asymptomatic]

Sometimes other colours [Brown, Red, Yellow] may also be seen

SCRATCH SIGN-

scratching of Lesions make powdery scale prominent in the scratch Line.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Δ -

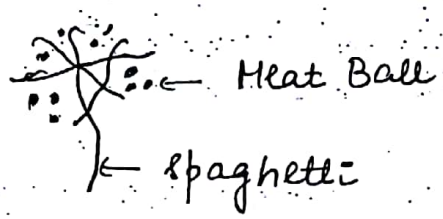
Scrapping

stain ⊂ KOH

↓

Spaghetti + MEAT BALL or

BANANA + GRAPES appearance Q.



Rx - 1) Oral + topical Azole group of drugs

2) Topical selenium sulphide

3) Oral griseofulvin / Oral Terbinafine dont work

* Organism is killed immediately but pigmentation problem takes longer (4-8 wks) to resolve.

2> SEBORRHEIC DERMATITIS (SD)

→ Malassezia overgrowth ⊂ Itching + yellow greasy scales in seborrheic areas.

→ SD in infants = CRADLE CAP

→ Extensive SD — HIV

Parkinson's Disease

Rx = Similar to pityriasis versicolor

3) CANDIDIASIS

Candida albicans (OPPORTUNISTIC Fungus)

↓

- DM
- Moisture
- Immunosuppression

TYPES

a> ORAL / THRUSH

↓

White creamy / white curdy plaques in oral cavity can be scrapped off (pseudomembrane)

↓

Leukoplakia can't be scrapped off.

b> CANDIDAL BALANITIS

↓

glans inflammation

erythematous itchy papule or erosion on glans often ī repeated washing ī water.

c> CANDIDAL BALANO-POSTHITIS

↳ prepuce

Fissures on prepuce

If recurrent → s/o uncontrolled DM Q.

D> CANDIDAL INTERTRIGO

↳ fold

↓ Bet"

Moist erythema in folds ī satellite lesions

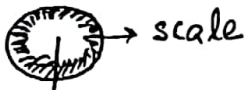
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Δ -

- Smear
- Staining ⁻ KOH + grams stain to show budding yeast

4> **TINEA**

causes annular Lesions
↓
⁻ itching + peripheral scale



central clearing

A/c moist skin

Groin → Tinea cruris (Jack itch, Dhobi itch)

Body → T. corporis

Scalp → T. capitis

Feet → T. pedis / Athlete's Foot

Nail → T. unguium (onychomycosis)

Hand → T. mannuum

Steroid modified Tinea → T. incognito

ONYCHOMYCOSIS (T. of nail)

→ Yellow Discolouration

→ Thickening of nail

→ Subungual hyperkeratosis

T. PEDIS

3 TYPES

INTER-DIGITAL — Trichophyton Rubrum

CHRONIC PLANTAR SCALING (MOCCASIN FOOT) — Trichophyton Rubrum

BULLOUS T. PEDIS — Trichophyton Mentagrophytes Q

Tinea caused by **Dermatophytes**

3 Species

	TRICHOPHYTON	MICROSPORUM	EPIDERMOPHYTON
		Keratophilic	
Hair	✓	✓	⊗
Skin	✓	✓	✓
Nail	✓	⊗	✓

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

SLIDE 15

T. CAPITIS	ALL OTHER TINEAS
M/c organism	M/c organism
India - T. violaceum	T. Rubrum
World - Microsporum canis	
US/UK - T. Tonosurans	
DOC - Griseofulvin	DOC - Terbenafen

T. CAPITIS

Easy pluckability of hair in a **child**

Creates patchy hair Loss

ECTO-THRIX

↓

Caused by Microsporum

ENDO-THRIX

↓

Caused by Trichophyton

(16) T. CAPITIS

NON - INFLAMMATORY (Non-scarring alopecia)	INFLAMMATORY (scarring alopecia)
• GREY PATCH.	KERION
Microsporum canis	(Boggy swelling)
M. audouinii	Poor prog
M. ferrugineum	T. Mentagrophyte
• BLACK DOT	M. canis
T. Tonsurans /	T. verrucca
T. violaceum	
— —	—FAVUS
	(yellow scutulum)
	T. schoenleinii

5) SPOROTRICHOSIS

Ioc - Skin Biopsy

↓

H/P →

↓

ASTEROID- Bodies in dermis

*

→ Cigar shaped yeasts

≡

Rx = Oral ITRACONAZOLE → DOC

Other — KI

↳ Amphotericin B.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

6> EUMYCETOMA

Swollen foot ~ Discharging sinuses
In a farmer walking BARE FOOT.

TRIAD Q.

TUMEFACTION (swelling

SLIDE-12

Swollen Foot ~ Discharging Sinus

- Botryomycosis [Staph]
- Eumycetoma
  Madurella mycetomatis
  → BLACK GRAINS
- Actinomycotes mycetoma
  a> Actinomadura madurae M/C
  b) Nocardia
  c) Streptomyces
  → WHITE GRAINS

EUMYCETOMA

Oral Itraconazole

KI.

Amputation.

ACTINOMYCOTIC MYCETOMA

Q. WELSH Regimen → Amikacin +
Rifampicin +
Cotrimoxazole.

7> CHROMOBLASTOMYCOSIS

Presents as cauliflower masses on feet in a barefoot farmer after a thorn prick

Smear shows → naturally yellow spore
SCLEROTIC BODIES
MURIFORM "
MEDLAR "
COPPER - PENNY

DOC- Oral ITRACONAZOLE + Sx excision of Mass.

VIRAL DISEASES

I) HPV

Causes warts

- Warts comes on Non-genital skin → VERUCA
  - V. VULGARIS → HPV 2
  - PLANA → HPV 3, 10
- Genital skin (STD) → CONDYLOMA ACUMINATA
  - means pointed → HPV 6, 11

GENITAL WARTS

Imiquimod - Immunomodulator - DOC

Podophyllin, Podophyllotoxin } Anti-mitotics

(purified extract of podophyllin)

IMIQUIMOD is a TLR-7, TLR-8 agonist

↓

hence, activates Langerhans cells

VERRUCA

- Burning (Cautery)
- Freeze - cryotherapy (Liquid N_2)
- Acids [Salicylic acid - DOC, Trichloro acetic acid]

GENITAL WART In ♀

- Trichloro acetic acid
- Cryotherapy (BETTER ANS)

PLANTAR WARTS Q

- SUPERFICIAL MOSAIC — HPV-2
- DEEP MYRMECIA — HPV-1

Q. BUSCHKE – LOWENSTEIN TUMOUR

Big cauliflower mass

mutated HPV-6, 11 → Creating Low grade Cauliflower shaped. SCC/ Verrucous carcinoma

SEBORRHEIC WART/ KERATOSIS.

BASAL CELL PAPILLOMA Q

Misnomer.

Sign of ~~Ageing~~

Due to benign proliferation of keratinocyte.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

LESSER TRELAT SIGN

Sudden eruption of multiple seborrheic keratosis suggest underlying malignancy
(Adenocarcinoma of stomach > colon)

2) HUMAN HERPES VIRUS [HHV]

HHV 1 = HSV 1
cause **Herpes Labialis**
group blisters on the lip + peri-oral area.
reactivating ~ fever [FEVER BLISTER]

HHV 2 = HSV2
causes **Herpes Genitalis**

ECZEMA HERPETICUM / KAPOSI'S VARICELLIFORM ERUP°
Disseminated HSV-1 in an atopic eczema patient who is immunosuppresed + is inoculated by HSV-1 through another patient
Also seen ~ DARRIER's DISEASE
P. FOLEACEOUS PI.

HHV 3 = Varicella Zoster virus
1st episode = Varicella [chicken pox]
Reactivation = Herpes Zoster [shingles]

Varicella presents as Vesicles (Dew Drop on Rose Peta) ~~pustule, finally crust (non-contagious)~~
It has polymorphic, centripetal lesions

After varicella gets → VZV remains hidden in spinal & cranial ganglia. & reactivate along dermatome. (immunosuppression)

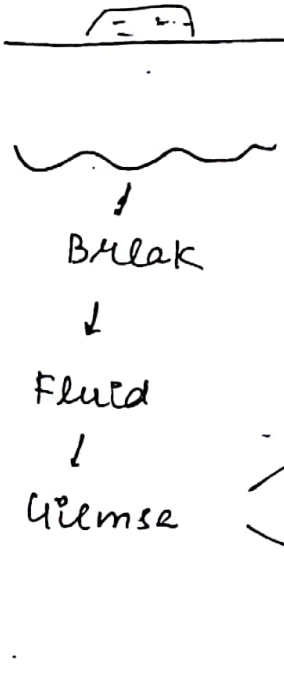
↓

HERPES ZOSTER

COMPLICATION OF HERPES ZOSTER

1) Post- herpetic neuralgia (PHN)
   defined as pain even after 4 weeks of resolution of herpes zoster
   DOC = GABAPENTIN

TZANCK SMEAR



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

PITYRIASIS ROSEA

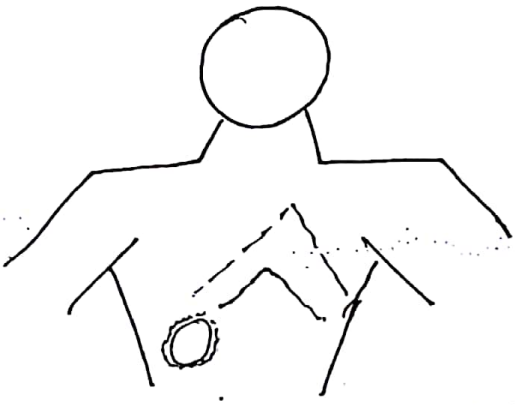
HHV 7 > HHV6

Rarely, Drug Induced.Q

1st Lesion of Disease ⇒ HERALD PATCH / MOTHER PATCH

↓

annular
Itchy
Peripheral scale (collarette)
TRUNK



Rest of lesion come in straight line meeting in centre

↓

FIR TREE / CHRISTMAS TREE pattern. (differentiate with Tenea)

→ Self limiting in 4-10 wks
→ Acyclovir shorten disease duration.

3) MOLLUSCUM CONTAGIOSUM

caused by MCV (DNA virus)

← Inclusion Body

↓

molluscum Body
[Henderson Peterson Body]

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

C/F- → Shiny umbilicated dome shaped papule
→ children, face
→ genital molluscum → STD

Rx - same as for warts

PARASITIC DISEASES

I> SCABIES

Caused by female scabies mite
enters finger web or genital through BURROWS
↓
S-shaped

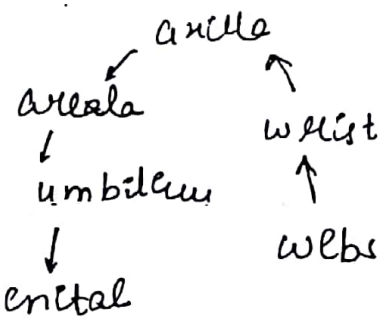
Avg. no. of mite on skin = 12

C/F- Itchy Papules in adults
Nocturnal Itch
Facial sparing in adults

Scabies → poor hygiene disease
[WATER WASHED DISEASE]

I.P. = 3-4 weeks → 1st episode
1-2 days - later episode
(due to memory T cells)

CIRCLE OF HEBRA



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Rx - For pt + close contact + clothing

Rx for INFANT SCABIES

→ Face is involved
→ Palm / sole involved
→ Papules + Vesicles

Rx - DOC → 5% Permethrin - single overnight application
[adults, infants, ♀]

other Rx -

Topical
1) Benzyl Benzoate 25%
2) Lindane
3) γ Benzene Hexachloride
4) Crotamiton
5) Sulphur

Oral → Ivermectin → 2 doses
14 days apart
(200 µg / kg / dose)

NODULAR SCABIES

Hypersensitivity response to scabies mite

INTRALESIONAL STEROIDS

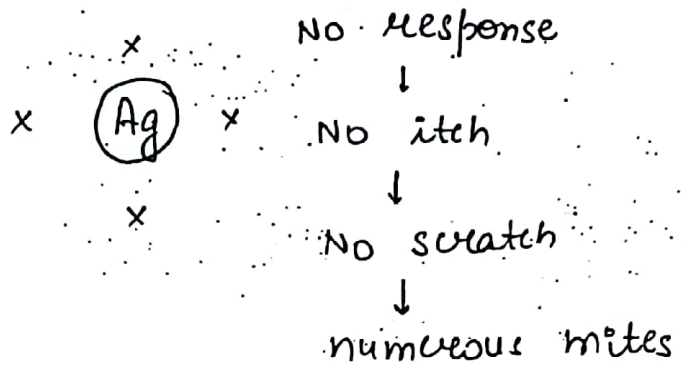
5% PERMETHRIN → Ag → more inflammation.
↓
more elevation (nodule)

Seen on genitals

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

NORWEGIAN / CRUSTED / KERATOTIC SCABIES

HIV ⊕ pts



C/F - **Hyperkeratosis**

R_x - Oral Ivermectin + Topical Permethrin.

PEDICULOSIS

caused by LOUSE

HEAD LOUSE

Long, slender, louse lays eggs (Nits) on scalp hairs

Nit → adult → Itch

P. CAPITIS

R_x - 1% permethrin

BODY LOUSE

causes pediculosis corporis.

VAGABOND'S DISEASE

Not on Body, But on clothing → Bite Skin → returns back to cloth

R_x = ~~Disinfect~~ of cloth

PUBIC LOUSE / CRAB LOUSE

Short, stocky louse

causes **P. PUBIS**

Louse bite mark → called Maculae cerulae

R_x = 1% permethrin

5% Permethrin

Oral ivermectin

III) ERYTHEMA CHROMICOM MIGRANS

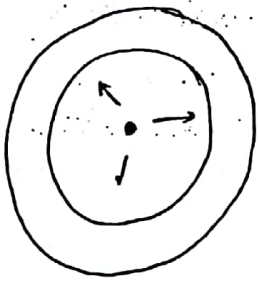
Bite by a hard tick (IXODES)

↓

deposits

BORRELIA BURGDORFERI into skin

↓



red rings around Bite ⟹ TARGET LESION

↘ ANNULAR LESION

↓

Later Pt develops

LYME'S DISEASE

IV) PKDL

Post-Kalazar Dermal Leishmaniasis

Bite by a sandfly

↓

deposits Leishmania

↙ cutaneous Leishmaniasis

↓

CRUSTED ULCER

↘ Visceral Leishmaniasis

↓

Fever ± hyperpigmentation

[KALA-AZAR]

↓

after many yrs of Kalazar

↓

PKDL

PKDL

Hypopig — Nodular

(B) forms resemble Leprosy

H/o Past fever in Q ⇒ Suggests PKDL

Δ of PKDL-

Crush smear (giemsa stain) for LD Bodies

Slit Skin smear (") for LD Bodies

DOC -

Oral MILTEFOSIN

V) INSECT BITE HYPERSENSITIVITY

Excessive Immune Response to Simple Insect Bite

→ Lesions on exposed areas.

→ ↑ in Rainy Season

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

ECZEMA / DERMATITIS

1) ATOPIC ECZEMA

TH2 mediated inflammation (B cell)

Δ :- Hanifin & Rajka criteria

SLIDE - 18 MAJOR CRITERIA - Any 3 out of 4.

1) Itching → Hallmark

2) Typical Sites
   - → Extensor Dermatitis [children] 0-2yr
   - → Flexor Dermatitis [Adults & children] 2-12yr

3) Personal H/o / Family H/o of atopy

4) Chronic relapsing course

classical flexor involved = ante-cubital fossa

" extensor " children = cheek

[HEADLIGHT SIGN]

↓

sparing of nose & ~~peri-oral area~~, ~~periorbital~~ area

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

ACUTE STAGE → Oozing, crusting

CHRONIC STAGE → Lichenification

MINOR CRITERIA

1) Dennie MORGAN FOLD -
   Extra crease on Lower eyelids

2) Pityriasis Alba -
   - Hypopigmented patch ± fine scaling on cheek in children
   - often recurrent / non-itchy

3) Peri-orbital Pigmentation

4) White Dermographism - Q
   Vasoconstriction on scratching.

5) Plantar Hyperlinearity

6) Palmar Hyperlinearity

7) Ichthyosis Vulgaris (Dry skin)

Rx -
1) → Moisturising cream (lipids)
   ← Lipid replacement

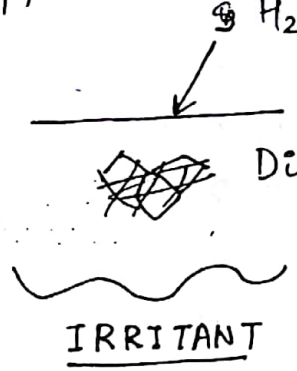
2) TH2 cell Inhibitors
   Localised D. → generalised Disease

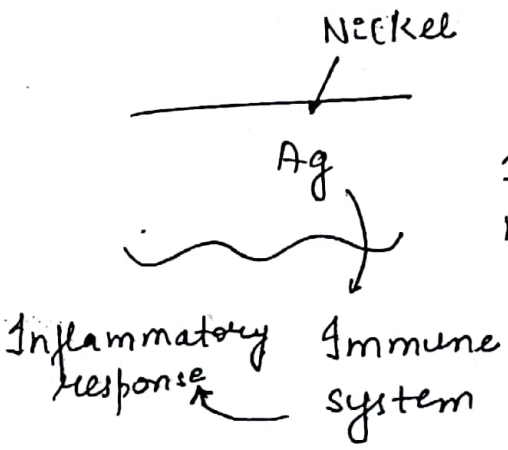
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Localised Disease	Generalised Disease
Steroid	steroid
Calcipotriol	Cyclosporine
Tacrolimus	Azathioprine
	Phototherapy
	Mycophenidate

II> CONTACT ECZEMA

SLIDE-19





1st exposure sensitizes next exposure cause clinical disease

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

IRRITANT

Not Immunological

Due to toxic chemical

No sensitization required direct clinical phase

Memory cells not Involved

Eg.

1) Detergents (HOUSE WIVES ECZEMA)
2) Acid & alkali Burn.

ALLERGIC

Immunological Type-4 hypersensitivity

Sensetization phase 1st followed by clinical phase

Memory cells involved In predisposed person

Δ -
PATCH TEST

Eg. 1) nickel → M/c overall
2) PPB → in hair dye
3) vegetable - M/c in Indian female

READINGS OF PATCH TEST

1st Read ↓ — 2nd Read ↓ — For neomycin, PPD - metals

Day 0 — Day 2 — Day 4 — Day 7 ↑ 3rd Reading

~~OCU~~ OCCUPATIONAL CONTACT DERMATITIS

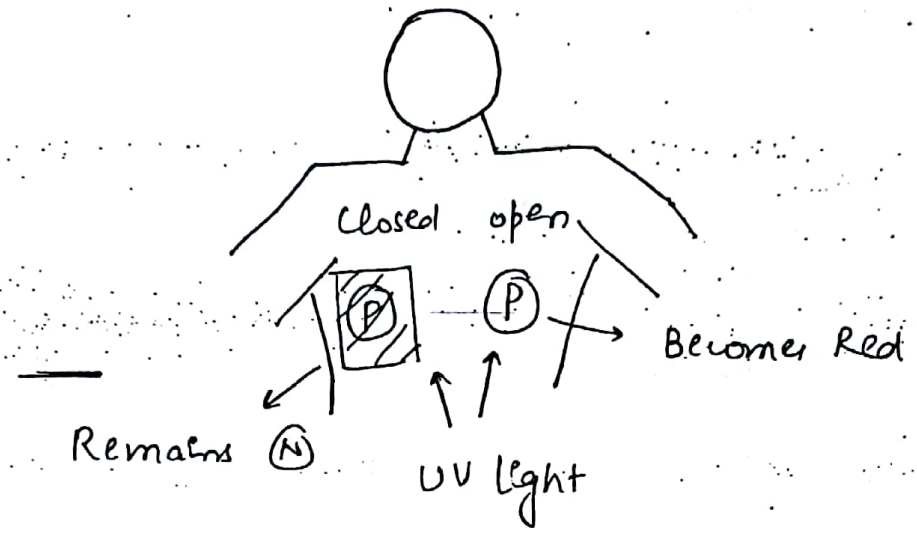
A) Air Borne Contact Dermatitis / Phytophoto dermatitis

seen in farmers.

exposed to Ag - from Parthenium Plant coupled ± some exposure

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

A- Photo PATCH TEST AIIMS - May 16.



DOC - AZATHIOPRINE

B) CEMENT DERMATITIS

Ag → Potassium Dichromate

C) HAIR DRESSERS

Ag - PPD

D) TEXTILES

Ag - AZO DYES

III) POMPHOLYX

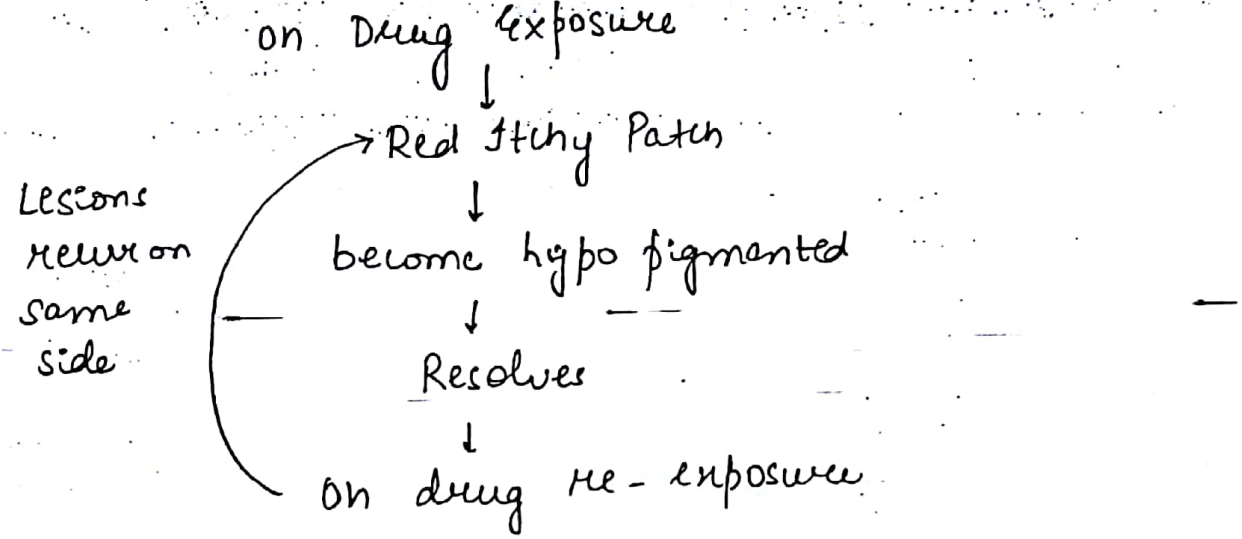
→ Form of HAND & FOOT ECZEMA ~ severe spongiosis

→ presenting as Deep seated Blisters on Palm & Soles ~ SAGO ~~GRAIN~~ like feel, severe Itching

DRUG REACTION

A> FIXED DRUG ERUPTION

- M/c cause - NSAIDS
  other tetracycline
  Metronidazole
  Sulphonamides



COMMON SITE = Lips, Genitals

Pigmentation is Bluish-Grey

[BROWN PIG. ON NOSE Post Fever = CHIK Sign seen in chickenguniya]

Bullous FDE is seen in Genitals.

On Genitals it comes ~~as~~ as recurrent blister / ulcer healing ↓ hyperpigmentation (not ↓ Herpes genitalis)

B> **ERYTHEMA MULTIFORME**

C/F- Target Lesions ∈ 3 ZONES

ETIO-

H/cc - HSV

other - Mycoplasma
Idiopathic
Drugs

Rx- self Limiting

BULLOUS EM ⇒ centre most area gets blister

2 types of EM

EM MINOR	EM MAJOR
Few target Lesions	Many target Lesions
No mucosal involvement	one mucosa involvement (oral)

C> **STEVENS JOHNSON SYNDROME (SJS)**
TOXIC EPIDERMAL NECROLYSIS (TEN)

ETIO → mainly Drug Induced
→ sometime mycoplasma.

C/F- 1) TARGETOID LESION or atypical target zones

2) ≥ 2 mucosa involved

Depending on % Body

<10% → SJS

10-30% → Overlap

>30% → TEN

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

TEN (LYELL'S SYNDROME)

cut in Basal Layer

↓

Blister

↓

Death extends to full epidermis (necrosis)

↓

falls off

↓

Barrier Loss

Rx- 1) FAS (R) Antagonist ⇒ IVIg

2) CD8 cell Inhibitor ⇒ CYCLOSPORINE.

~~NICHOLS~~ * NIKOLSKY SIGN

Tangential movement of finger create epidermal movement & a raw area underneath.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

BLISTERING DISORDERS

A) IMPETIGO

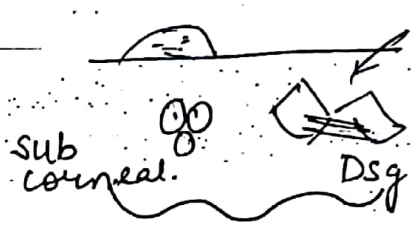
NON - BULLOUS

IMPETIGO CONTAGIOSA

- Staph > Gr A strepto
- Commonest skin infec" in children
- Honey coloured crusts around mouth ♀ nose

BULLOUS

PEMPHIGOUS NEONATORUM



E. Toxin. disseminates in Blood ↓

(exfoliative) SSSS
or
(epidermolytic)

DIF = (-ve)

HYPOPYON SIGN - pus in Lower 1/2

Dsg 1 → Seborrheic areas
↘ mucosa - absent

Child

RITTER's Disease

Presents only in children as scale crust lesions at seborrheic areas ∴ out mucosal involvement

Fever (+)

Nikolsky sign (+)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

B) PEMPHIGUS

1) P. FOLEACEOUS

Seen in adults
No fever
Scale / crust in seb. area
NO mucosa

2) P. ERYTHEMATOSUS

also called SENEAR- USHER SYNDROME
variant of PF

PF x + SLE
x xx
↓
PE

3) P. VULGARIS

Dsg 3 Disorder
↓
present all over body
↳ also tnt in mucosa

→

Deep wounds
open painful wound, slow to heal

Severe mucosal involvement.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

2 TYPES

MUCOSAL	MUCOCUTANEOUS
Only Dsg 3 involved	Both Dsg 1 + 3 involved

4) P. VEGETANS

↳ like a vegetable

↳ cauliflower-like masses in flexures

variant of PV.

Rarest pemphigus

5) PARANEOPLASTIC PEMPHIGUS

Resembles P. vulgaris but ∴ Internal Malignancy

↓

M/c → NHL

Others → CLL

↳ Castleman Disease

↳ Thymoma

↳ Retroperitoneal Sarcoma

Nikolsky sign ⊕ in all pemphigus.

Rx = 1) Systemic steroid - Doc

↓

High Dose

2) Non-steroidal immunosupp.

eg. Azathioprine, Mycophenolate, Cyclophosphamide

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

3) Rituximab → antibody
↓
monoclonal
against CD_{20} receptor on B cell surface

B c> **BULLOUS PEMPHIGOID**

Tense fluid filled blisters
Blisters come on red/ urticarial skin
extremities/ trunk
Elderly patients

H/P - subepidermal blisters + eosinophils

BULLA SPREAD SIGN/ LUTZ SIGN

Bullous Pemphigoid

P. vulgaris

ASBOE - HANSEN SIGN

Variant of Bulla sign
Pressing on **top** of blister not from one side

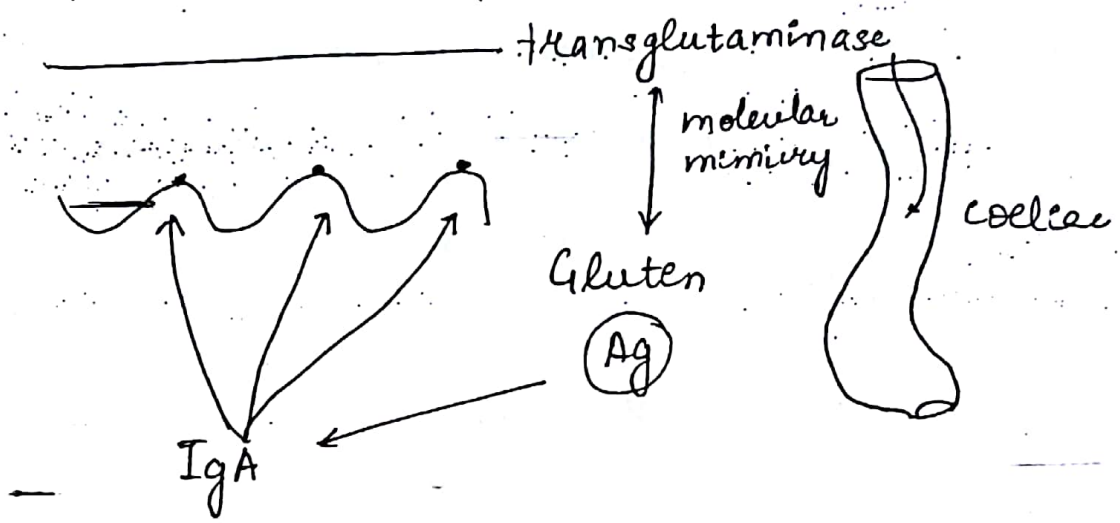
BP in ♀ ⇒ ~~GESTAT~~ PEMPHIGOID GESTATIONIS
(Herpes gestationis)
✕ → ↓ miscarriage
M/C site - Periumbilical Blisters

D) **DERMATITIS HERPETIFORMIS**

Papillary tip Blisters

↑ " " ↓ Microabscess Q.

SLIDE - 20



DIF → IgA @ tip of Dermal Papilla in a granular pattern

Severe Itching

Grouped papulovesicles on elbow.

DOC = Dapsone + Gluten free diet

E) **LIGA / Chronic Bullous Disorder of Childhood**

CBDC

ADULTS — children

→ Itchy tense blisters in a cluster of Jewel or string of pearls appearance

→ 50% have mucosal involvement

→ DOC - DAPSONE

F) HAILEY / HALLEY DISEASE

Benign Familial Pemphigus

Age of presentation - 2-4th Decade

Flaccid Blisters in Flexors rupturing easily to create erosions & painful fissure.

H/P – Dilapidated Brick Wall Appearance

Level of Blister: SUPRABASAL

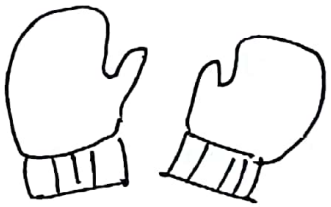
G) EPIDERMOLYSIS BULLOSA

(Trauma Induced Blister) —

Blisters @ site of handling

MITTEN HAND DEFORMITY seen in EBD.

Δ - electron microscopy



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

VASCULAR LESIONS

VASCULAR TUMOURS

CONG.

Infantile Hemangioma
(strawberry hemangioma
capillary "
cavernous ")

Grows Rapidly - till 9 months
then plateau phase then
resolves

Blanches on pressure

Propranolol is Doc. if
→ Rapidly ↑
→ Ulcerating
→ near eye

VASCULAR MALFORMATION

- Port wine Stain
Persists throughout life
(portwine stain on glabella -
called a salmon patch
resolves)

Doesn't blanch

Associated with Sturge weber
Syndrome

Pulse Dye Laser (PDL)

STURGE WEBER SYNDROME

I/L Portwine Stain +

I/L Eye Involvement +

Same side CNS involvement

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

ICTHYOSIS

→ Generalised Dry Skin
→ Fish like scales
Ichthyos → means fish

A) CONGENITAL ICTHYOSIS

(I) ICTHYOSIS VULGARIS

H/c type
Flexures spared
Palms/Soles Involved
Small scales
Association - atopy
H/P → Absent granular Layer

(II) X- LINKED RECESSIVE ICTHYOSIS

Flexures Involved
Palms/Sole spared
Steroid sulphatase deficiency
Large Brown scales

(III) LAMELLAR ICTHYOSIS

Entire skin involved
Plate like Large scales (Lamella - Plate)
Born ⊂ "COLLODION membrane" Q.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

B) ACQUIRED ICTHYOSIS

CRF

AIDS

Hypothyroidism

Hansens

Drug Induced (Nicotenic acid, clofazemines

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

MEDICINE

HANDWRITTEN NOTE

MBBS Help

http://mbbshelp.com

http://www.youtube.com/mbbshelp

http://www.facebook.com/mbbshelp.com

Name : _____

Subject : **Medicine**

MBBSHELP.COM

CVS

RHEUMATOLOGY

RESPIRATORY

ACID - BASE BALANCE

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

CVS

Examination

Non Auscultatory
- Pulse
- JVP
- Apex

Auscultatory : S_1-S_4
- clicks
- opening snap
- murmurs

Specific Disease.

Endocardial Disorders
- ARF, Valvular Heart Ds.
- Infective Endocarditis

Myocardial Ds
- cardiomyopathy
- CHF

Pericardial Ds
- acute pericarditis
- Tamponade
- constrictive Pericarditis

Vacular Disorders
- HTN,
- IHD,
- Aortic Dissec^n

PULSE

(I) Pulse Rate

(N) 60 - 100/min

Ab (N)

1) **Bradycardia** - < 60/min.

Causes

Physiological

1) Elderly
(age related SA node degeneration)

2) Sleep
(↓ in sympathetic activity)

3) Athletes
(Basal ↑ in vagal D/c)

(N) Thyroid hormone
↑ No. + ↑ func^{n} of β_1 receptors

Pathological

I) **CVS Cause**

1@) Brady arrhythmias
(AV Block)

2) MI [inf. wall]

SA node also supplied by (R) coronary artery

due to stimulation of vagal n/v nearby

II **Non - CVS Causes**

1) Hypothyroidism

2) Hypothermia
(directly affects SA Node)

3) Drugs
a) β blocker
b) non DHP CCB [cause AV Block]
c) ~~Digoxin~~ Digoxin effect

4) ↑ ICP
Cushing's reflex = BP ↑, HR ↓, irregular resp

To perfuse brain systemic BP ↑ → stimulate baro receptors in carotid → release vagal D/c

↑ Bile ⇒ ⊖ SA node

⑤ Obstructive jaundice

2) Tachycardia > 100/min

CAUSES

Physiological

1) Infants (↑ SA node activity)

2) Anxiety (↑ sympathetic activity)

3) Exercise (↑ demand)

Sympathetic system ← Thoracic n/vs [thoracolumbar]

Pathological

I) CVS Causes

1) Tachy ~~arrhythmias~~ arrythmias.

a) PSVT

b) AF

2) MI (ant. wall) [stimulation of nearby sympathetic n/vs]

II) Non-CVS causes.

1) Hyperthyroidism.

2) Fever. 3) Beri-Beri

4) Drugs

a) β agonist

b) short acting DHPs [reflex tachycardia due to compensation]

c) Digoxin toxicity

d) Theophyllin

e) Thyroxin.

③ **Relative Bradycardia / FAGET'S SIGN** Q,

HR doesn't ↑ in proportion to body temperature.

(N) For every 1°c from 37°c.

↓

HR ↑ by 15-20/min from baseline

For every 1°F from 98°F → HR ↑ by 10/min.

e.g. if Body Temp is 40°c. HR = 112/min (baseline = 80/min)

min expected HR = 80 + 45

= 125.

CAUSES

Infectious

(also ⊖SA node)

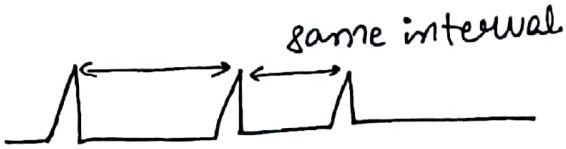
1) Typhoid fever
2) Brucella
3) Legionalla
   (Sputum AFB +ve)
4) Viral

Non-Infectious

1) Drug induced fever
2) Self induced fever or Factitous Fever. Q.
3) Fraudulent Fever
   (thermometer only).

(II) Rhythm :-

(N) → Regular = Fixed interval b/w any 2 consecutive pulses



Ab (N)

- Physiological
  - Sinus arrhythmia
    - HR changes ↑ inspiration ↓ Expiration
- Pathological.

During Inspiratory Phase

(-ve) Intrathoracic Pressure

↓

↑ Blood flow into (R) side of heart

↓

Pulmonary vessels dilatation (blood pooling)

↓

↓ blood flow into (L) side of heart

↓

CO will ↓

↓

SBP will ↓

↓

Baroreceptor stimulation ↓

↓

Vagal release ↓

↓

HR (↯) (↑)

During Expiratory Phase.

⊕ Intrathoracic Pressure

↓

↓ blood flow into Ⓡ side of heart

+

Pulmonary vessels are squeezed

↓

↑ blood flow into Ⓛ side of heart

↓

CO will ↑

↓

SBP ↑

↓

Baroreceptor ⊕↑

↓

Vagal ↑

↓

HR ↓

Pathological

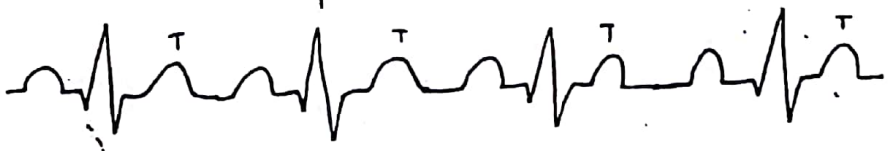
I) Regularly irregular rhythm

↓ predictable ↓ variable.

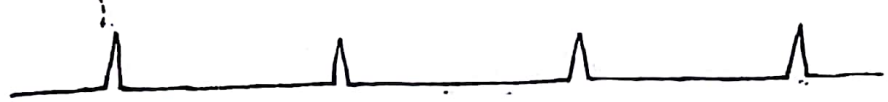
CAUSE :- 1) Bigeminy rhythm ← Digoxin Toxicity

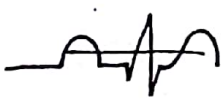
every alternate ventricle contrac° + depolarisate is due to premature ventricle ectopic

Ⓝ ECG.



Pulse





Bigeny

premature ventricular ectopic [hide p. QRS prolonged, inverted T. due to abnormal depolarization]

Pulsus Bigeminus

↑ due to ectopic.

↓ amplitude due to ↓ ventricle filling time hence ↓ stroke volume

II Irregularly Irregular rhythm

↓ no predictable ↓ variation in interval.

CAUSE = Atrial fibrillation. ∴ variable HR

(III) PULSE PRESSURE.

How well a pulse is felt

(N) : SBP - DBP [30 - 60 mm Hg].

AB(N)

I) ↓ PP. / Thready Pulse.

Mech. if SBP ↓ & DBP ↑

if CO ↓.

↓

Stimulate sympathetic activity

↓

arteriolar constrictn → PVR ↑

CAUSE = Shock [Hypovolemic, Shock].
not found in septic or neurogenic shock.

II) ↑ PP / Bounding Pulse.

Mech - if SBP ↑ or DBP ↓

occur. if CO↑

↓

to ↓ LV strain ⟶ PVR ↓

CO is inversely related to PVR

CAUSE : 1) **↑ CO state**

CVS

1) AR
2) MR.
3) PDA

Non- CVS

Physiological → ♀ when plasma vol ↑.

Pathological →

1) Hyperthyroidism

β_1 rec ⊕

ionotropic ⇓ ↑SV

chronotropic ⇓ HR ↑

CO↑↑ = ↑SV X HR ↑

Ⓝ vit B_1 ⊖ NO synthase

if Def of Vit B_1
↳ vasodilatation
↓ PVR ↓ → CO↑

2) Anaemia
3) Beri- Beri

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

PVR ↓ as arteriole are bypased
↳ COT

4) A-V fistula

5) Paget's Disease
[A-V fistula in Bone]

Q. ⊆ low CO state will cause bounding Pulse ?

Ans. severe bradycardia ⊆ complete AV Block

SV ↑ × HR ↓↓ → CO ↓

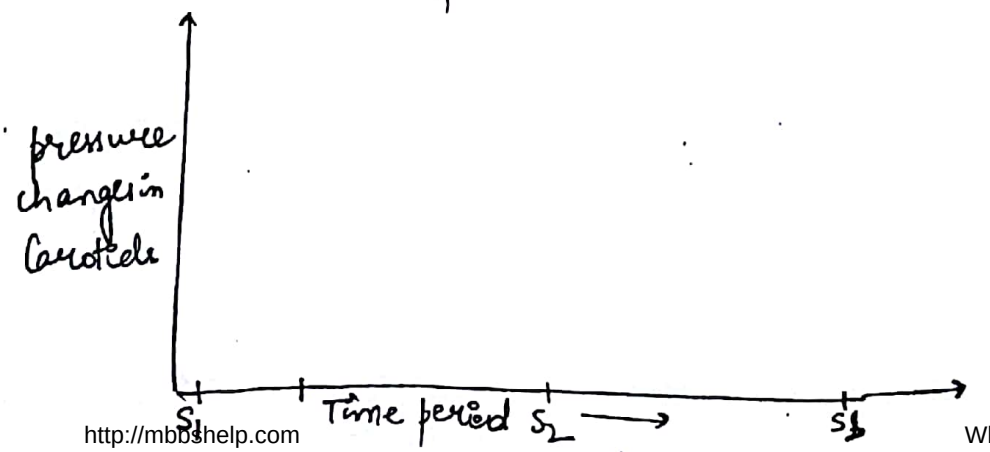
AV Block → ↓ depolarization of ~~purkinje~~ purkinje fibres
↓
rate is ↓ [firing speed is less in AVN]
↓
But EDV ↑
↓
SV ↑

(W) CHARACTER

Rate Rhythm best anised in Radial artery

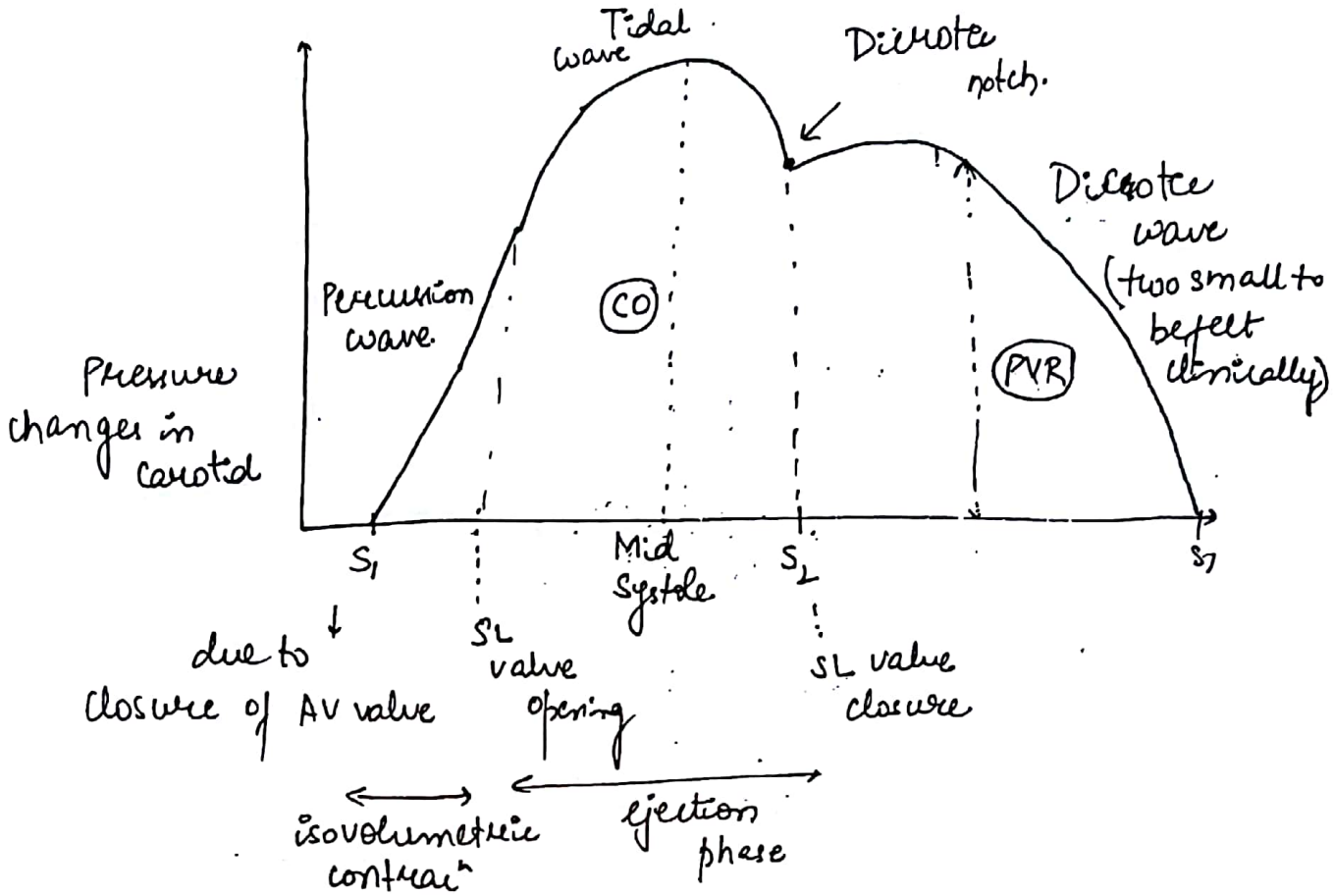
Character /contour " " " Carotid artery

(N) waveforms of carotid.



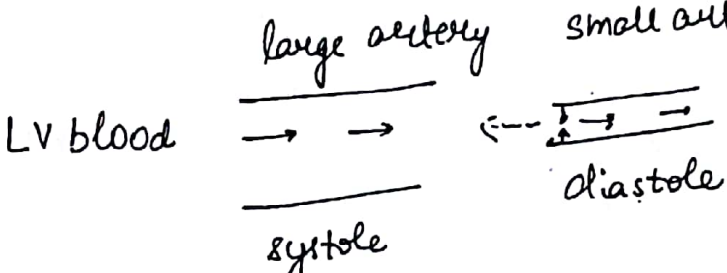
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

S_1 is due to closure of AV valves



WAVE	MECH
① Percussion wave	It is due to pressure transmission by isovolumetric LV contraction onto carotids
② Tidal wave	Because of blood ejection into carotids it's pressure further.
③ Dicrotic wave	Due to back pressure reflection from small vessels

Dicrotic notch represents closure of aortic & pulmonary valve (S_2)



Recoil of small vessel lead to +ve pressure impulse

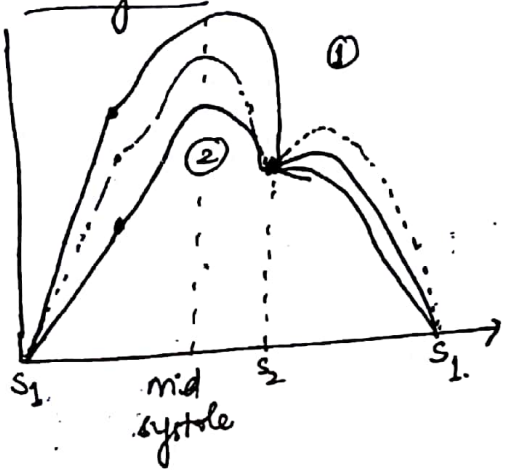
Ab (N)

Diagram

Cause

1) **Hyperkinetic Pulse**

⇒ ↑ amplitude



↑ CO state

2) **Hypokinetic Pulse**

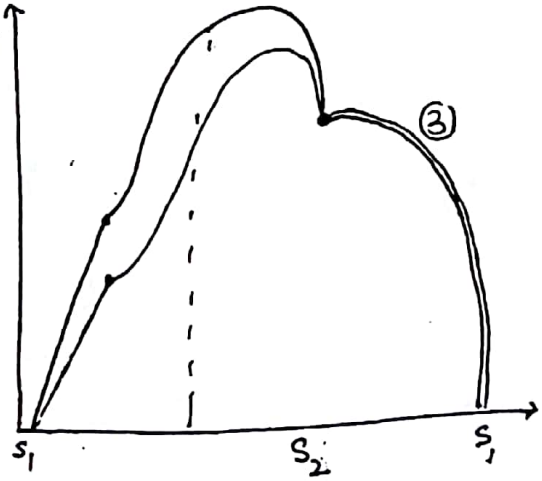
⇒ ↓ amplitude

though diastolic wave in ① but still not felt clinically.

↓ CO state

3) ↓ amplitude = **Parvus**

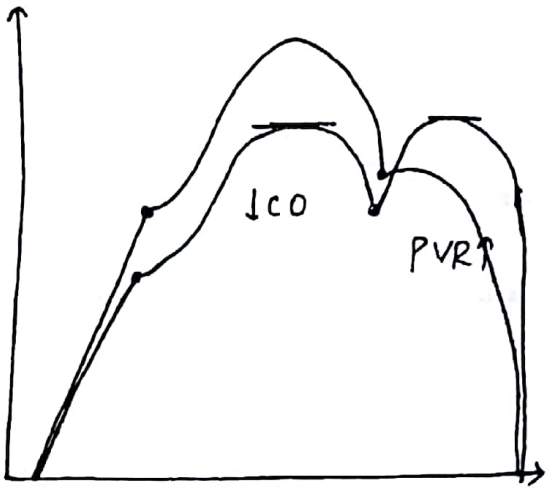
Late peak = **et tardus**



most specific pulse of severe AS.

④ Dicrotic Pulse

= 2 peaks
one in systole
other in diastole



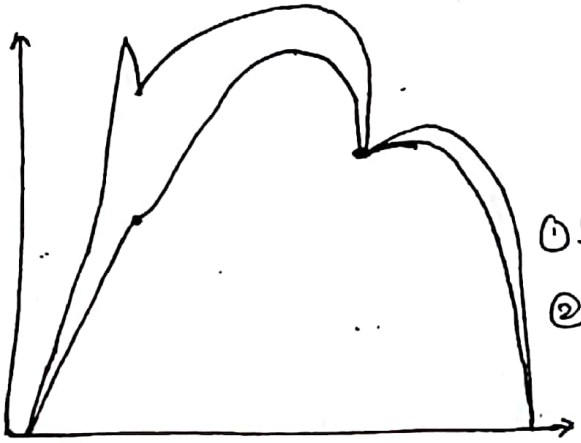
Dicrotic pulse is felt.

Shock
(Hypovolemic
Cardiogenic)

⑤ Bifferiens Pulse

= 2 peaks
(B) in systole

Best assessed in
Peripheral artery



Most specific pulse
of
① Severe AR.
② Severe AR + AS

Brisk isovolumetric (L) ventricular contraction.
(↑ LV vol. + ↑ stretching)
↓
Percussion wave will shift to (L) (as duration is less)
↓
gets separated from tidal wave.

It will make tidal wave to come late.

③ HOCM ---?

V MISCELLANEOUS POINTS IN PULSE.

1) PULSUS ALTERNANS - Best assessed in Radial.
Regular alteration of pulse amplitude.

only amplitude changes, interval remain same

CAUSE → LV (Systolic) Dysfunc^{n}. ← most specific pulse.

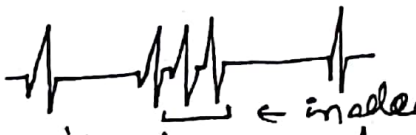
2) PULCE DEFICIT :-

(N) HR - PR ← due to adequate SV = 0
↳ arterial pulsation is felt
↓
due to ventricle contract

Ab (N) if HR - PR = (+ve) ⇒ PULSE DEFICIT.

CAUSES

1) AF ∵ variable heart rate



← inadequate ventricular filling ⇒ No pulse

Pulse ↓ adequate ventricle filling

Here 5 HR but 3 PR

2) Premature Ventricle Ectopics
less filling time → pulse not felt

If pulse Deficit > +10/min ⇒ AF only

3) PULSUS PARADOXUSES :-

(N) SBP_{exp} & SBP_{insp} = 0 to 10 mm Hg.

If this difference is > +10 ⇒ Pulsus Paradoxus.

Exaggeration of Normal Phenomenon. hence paradoxical word is wrong.

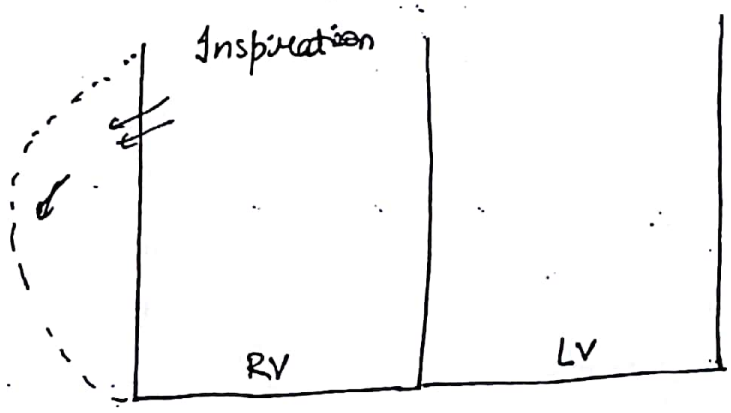
Mech ↓ in SBP_{insp} more than physio limits.

CAUSES

(I) CVS :- 1) H/c CVS cause = Cardiac Tamponade.

"Compression" of heart due to pericardial effusion.

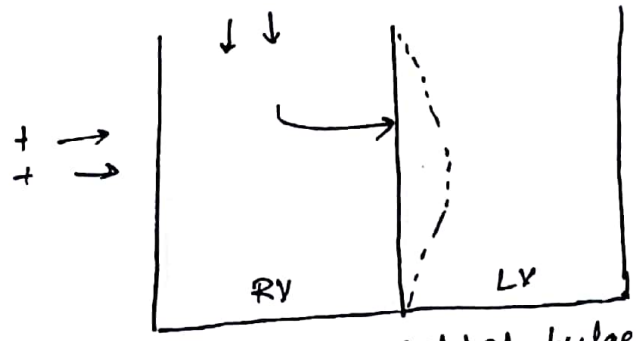
(N) During Inspiration,
Blood flow is more in (R) ventricle
↓
RV wall dilate to accomodate extra blood.



In Tamponade.

Inspiration

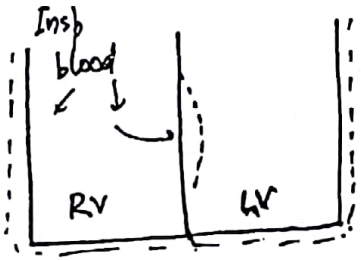
blood.



RV wall can't dilate due to ~~pleural~~ pericardial fluid. → septal bulge in LV → ↓ LV filling further → ↓ CO ↓ → SBP ↓ during inspiration than physiological limits.

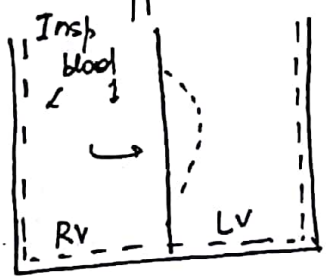
2) **Constrictive Pericarditis**

Failure of relaxation of heart due to stiff pericardium



3) **Restrictive cardiomyopathy**

Failure of relaxation of heart due to stiff endomyocardium.



Septum should be spared from stiffness to cause this ~~side~~ sign

II) Non CVS Cause

H/c overall cause → 1) **Acute Exacerbation of asthma or COPD.**

2) Pulmonary embolism

3) Kussmaul breathing [due to met-acidosis]

4) Obesity

Q. 5) SVC Obstruction [reason not known].

Deep Inspiratory efforts.

↓ Large -ve intrathoracic pressure

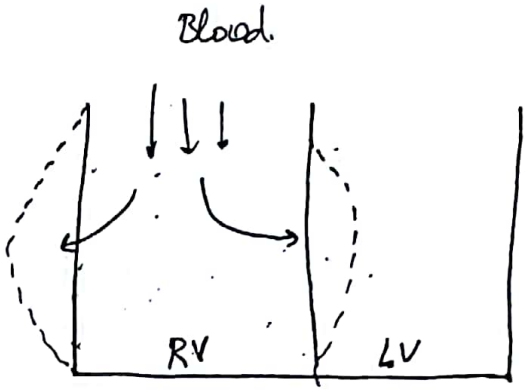
↑↑↑ venous return to the right side

↓

Septal bulge.

↓

Pulsus Paradoxus



Due to extra blood septal bulge occurs.

JVP

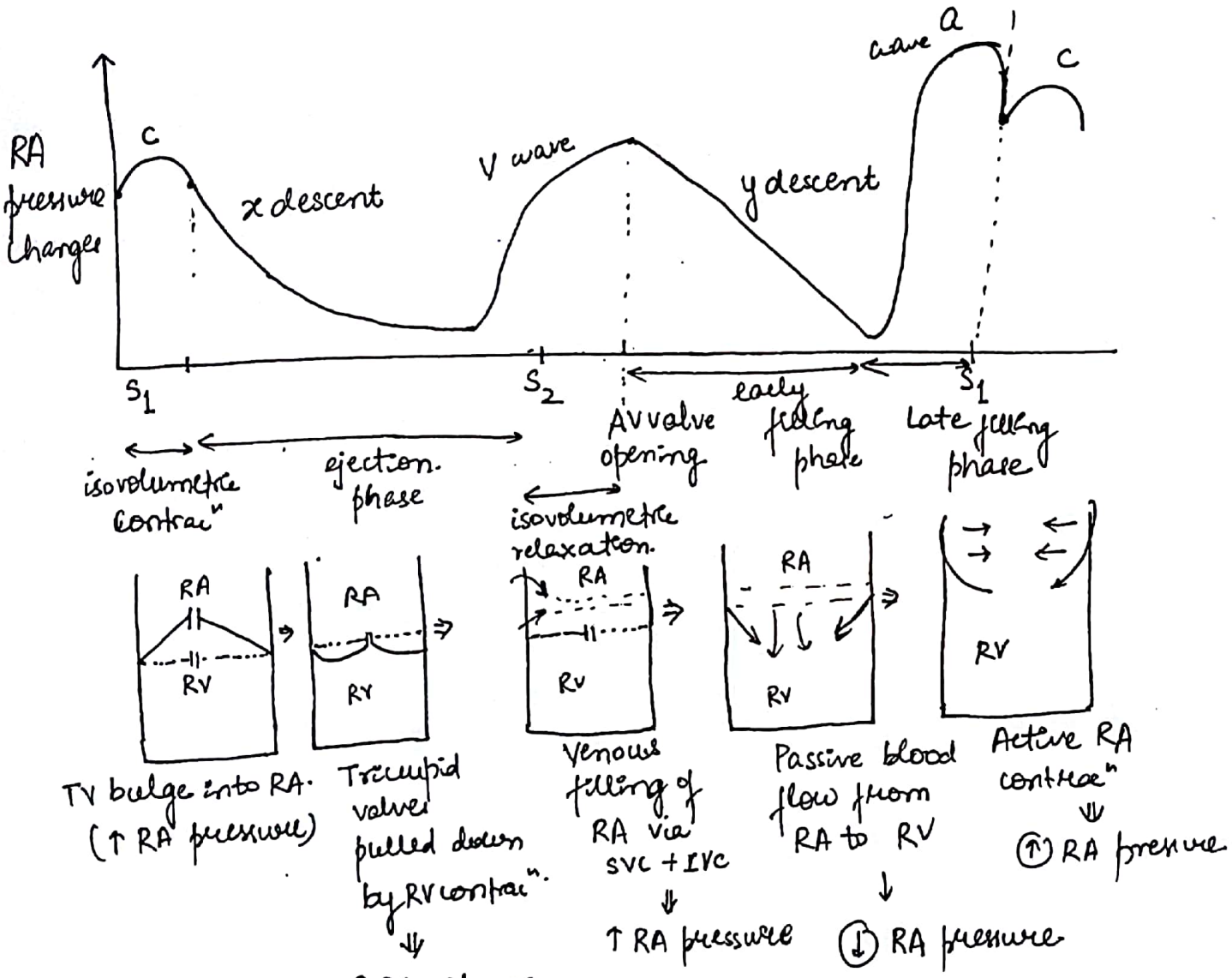
(N) - measure of (R) atrial pressure seen in (R) IJV

(N) Height → 0-3cm from sternal angle

↓ 5cm below

RA activity.

= 5-8cm from RV activity.



Q c wave ; (B) syst + diastole

⇒ V wave

Q. c wave will be more prominent?

⇒ a wave.

Q. c descent will be more prominent?

⇒ x ~~wave~~ descent

http://mbbshelp.com
WhatsApp: +1 (402) 235-1397

Ab (N) JVP

(I) **a wave** = due to (R) atrial contraction

1> **Absent a wave** = if ineffective atrial contraction

↓

AF

2> **Large a wave** = if (R) atria contracting against more resistance

(Diastolic Wave)

If (R) atria is contracting → 1) Tricuspid valve gives resistance
2) RV also gives resistance

cause-

a) **Tricuspid stenosis**

b) RV pressure ↑

- RVH (concentric) ↑ due to (PS) **PAH**
- RV failure (systolic) → RV blood retention. ↑
  1) **Pulmonary embolism**
  2) **RV MI**
  3)
- "Compression of RV" ↓ **Cardiac Tamponad**

5> **Canon a wave** = if RA contracting against closed T. valve.
(Systolic event)

occur if RA & RV are contracting simultaneously → cause TV closure

causes → (1) **Junctional rhythm.**

SA node arrest → AV node becomes pacemaker & impulse reach (B) atria & ventricle simultaneously

Rate of cannon a wave = 50/min, **Regular**

(2) **Complete AV Block**

SA node will depolarise atria &
Purkinje fibres will depolarise ventricle independently.

So occasionally atria & ventricle can depolarise simultaneously

Canon a wave is = **intermittent**

(II) X Descent

(N) due to tricuspid ring pulled down by RV contraction during ejection phase.

+

(R) atria is free of significant blood (during this phase)

Ab (N)

1> Absent x Descent

if (R) atrial pressure doesn't fall as it contains

↓

significant Blood or Clot

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Significant blood ↑ (TR)

Clot ↑ (AF)

② Deep x Descent

occur if tricuspid ring pulled more downward due to

↑

» Increased RV contract

(?) 1) Cardiac tamponade

2) Constrictive Pericarditis.

III V Wave

(N) due to venous filling of (R) atria

Ab(N)

1) Absent or Low V wave :-

occur if venous filling of RA (↓)

cause - a) obstruc^{n} SVC

2) Large V wave :-

↑ RA pressure ↑ during venous filling

↑ venous filling ↑

SVC → IVC → RV ↑ TR

or ↓ compliance of (R) atria

[failure of relaxation]

1) constrictive pericarditis

2) Restrictive cardiomyopathy

IV Y Descent

(N) due to passive blood flow from (R) atrea to (R) ventricle ab(N)

1) **Rapid Y Descent** :- / FREIDRICH'S SIGN.
Will occur if (R) atrial blood moves very fast into (R) ventricle as soon as Tricuspid valve opens.

All causes of large v = Rapid y

2) **Slow y Descent** :-
If (R) atrial blood moves into (R) ventricle slowly.

cause - 1) Tricuspid stenosis
2) ↑ RV pressure

Causes of Large a = Slow y

y descent absent - if RA blood doesn't move into RV during passive filling phase

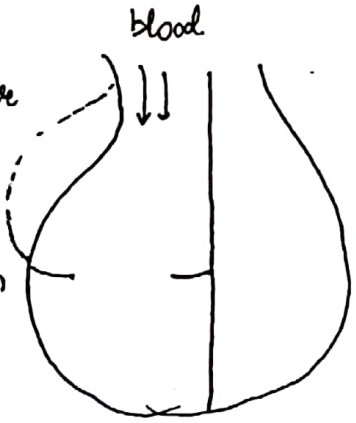
↑

occurs if (R) ventricle is fully "compressed"

↕

Cardiac Tamponade.

Signs of JVP	Description	Causes
① Abdomino Jugular reflex [abdomen compressed for 30 sec]	if JVP remain elevated by more than 3cm even after release of compression for >15 sec	Latent RVF. / no RVF in basal state + RVF is manifested if RV workload ↑
② Kussmaul's sign	↑ in JVP during inspiratory phase [Ⓝ JVP ↓ during inspiration]	if Ⓡ atria fail to relax Ⓝ ↓ Constrictive pericarditis, Restrictive cardiomyopathy



RA relaxes further [RA Ⓟ doesn't ↑] + Diaphragm goes down ⇓ Ⓡ atria goes down ↓ JVP falls

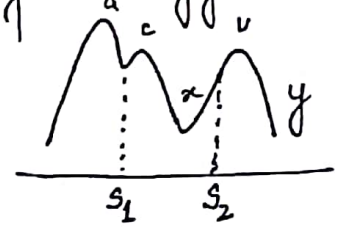
If basal RA Ⓟ if = TS RVF

Basal atrial 'P' ↑ due to
- ↙ if AV valve Stenosis
- → ventricle failure

Kussmaul's sign is absent in tamponade. --- ?

Q. Δ of etiology :-

Ⓝ



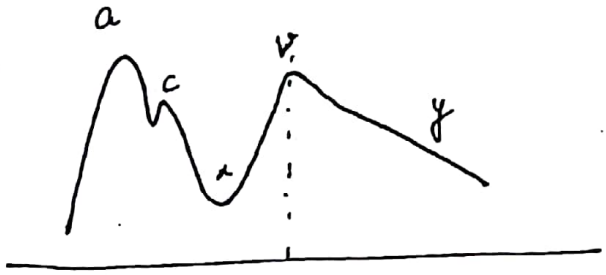
Ab (N)

(1)

Δ = y is absent

a) TS b) constrictive Pericarditis c) Tamponade d) TR.

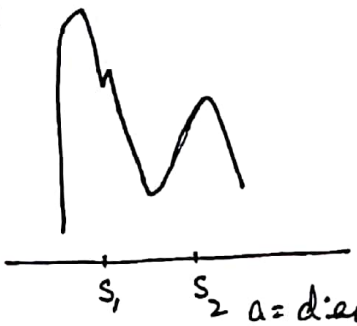
(2)



Δ = slow y descent

ans (a) → TS

(3)



a = diastolic a

(A)

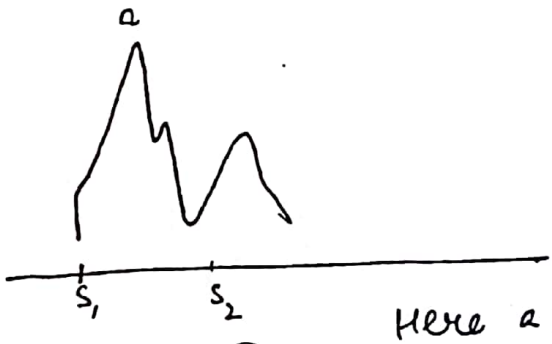
Δ = large a

TS

Options

(1) TS

(2) Junctional rhythm



(B)

Here a is systolic

Δ = canon A wave

↓

Junctional rhythm

APEX BEAT

Ⓝ - due to isovolumetric Ⓛ ventricular contrac^{n}.

⇓

LV apex displaced superiorly

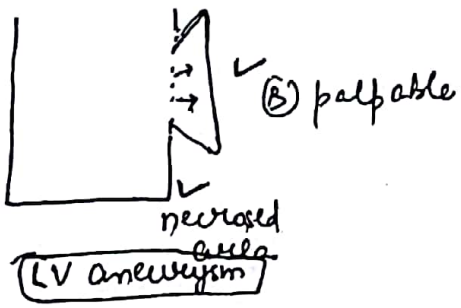
Nature → Tapping.

Site → Ⓛ 5th ICS; just medial to mid-clavicular line

Area → < 2.5 cm^2 [localised].

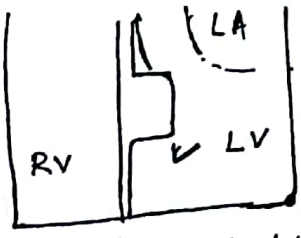
Ab Ⓝ of Apex

	Ab Ⓝ	Description	Cause
①	Hyperdynamic	Palpable for upto $\frac{2}{3}^{rd}$ of systole	Ⓛ ventricular volume overload. [↑ CO state]
②	Sustained	Palpable for > $\frac{2}{3}^{rd}$ of systole	Ⓛ ventricle pressure overload. eg. AS.
③	Diffuse	area > 2.5 cm^2	Dilated cardiomyopathy
④	Double	2 impulses palpable in systole	LV aneurysm (complication of MI)



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Asymmetrical Septal hypetrophy



= HOCM / Subvalvular Aortic Stenosis

If hypertrophy is anterior then palpable

↳ it obstruct LV outflow

⑤ Triple — 3 impulses palpable in systole

HOCM.

⑥ Absent — non-palpable

Pericardial effusion
Emphysema
Obesity
Dextrocardia Q
↳ apex goes posteriorly hence not palpable

Q. Double Apex seen in
① ~~As~~ [HOCM is subvalvular AS]
② TS
③ MS
④ AR.

AUSCULTATORY FINDINGS

* S_1.

due to closure of AV valve.

(N) = $M_1 T_1$ [mainly contributed by mitral valve].

Split < 20msec.

Site : Apex

* Pitch : moderate

Any mitral valve sound/ murmur.
Best area = Apex

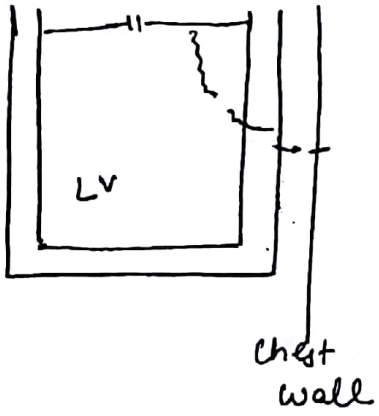
Ab(N)

Factors affecting the intensity	soft S_1	Loud S_1
1) Force of isovolumetric ventricle contraction	↓ weak force eg. Dilated CMP LVF, RVF VSD &	Strong force eg MS, TS (↑ atrial (P) is high)
2) Cond^n of A-V leaflets	if fail to strecke each other eg. MR TR calification of leaflet	–

3) The presence of fluid, mls air fat between AV leaflet & stethoscope

- if ventricle blood vol. ↑
  - AR
  - PR
- if ventricle wall thickness ↑
  - LVH ← AS
  - RVH ← PS

thin, lean.

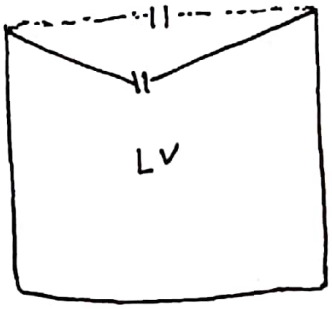


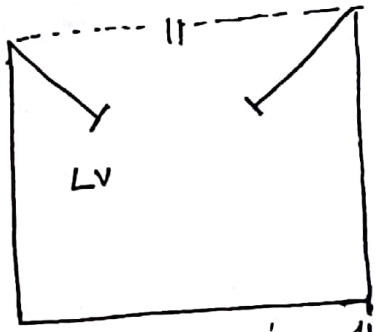
LMR

All valvular Lesions cause Soft S_1 except MS & TS

4) Most imp factor

Position of AV leaflets at onset of ventricular contraction.





If impulse reaches ventricle late + ventricular blood filling fully complete

↓

AV leaflets pushed to close position.

- Bradycardia
- PR interval ↑

If impulse reaches ventricle fast + ventricle blood filling incomplete

↓

AV leaflets fully open.

Tachycardia

Short PR interval

Q. In Hypothyroidism, S_1 is soft-

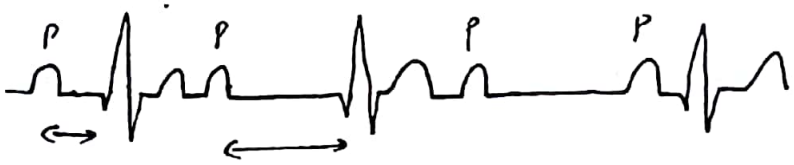
Q. In Digoxin effect, S_1 is soft ans AV Block → PR ↑ interval

Q Cond^n causing variable S_1 intensity :-

If variable HR = AF

Q If variable PR interval = 2° AV Block

→ Mobitz -I. Q.Q.



Progressively PR interval ↑ till atrial impulse fails to conduct to ventricle

= Wenkebach's phenomenon.

* S_2

It is due to closure of Semilunar Valves.

(N) - A_2 P_2

Aortic valve closes earlier than Pulmonary valve

↓

LV ejec^n time is less than RV

Site = For A_2 — aortic area — (R) 2nd ICS

For P_2 — Pulmonary area — (L) 2nd ICS

Best for S_2 → Pulmonary area. [as both sound heard]

Split = 30-60msec.

During Inspiration → split Increase

LV blood vol ↓
LV ejec" time ↓
A_2 early

RV blood vol ↑
RV ejec" time ↑
P_2 → Late

During Expiration → split Decreases. or Expired

LV blood vol. ↑
A_2 late.

RV blood vol ↓
P_2 early

Ab (N) of S_2 split

1. **Wide split**

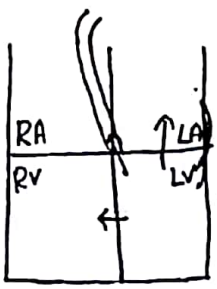
CAUSES

I) **Early A_2.** (earlier than physio limit)

↓ If LV ejec" time ↓
- VSD
- MR

or

↓ If LV early depolarisation.



accessory pathway from LA to LV will depolarise LV early.
Q (Bundle of Kent)

- WPW Syndrome
- M/cSite → (L) Q.

→ Type A WPW syndrome

WhatsApp: +1 (402) 235-1397

WPW SYNDROME

1) ♂ > ♀
2) (L) side more common
3) short PR interval
4) S, will be Soft Q. ... ?

II) P_2 is Late [Later than physio limit]

RV ejec" time ↑ or RV late depolarisation

eg PS
RVF

eg. RBBB

(2) REVERSE SPLIT or PARADOXICAL SPLIT

P_2 A_2.

CAUSES

(I) P_2 is early (earlier than A_2)

RV ejec" time ↓ or RV early depolarisation.

- TR
- VSD ± R to L shunt
  (Eisenmenger Syndrome)

WPW type (B)

(II) **A_2 is Late** (later than P_2)

- LV ejec" time ↑
  - AS
  - LVF
- LV Late depolarisation
  - LBBB

Q. How to differentiate bet" Split & Reverse Split.

During Inspiration.

Reverse split will Decrease RV vol ↑

LV vol ↓

Split Decrease [against (N) rule].

During Expiration

Rever split will Increase

RV vol ↓

LV vol ↑

Split Increase

Q. In. Pulmonary artery HTN, S_2 Split

(a) (I)

(b) ↑

(c) No change

→ P_2 comes early ----?

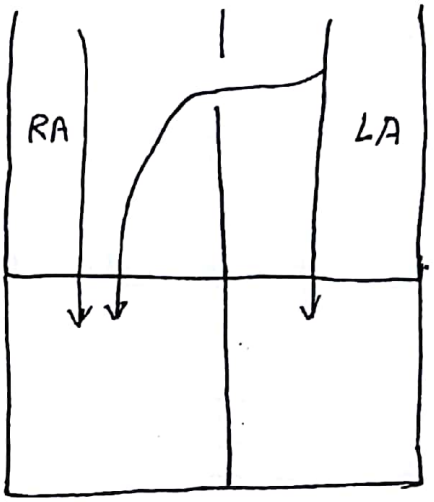
Hint - Pulmonary hang out interval

(3) WIDE + FIXED SPLIT

doesn't vary ē resp. phases.

cause → ASD.

RV blood ↑ → P_2 late
LV blood ↓ → A_2 early
} Wide



Split is fixed
= ventricle blood vol remain constant during Insp. + Exp.

⇓

RV blood → Insp. = ↑ + ↓
→ Exp. = ↓ + ↑
⇒ Fixed.

Intensity of S_2

Factors	Soft	Loud
1) Pressure of aorta/ Pulmonary to close SL valves.	Hypotension	Systemic HTN → A_2 P. HTN → P_2
2) Cond^n of SL valves Leaflets.	calcified AR PR	x

* Single S_2 seen in - AR [A_2 is absent]
PR [P_2 absent]
AS/PS [valves get severely calcified]

S_3 / Ventricle Gallop

It is due to ↑ in ventricle blood volume during early filling phase.

↓

ventricle vibrations

Causes:-

Systolic dysfunc^n

[↑ end systole volume]

↓

(L) VF.
RVF
DCMP
MI
LV aneurysm

Atrial venous filling ↑

↓ early filling phase

↑ blood will enter ventricles from atria

↓

eg. high CO state
MR . TR

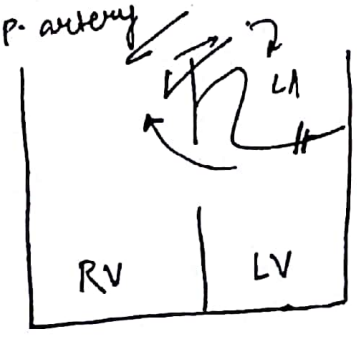
Site → LV S_3 → Apex
RV S_3 → Tricuspid area. [(L) lower parasternal]

Pitch → Low pitch.

Q. In atrial septal defect ⊆ side S_3 → RV S_3 / LV S_3 ?

ans → RV S_3.

Q. In VSD, ⊆ side S_3 = LV S_3



Pulmonary valve is open in systole so blood from VSD goes into P. artery

↓

P. vein

↓

(L) atrium

MV is closed in systole & blood is collected in it
1st chamber to enlarge is (L) atria.

Q. In PDA ⊆ side S_3 = LVS_3

S_4 / Atrial Gallop

It is due to atria contracting against stiff ventricles → ventricle vibrate

Causes-

1) Restrictive CMP
2) HOCM
3) LVH due to AS
4) RVH due to PS
5) Acute MI.

In acute MI Both S_3 & S_4.

↓ relaxation
↕
↓ ATP due to ischaemia.

Site- LVS_4 → Apex
RVS_4 → Tricuspid area

Pitch - Low pitch.

Q. S_3 can be physiological (=True)/False

Ans → ♀ . young children & athletes

Q. S_4 can be physio - True (False)

Q. S_3 represents systolic failure

Q. S_4 represents Diastolic failure

Q. S_4 seen in all except

a) AS [LVH]

b) Constrictive Pericarditis [ventricles are trapped → can't vibrate]

c) AR → extreme (L) ventricle dilatation → making it stiff

d) Amyloidosis [RCMP]

Constrictive Pericarditis doesn't produce S_3 & S_4.

ADDITIONAL HEART SOUNDS

Name	Cause	Timing	Pitch
1) Ejection click	due to sudden cessation of opening of SL valves at it open i high pressure	S_1 ——— S_2 early systole	High.

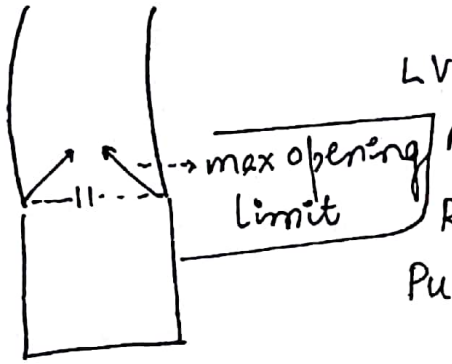
↑

LV 'P' (↑) = AS

Aorta 'P' (↓) = aortic aneurysm

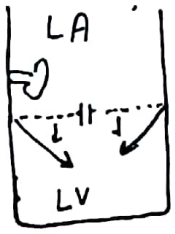
RV 'P' (↑) = PS

Pulm. artery 'P' (↓) = P. artery aneurysm.



Ejection click ↓ in calcified lesions.

2. Opening Snap

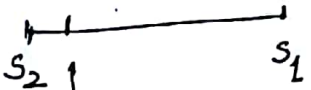


Sudden cessation of opening of AV valve as it opens ∵ high Pressure

↓

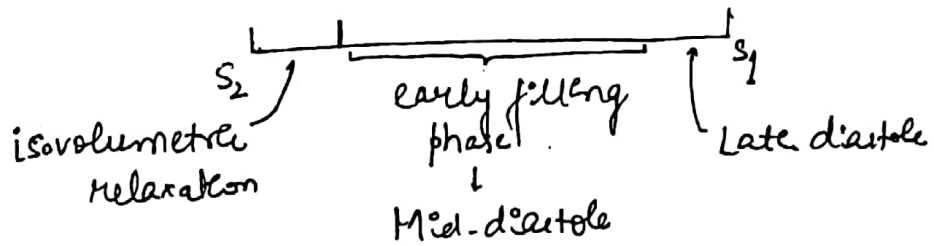
LA ↑ pressure ↑ = MS, LA myxoma

RA pressure ↑ = TS



early diastole phase

High



↓

Mid-diastole

③ Tumour Polyp

Ⓛ atrial myxoma striking mitral valve

Early diastole

Low

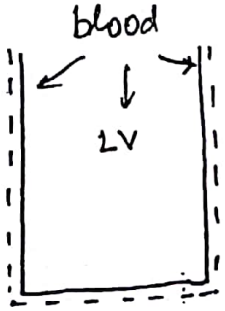
QQ

④ Pericardial Knock

ventricle wall strike [knock] on stiff pericardium

Early filling phase

High.



Most Specific sign of

Constrictive Pericarditis.

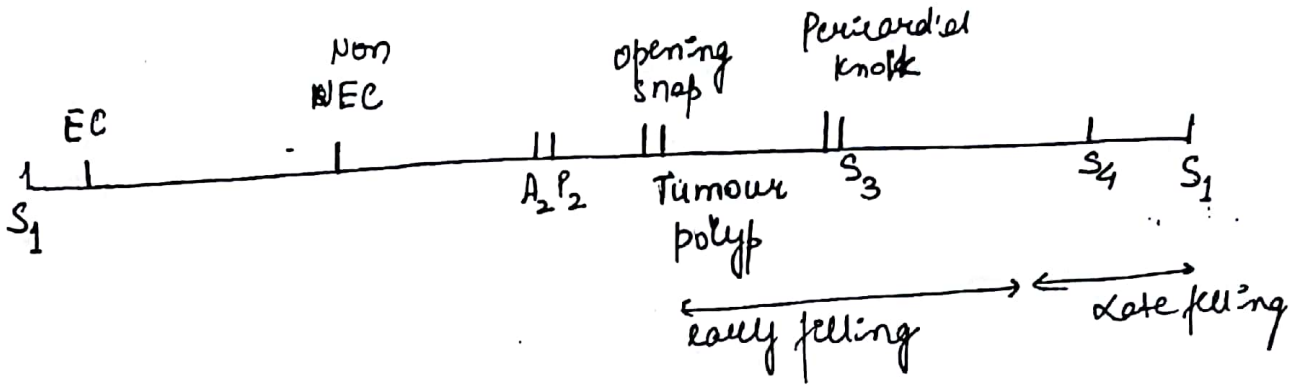
⑤ Non-ejection Click

MVP rolapse

≥ mid systole

High

http://mbbshelp.com WhatsApp: +1 (402) 235-1397



In AF. JVP = a wave absent

Hs = S_4 ⊖ [if previously present]

MURMURS

Due to turbulence of blood flow ~~in the~~

If ab Ⓝ ↑ pressure gradient during normal direc^n of blood flow

↓

due to stenotic Lesions

If ab Ⓝ direc^n of blood flows

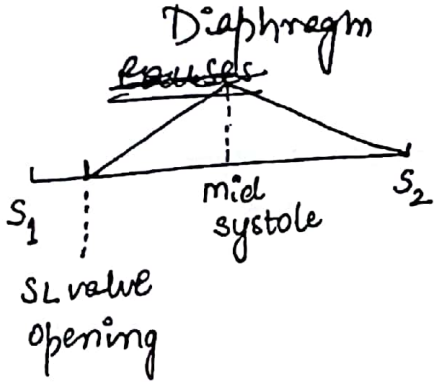
↓

due to Regurgitant Lesions or VSD

TYPES

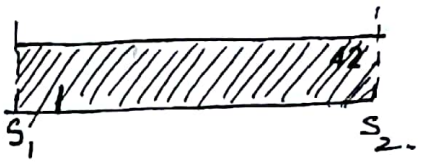
(I) SYSTOLIC MURMURS

Name	M/c murmur overall	Causes
① Ejection systolic murmur or Mid-systolic murmur or crescendo-Decrescendo	~~Diagram~~	due to turbulence of blood flow due to ejection phase AS, PS ↑CO states. → [Φ]. (↑ blood flow across SL valves)



② Pansystolic Murmur
No peak.

VSD
[LV pressure remain > RVP throughout systole]



chr MR
[LV 'P' remain > LA 'P' throughout systole]
Chr. TR.

QQ.
③ Early systolic murmur

If defect closes before mid-systole
eg. Small muscular VSD

or

If pressure gradient becomes zero (≤ mid-systole)
ⓑ Acute MR.
[MI or IE].

LA is not dilated unlike chr. MR.

During early systole, Ⓛ ventricle blood enters LA
⇓
LA 'P' will ↑ rapidly
⇓
during mid systole Ⓛ atrial 'P' = Ⓛ ventricle 'P'
⇓
murmur will stop

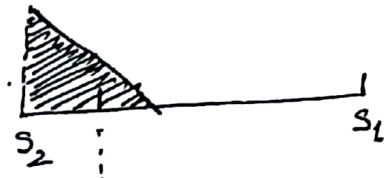
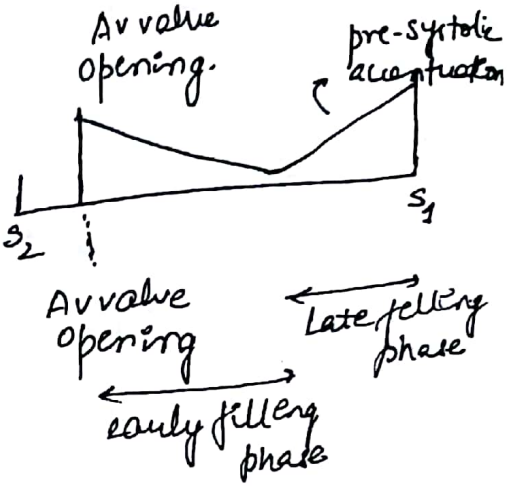
ⓒ Acute TR.

④ Late systolic murmur

MV Prolapse

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(II) DIASTOLIC MURMURS

Name	Causes	Diagram
1) Early Diastolic murmur. or Decrescendo Murmur	AR, PR	
2) Mid-Diastolic murmur	Turbulence of blood flow from atria to ventricles. MS, TS	

Q. Early Systolic murmur seen in all except

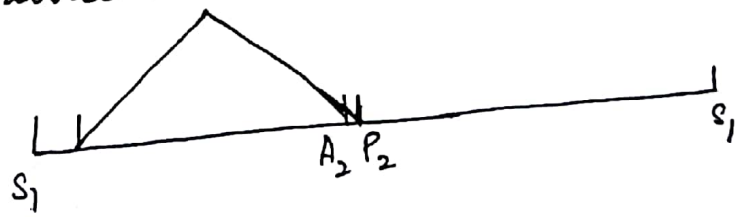
a) TR (acute)

b) VSD (small muscular)

c) papillary m/s necrosis (MI → acute MR)

d) AS

Q. Identify the valvular lesion



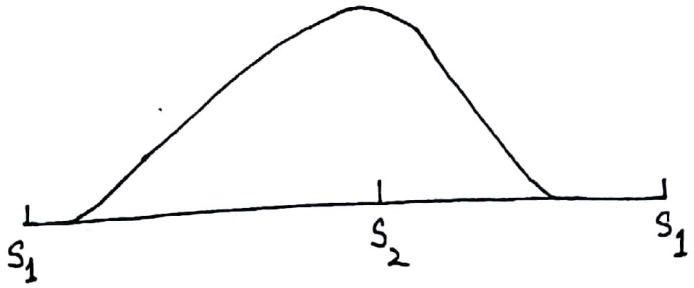
(a) MS

(b) TS

(c) PS

(d) PS

(III) CONTINUOUS MURMUR



- Starts in systole
- Peaks around S_2
- Ends in Diastole

Origin - single site

Mechanisms :-

If Ab (N) pressure gradient is maintained throughout systole & Diastole

&

If Defect remains open throughout Systole & Diastole

Continuous murmurs are never due to valvular Lesions

CAUSES :-

1) Ab (N) communication b/w artery to vein

eg : A-V fistula

Ruptured sinus of valsalva (aorta to (R) atria connection)

2) Ab (N) communication b/w systemic to Pulm.

eg. PDA

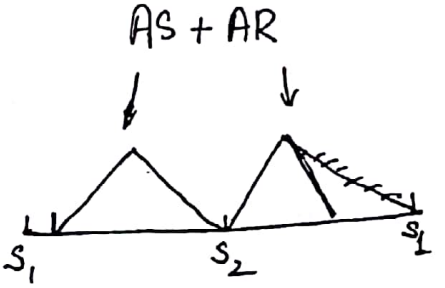
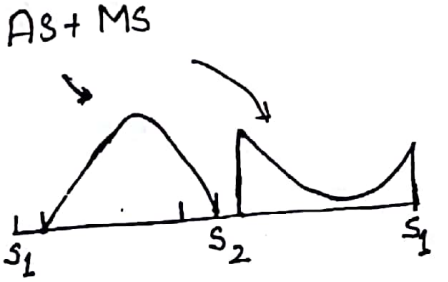
(3) ↑ blood flow into blood vessels
mammary artery souffle (lactation)
uterine artery souffle. (♀)

(4) Severe arterial stenosis [>70% narrowing of diameter]
Renal artery stenosis → 'bruit'

Q. Continuous murmur can be physiological - True/false
↳ ♀, Lactation

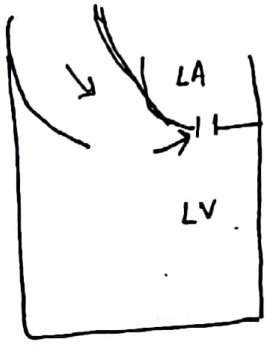
Q. All causes continuous murmur except
a) Pt. of CKD on heamodialysis [A-V fistula]
b) Severe atherosclerosis [carotid or renal artery stenosis]
c) AR + AS
d) Lactation.

D/D of Continuous Murmur.

	Continuous murmur ✓	To & Fro ✓	Systolic-diastolic ✓
Systole + Diastole			
Origin	single site	single site	Different sites
Peak around S_2	✓	×	×
Eg.	✓	AS + AR 	AS + MS 

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Name	Cause	Type	Site
1) Gibson's murmur	PDA	continuous	(L) upper parasternal area
2) Key Hodgkin's murmur	AR	early diastolic	(L) 3rd ICS = Erb's area = Neo-aortic area
3) Graham-Steel's murmur	PR	early diastolic	(L) 2nd ICS Pulmonary area
4) Austin flint murmur	AR Regurgitant jet of AR striking mitral valve.	mid-diastolic to late	Apex
5) Carey Coomb's murmur	ARF Turbulence of blood flow over inflammed rough mitral valve	mid-diastolic murmur.	Apex
6) Dock's murmur	Severe stenosis of LAD artery (widow's artery)	continuous murmur.	3rd (L) ICS 4cm from sternal margin



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

⑦ Still's murmur — young children — Ejection systolic murmur — Pulmonary area

- Innocent murmur

(Relatively ↑ blood flow across Pulm. valve)

⑧ Rytand's murmur — complete AV Block. ⇓ ↑ Blood flow across AV valve — mid-diastolic — apex.

FACTORS AFFECTING MURMURS:-

If blood flow ↑ → all murmur will ↑ [except]. ⇓ MVP, HOCM.

	Blood flow	Murmur
1) Respiratory variation.		
a) Inspiration	↑ blood on ® side	↑ TS, TR, PS, PR (except Pulmonary ejection click ↓ in inspiration)
b) Expiration	↑ blood on Ⓛ side	↑ MS, MR, AS, AR [except HOCM, MVP]
c) Valsalva effect (Persistent expiration)	~~Persistent expiratory~~ ↓ blood on ® side followed by Ⓛ side.	All murmur will ↓ [except HOCM, MVP].

II Postural :- Valiation

a) Standing — ↓ blood flow into R+L side — all murmur will ↓ except HOCM, MVP

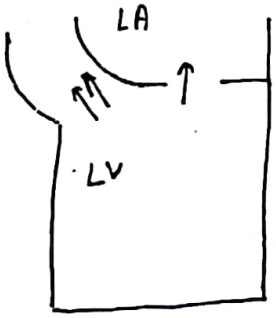
b) squatting (immediate effect) — ↑ blood flow into R+L side — all murmur will ↑ except HOCM, MVP

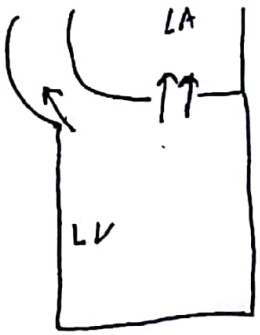
III Effects of Afterload changes :-

Lesion	Afterload ↓ (aorta 'P' ↓)	Afterload ↑ (aorta 'P' ↑)
AS	murmur ↑	murmur ↓
AR	murmur ↓	murmur ↑
MR	murmur ↓	murmur ↑

Pressure gradient = LV 'P' - aorta 'P'

Pressure gradient = aorta 'P' - LV 'P'





Regurgitant Lesions behave similar

MVP

Cause- Deficiency of type III collagen in MV leaflets (posterior)

⇓

↑ leaflet flexibility

↓

surface area of MV leaflet ↑

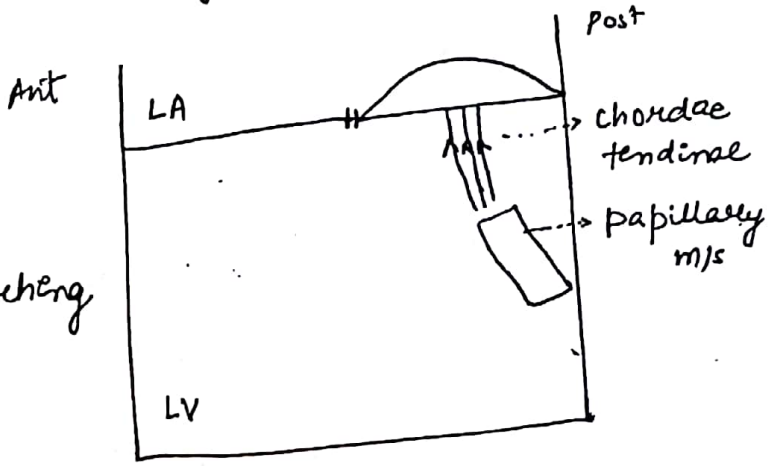
↓

too big for LV cavity

C/F

Symptoms:-

1) chest pain
   M/c symptom
   Due to papillary m/s stretching

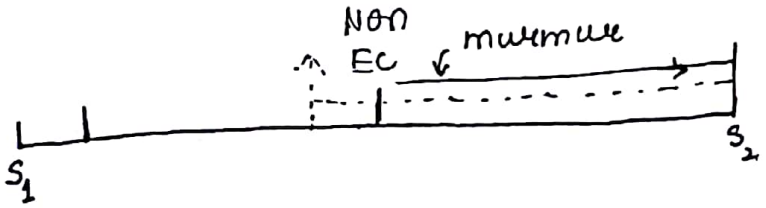


2) Palpitations
   Ventricle fibre stretching
   ↓
   produce ventricle ectopic

Sign:-

▷ M/c sign → **Non-ejection click.**
   due to doming of MV
   ↓ occurs when LV cavity size ↓ significantly

2) Late systolic murmur (MR)
   occur when post. leaflet looses contract & ant. leaflet



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

If LV cavity blood vol. ↓ → Prolapse will occur early
[standing position
inspiratory phase]

↓

Non-Ejec^n Click earlier.

↓

murmur will start earlier

Inv

2D Echo

if prolapse is **> 2mm** into LA

T/t

1) Reassurance. (mostly benign)

2) β blockers (if palpitations) DOC

3) S_X repair ← NYHA symp ≥ II

+

Severe MR on Echo.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

HOCM

Cause - AD
mutation of β-myosin heavy chain.
["Private mutations"]
⇓
Assymetrical Proliferation of septum near the LV outflow tract
⇓
Free wall hypertrophy

- → Diastolic func' ↓ as filling is impaired
- → LV systolic function ↑ to overcome obstruc"

C/F

Symptom :-

1) Earliest → Dyspnoea ← LA P' ↑ ← LV P' ↑

2) Angina ← ↑ LV workload + Coronary vessels compressed by hypertrophied myocytes

3) Syncope ← Fixed CO [CO will not ↑ during demand]

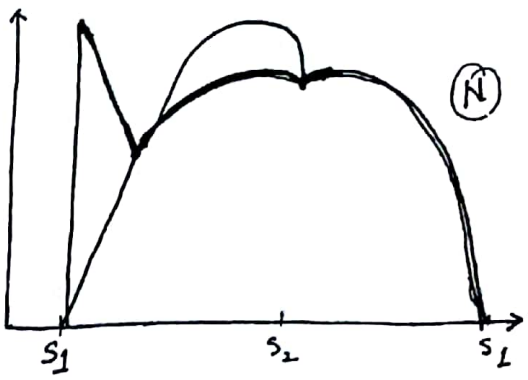
4) * **Sudden cardiac death**
→ Irreversible loss of cardiac func"
∴ in 1 hour of symptoms

→ HOCM is M/cc.
→ SCD is due to ventricular arrhythmias due to ischaemia
↓
⑥ ⊖ Na⁺/K⁺ atpase.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Signs:-

1) Pulse = Bifid
or
Pointed finger pulse



2) JVP :

If hypertrophied septum bulge into (R) atrium

Bernheim's effect → RV 'P' T
- Q ↑
- y slow

Systolic func" ↑ - Brisk ventricular contrac" → Percussion wave will be early + Tidal wave low due to obstruc" of blood flow

3) Apex = Double / Triple

4) S_1 = Intensity soft
S_2 = Split Reverse
S_3 = Rare
S_4 = LV S_4 ++

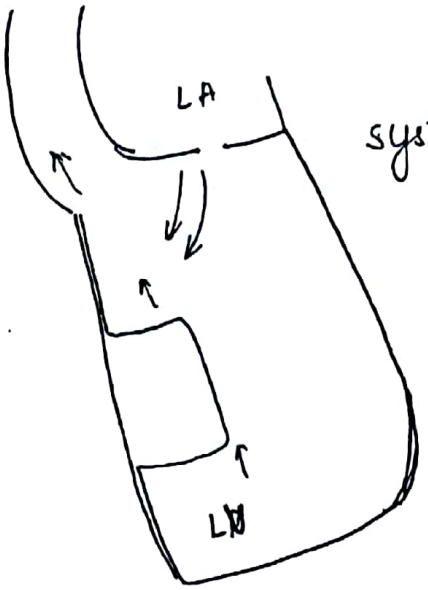
A_2 late → LV ejection time ↑ (due to obstruc")

QQ

5) Most characteristic sign:-

Type → ejection systolic

Site → (L) 3rd ICS Erb's area



(SAM)
systolic ant. movement of mitral valve towards septum
↓
further ↑ing the obstruc^{n}.

2 most imp factors affecting obstruc^{n}

① Contractility
if ↑ → SAM ↑ → obstruc^{n} ↑

② Blood in LV if ↓ → obstruc^{n} ↑
(preload)
(Blood act as physical barrier separating MV & septum)

Drug
Digoxin. C/I in HOCM.

Diuretics
Veno Dilators

Inv
1) CXR → cardiac size (N)
2) ECG →
(N)

HOCM
QRS amplitude ↑
depth > 10mm
Giant Inverted Twave

3) Echo - $\frac{\text{septum thickness}}{\text{LV free wall thickness}}$ · $\frac{3}{1}$ [reversed from (N)]

Rx

1) β blocker → Initial DOC

If CI → Non DHP CCB.

Doesn't prevent sudden cardiac death.

2) AMIODARONE

given if post H/o ventricle arrhythmia

3) Implantable defibrillator. Device (intracardiac)

↳ prevent SCD

4) Septal artery sclerosis [ethanol]

↓

causes regression of septum.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

LMR

ARF

12/2/18

Cause :-

Hypersensitivity reac^{n} to Group 'A' β haemolytic Streptococci [Pharyngitis]

Type II HSN Reac^{n}.

C/F & Inv :-

Modified Jones Criteria

Major :- (5)

Unique features

① **Arthritis**

M/c major manifestation
Large joints
asymmetrical
migratory
Non-erosive (non-deformity)
Polyarthritis
Duration ≤ 4 wks

Exception - JACCOUD's arthropathy (deformities +)

Rx
DOC - Aspirin
75mg / 1g / day

② **Carditis**

M/c cause of Death = CHF
M/c layer = Endocarditis
M/c valve = Mitral
M/c Lesion = MR
L/c Valve = Pulmonary
Myocarditis = no necrosis
[Troponin - N]

Pericarditis → Tamponade
Constrictive Pericarditis
] very rare

DOC Diuretic
↓ no response
Steroid
↓ no response
Valve replacement

M/c Valvular Lesion in RHD = MS

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

③ **Sydenham's Chorea**

[Ab against basal ganglia, cerebral cortex]

Motor = Tongue fibrillation
+
Ext. Rotation of hand
["scooping"]
+
"Milking action"
Disappear in sleep
♀ > ♂
Late manifestation
> 1-7 months
Neuropsychiatric disorders

Sedation
↓ no response
Valproate.
↓ no response
IVIg ??
(for refractory cases)

④ **Subcutaneous Nodules**

Site: extensor surface
Non-tender
Size - 0.5-2 cm

No t/t required

⑤ **Erythema Marginatum**

Site - extremities
Trunk.
(never on face)
Serpentine edge
progress fast

t/t Not required

Minor Manifestation

Clinical

1) Fever (Mlc Symptom)
2) Arthralgias

Lab

1) ↑ ESR
2) ↑ CRP
3) ↑ PR interval on ECG.
4) [due to AV node inflammation]

Essential Criteria

h/o scarlet fever is removed now.

1) Evidence of recent streptococcal infec" (<45 days)

Any one of 3 criterias -

a) Throat culture +ve

b) Ab +ve for [ASO ↑ &/or AntiDNase]

c) Rapid Streptococcal Ag test

Minimum criteria needed to make Δ of

Clinical	Major	Minor	~~Minor~~ Essential
1) 1° ARF	2 major	–	~~1 Ab~~ +
	1	or 2	+
2) Recurrent ARF		3	+
3) Recurrent ARF on established RHD	–	2	+
4) Sydenham's ~~chorea~~ chorea	–	–	–
5) ~~Eff~~ Indolent Carditis (~~c~~ out any h/o cause)	–	–	–

Changes in Jones Criteria.

Low Prevalence	High Prevalence
ARF < 2/1 lakh school going children	72/1 lakh [India].
Major	
Joint Involvement = Polyarthritis	Polyarthritis or Monoarthritis or Polyarthralgia
Minor	
Fever > 38.5°C	> 38°C
Arthralgia - Polyarthralgia	Monoarthralgia.
ESR > 60 mm/hour	> 30 mm/hour

Prophylaxis :-

1) 1° Prophylaxis :- Streptococcus pharyngitis ⟶✗ ARF

- Ab of choice = Benzathine Penicillin (1.2 mU) if > 27 kg — Single Dose
  ~~if > 27~~ 0.6 mU if < 27 kg.

Should be started less than 10 days of Pharyngitis

↓ if penicillin allergy

Macrolides (erythromycin or azithromycin)

27 2° Prophylaxis ARF ⟶ Recurrent ARF

Ab of choice = Benzathine Penicillin. (1.2 or 0.6 mU) every 3-4 wkly

↓ if allergy to penicillin

Sulfadiazine Q

↓ if allergy

Macrolides

Duration of 2° prophylaxis.

1) 5 years or till pt's age 21 yrs [whichever is longer]

2) 10 yrs or till pt's age 21 yrs. [whichever is longer]

3) India - Lifelong ideally
10 years till pt's age 40 yrs (whichever longer)

Clinical A

ARF c/out carditis

ARF c/ carditis

ARF c/ RHD established

D/D of ARF :-

1) Post-Streptococcal Reactive arthritis (PSRA):-
- Small joints
- Symmetrical
- Duration > 1 month.
- Poor response to aspirin.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(2) P - paediatric
A - autoimmune
N - neuropsychiatric
D - Disorder
A - associated c
S - strepto.

→ NO other ARF manifestations

Complications of ARF.

VALVULAR HEART DISEASE.

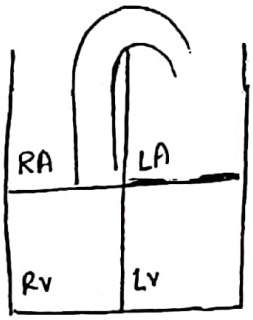
MS

Cause- M/C - RHD

M/C non-rheumatic = congenital

Pathophysiology:-

↑ LA 'P' (dyspnoea early symptom)
⇓
↑ Pulm. Vein
followed by
↑ Pulm. artery 'P'
⇓
RV pressure overload
⇓ remodelling
RV [concentric hypertrophy]
⇓ Later
RV systolic failure
⇓
RV blood retention occur
⇓
RA 'P' ↑ ⟷ Systemic vein 'P' ↑
⇓
2nd site of stenosis → Pulmonary artery.



MR

M/C - RHD

M/C non-rheumatic = MVP

↓ CO
⇓
Gradual LA dilatation.
⇓ during diastole
↑ blood will move from LA to LV
⇓
LV volume overload.
⇓ remodelling
LV eccentric hypertrophy
COT
⇓ Later
LV systolic failure
⇓
LA 'P' ↑

Symptoms	Mech
① Dyspnoea	← LA 'P' ↑
② Haemoptysis	← M/c source = Bronchial vein
③ Anasarca	← Systemic vein hydrostatic 'P' ↑

④

Hoarseness of voice

[Ortner's Syndrome]

Symptom	Mech
① Fatigue	← ↓ CO
② Palpitations	← LV force of contrac" ↑
③ Dyspnoea	← LA 'P' ↑

Signs

	Due to AF → Pulse	← Due to AF Pulse
Pulse - irregularly irregular rhythm	+	+
Pulse Deficit	+	+

JVP →

Reverse occur

Absent	Prominent
a	v
x	y

Apex - LV (N)

Site - (N)

Nature - Tapping

LV - Dilated + vol. overload

Site - shifted laterally

Nature - Hyperdynamic

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Auscultatory signs

S_1 = Loud
exception - if calcified valves

S_2 = split - wide

if RVF occur → P_2 late.

S_3 = never LV S_3

if RVF → RV S_3 +

S_4 = if RVH → RV S_4

Opening snap : +ve
becomes ⊖ if calcified valves.

Murmur:

(1°)

Typ = mid-diastolic

Site - Apex

Pitch = Low pitch

if pressure gradient <40 mmHg
= low pitch murmur

Radiation - Nil

Best pt's position - (L) Lateral Decubitus

Phase - expiratory

S_1 = soft

S_2 = split → wide

LV ejc" time ↓ = A_2 early

S_3 - LV S_3 ++

S_4 : LV S_4 ± [in late MR due to extreme LV dilatation making it stiff]

Opening snap = -ve

(1°)

Typ - pan-systolic

Acute MR = early systolic
MVP induced = Late systolic

Site - Apex

Pitch - High pitch

Stenotic lesions are low pitch
Regurgitant " are high pitch

Radiation - Interscapular area
Axilla

Best pt's positon - (L) Lateral decubitus

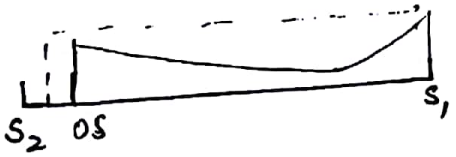
Phase - expiratory

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

2° murmur = ⊖

Clinical Criteria for severity

1) Opening snap
S_2-OS gap inversely related to severity



2) Length of murmur is directly related to severity

Ix

ECG- Sequence

① Ⓛ atrial enlargement

↓

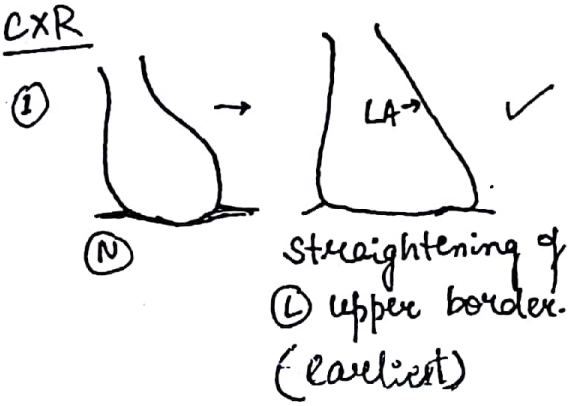
② RV H signs

↓

③ RA enlargement

Biatrial enlargement = due to Ms

CXR



✓

2° murmur

↑ blood flow across MV 63 during diastole due to ↑ blood.

= mid-diastolic murmur

= Functional Ms → severe MR

1) Apex = shifted laterally

2) S_2 = wide split

3) S_3 = trace of LVS$_3$

4) murmur = mid-diastolic

Loudness or intensity is never a criteria for severity in Valvular Heart Disease

Ix

ECG

1) LAE

↓

2) ~~RVH signs~~ LVH signs.

CXR

✓

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

② Double atrial shadow

very rare.

Rx

Severe MS [area < 1.5 cm²]

N - 4-6 cm²

↓

NYHA symp

- ≥ II [symptomatic] → Sx
- I [asymptomatic] → AF
  - (+) → Consider Sx
  - (−) → observation

Severe MR

↓

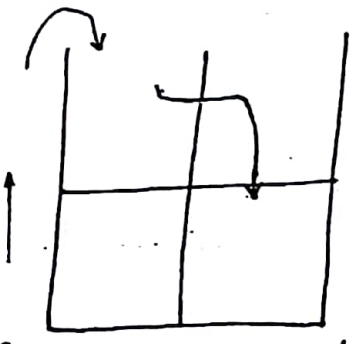
NYHA symp

- ≥ II [symptomatic] → Sx
- I [asymptomatic] → AF
  - AF (+) or LVEF < 60% → Sx
  - AF (−) or LVEF > 60% → observation

Sx

Preferred Sx / Initial Process of choice / Sx in ♀

Balloon valvotomy



Done under Lung-Heart Bypass machine.

Preferred Sx = MV Repair

↓ If not possible

MV Replacement

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Criteria:

1) Isolated MS
2) no calcification
3) no LA Thrombus

↓ if not fulfilled

MV Replacement

Metallic	Bioprosthetic
Dur. 25yrs	5-10yrs
Anticoagulation = lifelong	X
Age Preference = young	elderly

Q. 26yr old, unmarried ♀. K/c/o RHD ē MS
c/o - dyspnoea on 10 steps. Echo = MVA 0.8cm².
Next Line Rx
a) observation
b) baloon valvotomy
c) Bioprosth, MV replacement
d) Metallic, MV "

Q. same history. O/E - opening snap (+ve.)
ans - (b)

Q. Same history, O/E - Pulse Deficit +20 (AF), opening snap (-nt) calcification.
ans - (d)

Q. Same history. married. QE - opening snap (-), MR (+)

ans → (d)

♀

↓

Give heparin in 1st Trimester
anticoag in 2nd Trimester - 3rd
heparin in ~~3rd~~ " delivery.
2 wks prior to.

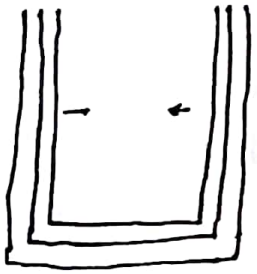
AS

Cause - M/c age related calcification

Pathophysiology:-

LV pressure overload

↓ remodelling



LV (concentric) Hypertrophy

↓ Later

LV systolic failure

↓

LA 'P' ↑

AR

M/c - age related degeneration

LV volume overload.

↓ remodelling

LV (eccentric) Hypertrophy

↓ Later

LV systolic failure

↓

LA 'P'

Symptoms :-

Mech.

~~1> Due to~~

1> Angina ← ↑ LV workload

1> Palpitations ← LV force of contrat^n ↑

2) Syncope ← Fixed CO

3) Dyspnoea ← LA 'P' ↑

[Worst Prognosis]

↓

Mortality ↑ in 1½ yr even ↑ medical Mt

Signs:-

1) Pulse - Most specific

Parvus et tardus

2) Apex - LV 'P' overload

↓

Site = (N)

Nature = Sustained

3) S_1 = Soft

S_2 = split = reverse

LV ejec° time ↑ → Late A_2

in early stages → narrow split

S_3 = + if LVF occurs

S_4 = ++

Ejection click = (+)

2) Angina [Nocturnal]

← ↓ in Diastolic BP ∴ lead to less perfusion

↓

This occurs more during night as sympathetic activity ↓ further ↓ vascular tone.

3) Dyspnoea ← LA 'P' ↑

Most specific.

= Bisferiens

LV Dilatated + Vol. overload

Site = Shifted Laterally

Nature = Hyperdynamic

S_1 = Soft

S_2 = Single P_2.

aortic valve leaflets fail to strike.

S_3 = ++

S_4 = + Late AR.

(−)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

47 <u>1° Murmur</u>

Type: Ejection Systolic murmur

Site: (R) 2nd ICS [Aortic area - 1st]

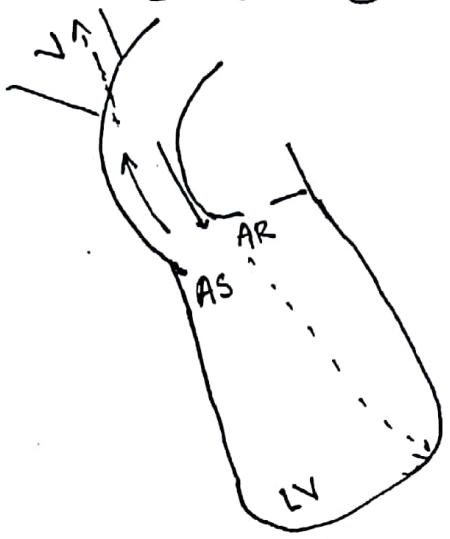
Type: Early diastolic

Site: (L) 3rd ICS [Erb's Area]

2nd Aortic Area

or

Neo-aortic area



Pitch: Low

Radiation: Common carotid [or neck]

after striking arch of aorta

Radiation to apex

= GALLAVERDIN PHENOMENA

Pitch = high

Radiation = towards apex

if radiation to axilla

= COLE - CECIL MURMUR

Best Pt's Position = Leaning forward. ✓ ✓

Phase - expiration ✓

<u>2° Murmur</u>

Not seen in AS

1) Austin - Flint murmur
mid - Late diastolic

2) Functional AS
↑ Blood flow across aortic valve
[Ejection Systolic]

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Clinical Criteria for Severity

1) S_1 = Soft
2) S_2 = Reverse split
3) S_3 = ⊕
4) S_4 = ⊕

* **Severe Silent AS**
  1) associated MS] ↓CO → Hence sound ⊖
  2) LVF]

I_X

ECG = Sequence
① LVH signs
↓
② LA enlargement

ST Depression
T inversion
→ Strain pattern

CXR
Cardiac Size = (N)

17 Any peripheral sign of AR
2) Pulse - Bisferiance
3) Apex - Displaced Laterally
4) ~~1~~ S_1 - soft
57 S_5 - ⊕
Q
67 1° murmur = **Duration.**
77 Presence of 2° murmur
= Austin-Flint murmur

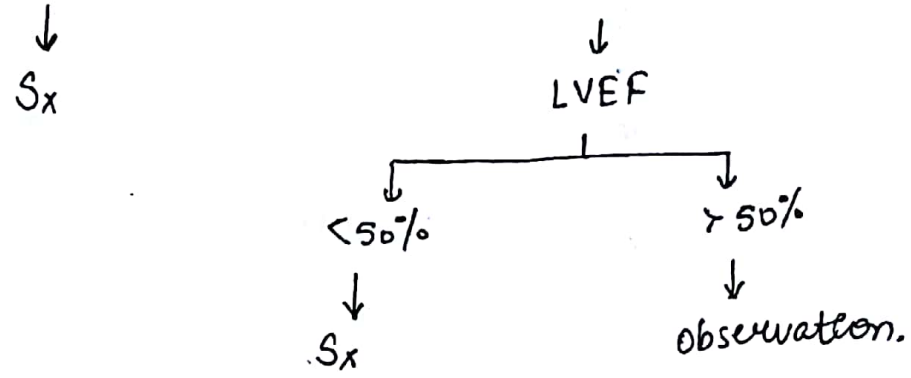
ECG = sequence
①. LVH
↓
② LA enlargement

ST Normal
T upright
as inner myocytes receive blood from cavity

CXR
enlarged

R_X

Similar
Severe AS or severe AR
[Area <1cm²]
↓
NYHA symptoms
↓
≥II (symptomatic)
I (asymptomatic)



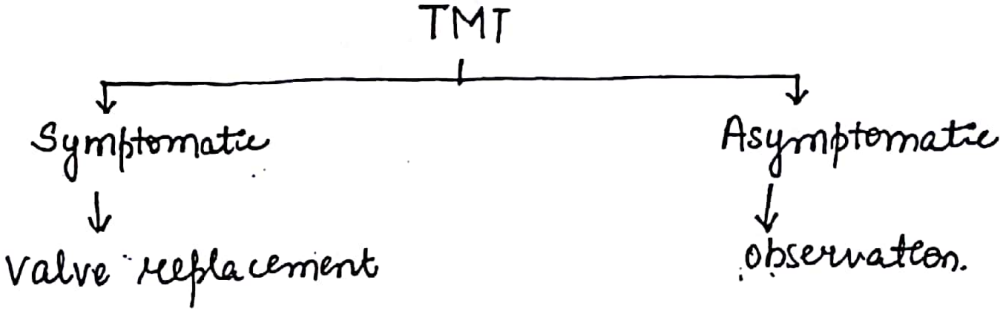
Preferred Sx = Aortic Valve Replacement

Q. 60yr old ♂, ē Aortic valve pressure gradient of 60 mmHg. K/c/o AS, c/o - equivocal dyspnoea symptoms. Next step. ?

Ans. a) observation
b) Trade mill test
c) Aortic valve Replacement
d) Diuretics.

Q. Same pt. underwent treadle mill test [Bruce Protocol] c/o Dyspnoea & Fatigue at 11 min of exercise. Next step

Ans.



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Bruce Protocol

Bruce Stage	Duration
I	0 - 2:59 min
II	3 - 5:59 "
III	6 - 8:59 "
IV	9 - 11:59 "

Pt. considered symptomatic if c/o dyspnea/fatigue ≤ Stage II

Asymptomatic if c/o dyspnea/fatigue ≥ Stage III

* Severe AS + NYHA-I + underlying CABG = Aortic valve Replacement

(R) SIDED VALVULAR LESIONS

Lesion	M/c Cause	Other causes
1) TS	RHD	(X)
2) TR	RV dilatation. [eg. Pulmonary embolism] cor-pulmonale	M/c Valvular Lesion due to CARCINOID
3) PS	Congenital	Carcinoid, Rubella
4) PR	PAH	Carcinoid

Valve fibrosis → Regurgitation

Ring fibrosis → stenosis

LHR INFECTIVE ENDOCARDITIS

CAUSE :-

Predisposing Causes

1) M/c Valvular Lesion = MR > AR.

2) M/c congenital HD = VSD [® ventricle has vegetation]

3) M/c cyanotic cong. HD = TOF [Ⓛ ventricle has vegetation]
↳ systemic embolism.

4) Least common HD leading to IE = ASD

5) MC non-CV risk = " " " = IV Drug Abuse

Micro-organisms

* According to nature of valve affected.

- **NATIVE**
  - Community acquired — M/c - Strepto. Viridans
  - Hospital acquired — M/c - Staph aureus
  - **Overall M/c = Staph. aureus**
- **PROSTHETIC**
  - < 12 months after Sx — M/c - Coagulase neg. Staph
  - > 12 months of Sx — M/c - Strepto viridians
  - **Overall M/c = coagulase neg.**
  - Max incidence = 6-12 months

HIV is the only virus to cause IE.

* According to Onset of

- **Acute** [<2wks]
  - M/c = Staph aureus
  - other
    - Strepto β-haemolytic
    - Fungus
- **Subacute** [>2wks]
  - M/c = Strepto. Viridians
  - other
    - Staph coagulase neg.
    - Fungus

* Typical Bacteria of IE
  1) Strepto Viridians
  2) " Bovis [Gallolyticus] → ass/c Colonic cancer/Polyp.
  3) Staph aureus → M/c in IV Drug Abuse → (R) sided
  4) Enterococci → M/c in IV Drug Abuse → (L) sided.
  5) HACEK group

C/F + Ix

Modified DUKE's Criteria

- 2 MAJOR
- 5 MINOR
- 3 EXCLUSION

* **Major Criteria**-

(I) Evidence of micro-organisms consistent c IE.

1) ≥ 2 Blood culture (+) of Typical Bacteria
   or
2) Persistent Bacteremia of micro-organism consistent c IE.
   or
   - ≥ 2 Blood culture (+) [separated by 12 hours]
   - ≥ 3 Blood culture (+) out of ≥ 4 samples [1st & Last sample separated by 1hr]

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

3) ≥1 Blood Culture] of Coxiella Burnetti
or
IgG ↑

(II) Evidence of Endocarditis. [ECHO]

↓

① Oscillating Mass Lesion on valve or its structure
or
② Intra-cardiac abscess
or
③ New valvular regurgitant lesion ← M/c CVS complication of IE.
or
④ Partial Dehiscence of prosthetic valve

* **Minor Criteria**

1) H/o Predisposing cause = RHD, I.V. Drug Abuser.

2) Fever > 38°C ← M/c symptom

3) Immune phenomena = RROG

R → **Roth's Spots** → Immune complex vasculitis in Retina
Oval
Pale centre ± haemorrhagic margin

Other causes.
a) SLE
b) CLL

O → **Osler's Nodes** → Immune complex deposits in Finger tips / Palms / Soles.
Tender
Palpable

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

G → GN → Immune complex deposited in
S. C_3 level ↓

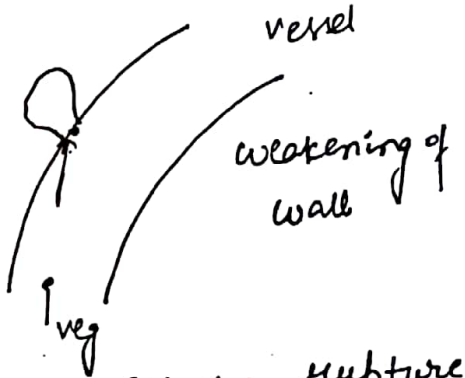
R → RA factor +ve

47 Vascular Events

* Major Arterial Embolisation
  [L sided] M/c site → Brain [MCA territory → Parietal]
  > Spleen
  M/c organism → Staph Aureus
  M/c valvular IE → Mitral valve

* Septic Pulmonary Infarcts
  [R sided].

* Mycotic aneurysm



* Haemorrhagic stroke [if mycotic aneurysm rupture in Brain ∃

* Conjunctiva petechae.
  M/c Peripheral Sign of IE.

* Janeway Lesion = Palms.
  Macular [non-palpable]
  Non-tender

57 Blood Culture Positive of micro-org consistent ⊂ IE
(not satisfying major criteria)
or
Serology +ve

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Definitive Δ of IE = 2 Major
or
1 Major + 3 Minor
or
All 5 minor

* **Exclusion Criteria**

1) Firm alternate Δ of Fever established.
2) If fever subsided in 4 days of Antibiotic Use.
3) If there is no histopathological evidence of IE < 4 days of Antibiotic Use.

Rx + Prophylaxis of IE = given in supplement.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

14/2/18

CARDIOMYOPATHY

Definition:-
Diseases of **endomyocardium**
Not due to 1° valvular Heart disease.
2° Cong. Heart disease
3° HTN
4° Ischaemia
5° Pericardial Disease

Types:-

Dilated CMP (M/c pattern)	HOCM	Restrictive CMP (Least common)
↓ Defect: ↓ contrac" ⇓ **↓ in systolic func"** + Preserved diastolic func" till late stages	Obstruc" to LV outflow ⇓ overcome obstruc" ↑ in systolic func" + (↓ cavity space) **↓ diastolic func"**	Failure of relaxation ⇓ **↓ in diastolic func"** ⇓ systolic func" preserved. Gross atrial Dilatation"

DILATED CMP

CAUSE-I **Idiopathic** (M/c cause)
Rx - supportive. [chr. HF ≈ low EF]

II Mc 2° cause - **alcohol**
Mech :- a) Direct ethanol effect
b) Becoz of Cobalt [cardiotoxic agent]
(↓ foam stabilizing agent)

Risk :- Mutation of alcohol dehydrogenase
· Mutation of ACE (?)

Dose of alcohol :- ≥120 gm/day for 5-10 years

Rx = reversible. ∵ in 3-6 months of cessation.

Other CVS manifestations of alcohol (>30g/d)

1> Dyslipidemia
a> M/C = ↑ TG
b> ↑ HDL Q.
c> ↑ LDL

Ethanol
↓ ⊖
FA metabolism
↓
TG↑ ← FFA↑

2> Effect on BP
Acute - vasodilatation = (↓ BP)
Chronic - ⊕ sympathetic system = (↑ BP)

3> CVS events
a) CAD → ↓ risk by ↑ HDL [French paradox]
b) stroke → (↑ risk) due to ↑ BP
c)

4> Arrhythmia
alcohol binge → (AF) [Holiday Heart Syndrome]

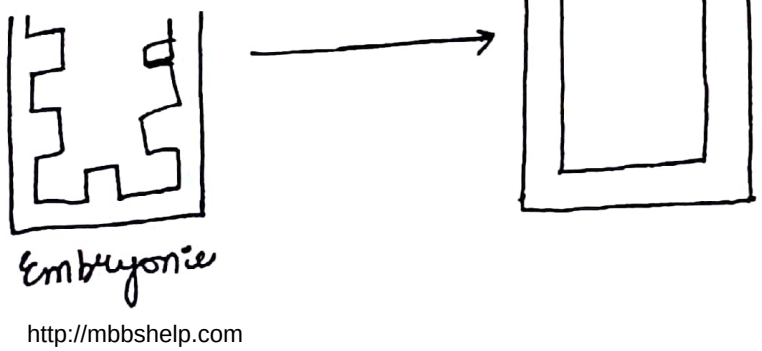
II> Genetic Causes

MOI	Q. Gene/Protein	Unique feature
1) AD	TTN / Titin → sarcomeric protein. (N) helps in contraction	M/c genetic cause of DCMP
2) AR	DSP / Desmoplakin → Desmosome protein (N) helps in synchro. contraction	Arrhythmogenic RV Dysplasia. (ARVD) → sudden cardiac death in young population.
	NAXOS Disease	- woolly hairs + thick palmar skin + ARVD
3) X-R	TAZ / Tafazzin → (N) helps in compaction of ventricle cavity during embryonic development	LV non compaction. * LV thrombus since birth.

(N) V_1 =

ECG. ← epsilon wave.

V_1 -



IV Post Myocarditis

Causes :-

Infectious

1) MC viral - Coxsackie B
other viral infe"
- Parvovirus B19
- HIV
- Hepatitis C

2) Bacterial
M/c - Diphtheria [death is by myocarditis]
R_x - anti-toxin

3) Protozoa
M/c - Trypanosoma Cruzi
[chaga's Disease]
R_x - Benznidazole

4) Parasite
M/c - Trichinella
R_x - albendazole

Non-infectious

1) M/c - Sarcoidosis [lung involves]
M/c site → LV free wall
M/c pattern → DCMP > RCMP
R_x = steroids

2) Giant cell Myocarditis
(no lung involvement)
R_x - steroid.

3) Hypersensitivity Myocarditis
cause - Thiazide
Indomethacin
Methyldopa
R_x - cessation of drug
± steroids

V. Tako-Tsubo CMP / BROKEN HEART SYNDROME / APICAL BALOONING SYNDROME

C/F - ♀ + ↑ catecholamine release
⇓
vasoconstrict of LV apex
⇓
LV apex non-contractile
⇓
During systole RV apex bulge out in systole like ballon.

Ix - ECG - ST↑
Troponin = ↑ or Ⓝ
coronary angiography → no thrombus
ECHO - LV apex bulging out in systole.

→ resembles a jar used to trap octopus
⇓
hence called Tako-Tsubo.

Rx - reversible, so supportive therapy
+ α blocker followed by β blocker [like Pheochromocytoma]

VI. Peri-Partum CMP

Mech:- 1) Autoimmune damage to myocyte by foetal Ag.

2) Prolactin fragments → myocyte damage

C/F:- occur in 3rd trimester - 6 months post delivery

Risk ↑ → Twin Delivery
multipara
age > 30 yrs

Rx - 1) Diuretics

2) **Bromocriptine** [by ⊖ Prolactin].
↳ also used in Type 2 DM.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

RESTRICTIVE CMP

Pathology :- Infilteration → Fibrosis

(I) Infilteration

A> In between myocytes

eg. Amyloidosis ← M/cc of RCMP

Types	Protein/cause	C/F	Rx
1> 1° amyloidosis	AL/multiple myeloma Waldenstrom macroglobulinemia NHL	Age - >50 yrs M/c organ - Renal M/cc = CVS of death unique - Black or Raccon eyes.	underlying disorder.

Factor Xa adsorb on AL protein leading to ↓ in blood → blood def. of Xa. [ecchymosis]

2> Familial	Transthyretin [liver] ↑ genetic	Age > 20 yrs M/c = CVS organ M/cc of death - CVS unique = ascending neuropathy	1) Liver Transplant only cond" where liver Transplantation is done c out Liver failure

New Rx
TAFAMIDIS
↳ stabilizes ↓ transthyretin

3) Senile Cardiac Amyloidosis — Transthyretin ↓ Age. — Age > 70 yrs — Tafamidis

M/c organ } - CVS
M/c cause of death }

* 2° amyloidosis doesn't cause restrictive CMP
* ECG will show Low voltage QRS as amyloid is poor conductor
* ECHO = ↑ ventricle wall QRS

(B) Infilteration Inside Myocyte.

1) Haemochromatosis

M/c pattern of CMP → DCMP > RCMP

M/cc of death in untreated pt → CVS

M/cc of death in treated pt → HCC

Rx - Phlebotomy → [CMP is reversible]

2) Fabry's Disease

cause - Def^{n} of α-~~glu~~ galactosidase
↓
Glycosphingolipid accumulate

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

C/F.

1) CVS → RCMP

2) Kidney → (GBM damage)

3rd H/c systemic cause of Nephrotic Syndrome

3) Abdomen - Angiokeratoma ?

Ix - Kidney Bx = GBM. ≡≡≡ Zebra Bodies
(electron microscopy)

Rx

Recombinant Galactosidase. [stop the progression of Ds]

(II) Fibrosis

1) Radiation [Ca breast/lung] } Supportive Rx.

2) Systemic sclerosis

3) Loeffler's Endocarditis

Eosinophilia

Release of ↓ Basic Protein.

Fibrosis

Rx - Steroid (by ↓ eosinophils)

CHF

ACUTE HF

↑

Acute MI
HT
Arrhythmia
IE

CHRONIC HF

Low EF [<40%]

↓

CO will reduce

Systolic failure

↑

eg. DCMP
Late AS, AR, MR

Preserved EF [>40-50%].

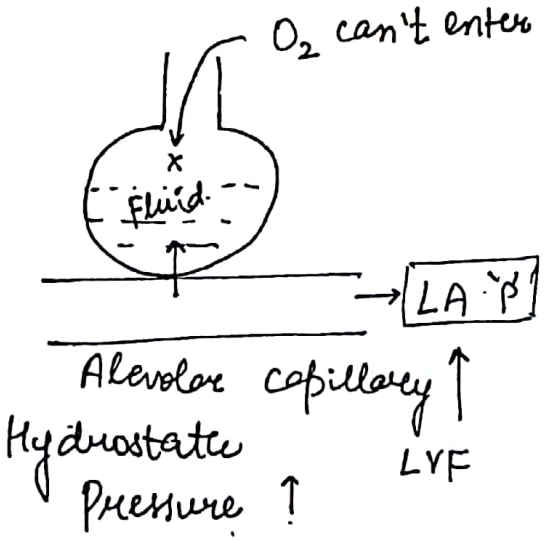
Diastolic failure

↑

eg. HOCM.
RCMP
Ageing Process

Rx of Acute HF :-

Acute HF = Acute cardiogenic Pulm. edema



AIM OF Rx - Shift alveolar fluid into capillaries

↓

by ↓ capillary hydrostatic pressure

⇓

Achieved by ↓ Ⓡ sided Preload

1> Diuretic [Furosemide] ← Initial Rx
+
2> Morphine [venodilator]
+
3> O_2 inhalation.

↓

Systolic BP

↓ <90 — Cardiogenic Shock
[cardiac index <2.2 L/min/m² + SBP <90 for >30 min]

↓

Add -

DOC - NOR-EPINEPHRINE

↓ 90–100

Add - Dobutamine
[slight vasodilator effect also]

↓ >110.

↑CO by ↓ afterload.

Add. Vasodilators

N - Nitroprusside

N - ~~Nitro~~ NTG

N - Nesiritide

Rx of Chr. Heart Failure ⊂ ↓ EF.

↓

Fluid Overload

⊕ ↓

Diuretic - - - - - - - - → Standard t/t

1> ACE Inhibitors.
By ↓ remodelling + ↓ afterload.
+
2> β blocker
By ↓ workload + ↓ sympathetic activity

⇐ a> Metoprolol
b> Carvedilol
c> Bisoprolol.
↳ vasodilator also

⊖ ↓

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

if | no response

↓

Add

↓

by ↑ contractility (or) ↓ remodelling (or) ↓ aldosterone effect

Digoxin | ~~ACE~~ ARB | ↓ Spironolactone

Chr. ↓ CO → chr ↑ aldosterone (by ⊕ RAAS)

↓

Fibrosis

↙ ↘

Heart | Blood vessels

Rx of Chr. HF c Preserved Ejection Fraction

↓

Rx ppt. cause

Cause - Thyrotoxicosis

♀

Anaemia

Rx underlying cause

HOCM

RCMP

Aging

↓ calorie intake

↓

↑ Sirtuin protein QQ

(Anti-oxidant)

PERICARDIAL DISEASES

Acute Pericarditis

→ Recovery (c out any complication)

(or) Pericardial effusion → if rapid → Cardiac Tamponade

(or) Constrictive Pericarditis

ACUTE PERICARDITIS

[ause- M/c- Idiopathic

Symp-
1) M/c- chest pain [due to rubbing c mediastinal pleura]

?

Ac. Pericarditis

Site- M/c Retrosternum

Nature- sharp pain

Radiation - Trapezius

Aggravating factors - Supine (as area of contact c pleura ↑)

Releiving factors - Leaning forward
Not relieved by nitrate

Ischaemic Pain

Retrosternum

Dull / constricting

Never sharp

(L) arm. forearm

Never Radiate to Trapezius

Exertion
Cold Temp

Rest
Sublingual nitrate

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Sign - Most Specific ⇒ Pericardial Rub.

- Crackling sound due to rubbing of 2 inflammed pericardial layers
- Diastolic Phase

Ix

ECG :-

Stage of Ac. Pericarditis

I

PR segment depression +
ST concave upwards ST elevation
[Smiling Phase ST elevation]

II

ST (N) + PR segment (N) or remain ↓

III

T wave inversion

IV

(N) ECG [recovery phase]

ECG

	Ac. Pericarditis	Ac. MI
① ST ↑	concave upward	convex upward.
② ST ↑ seen in	all lead. almost except - ~~aVR~~ aVR, V1	Specific lead
③ ST (N)	followed by T inversion	T inversion occur before T normalise
④ Incr of reciprocal ST depression in Opp. wall lead.	⊖	⊕
⑤ Pathological q wave [indicate myocardial necrosis]	⊖	⊕ Deep q Wave depth > 25% of R wave + Duration > 1 mm.

Rx - 1) Underlying cause

2) Idiopathic.

DOC → NSAIDS

↓ no response

Colchicine → no response → steroid

anti-inflammatory + anti-fibrotic

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

TAMPONADE

Cause - M/c (overall) - idiopathic
M/c in India - TB

Pathophysio - Acute
"Compression" of heart + venous roots + Aortic roots
↓↓ venous return (40-50mL) ↓↓ CO

Compensatory vigorous ventricle contrac" to maintain CO.

Obstructive
or shock
Compressive

Symptoms -
M/c → Dyspnoea due to ↓ in resp. M/s perfusion

* Not due to Pulmonary congestion.

Lungs - Oligemia

Signs -
Pulse - Pulsus Paradoxus
≥ 90% cases
↓
⊖ in Tamponade

CONSTRICTIVE PERICARDITIS

idiopathic

TB

Chronic
"Failure of relaxation" of heart due to stiff. Pericardium + CO is preserved

↓↓ venous return (100mL)

Compensatory vigorous ventricle contrac" to maintain CO

M/c → Swelling
due to ↓ in venous return.
⇓
Hydrostatic 'P' ↑ in systemic veins

≤ 1/3rd cases

WhatsApp: +1 (402) 235-1397

Absent Pulsus Paradoxus in Tamponade

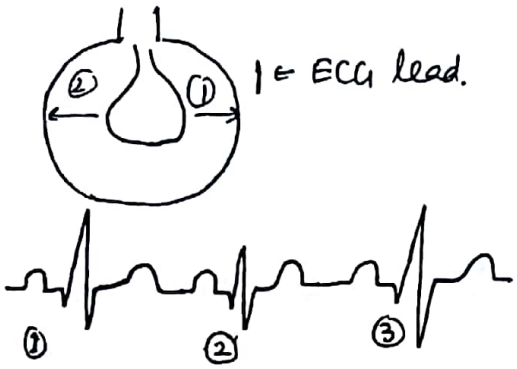
	Tamponade	
1> AR		
2> CHF		
JVP	Deep x	Deep x
	Vigorous RV constriction ⇓ Thrombosed ring pulled downward	
	Y = Absent	Y = Rapid
	a = Prominent	v = Prominent [failure of relaxation of RA]
Kussmaul sign	⊖ as venous return doesn't ↑ significantly in Tamponade	⊕
Apex	Non-Localised	Non-Localised
S_1/S_2	soft	soft
S_3/S_4	⊖	⊖
		Pericardial knock ⊕ [3rd HS]
Ix		
① CXR	↑ cardiac shadow (Not true cardiomegaly)	CXR - cardiac size normal + calcified pericardium

← Margins Smooth. + Lung field oligemic

2) ECG =

QRS amplitude ↓

[Electric alternans]



II = ECG lead.

ECG

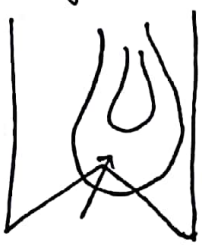
QRS amplitude ↓

[Non specific ST ↓ or T ↓]

℞

Emergency Pericardiocentesis

Routine - Pericardiectomy



[ECHO]

Needle [Subxiphoid area]

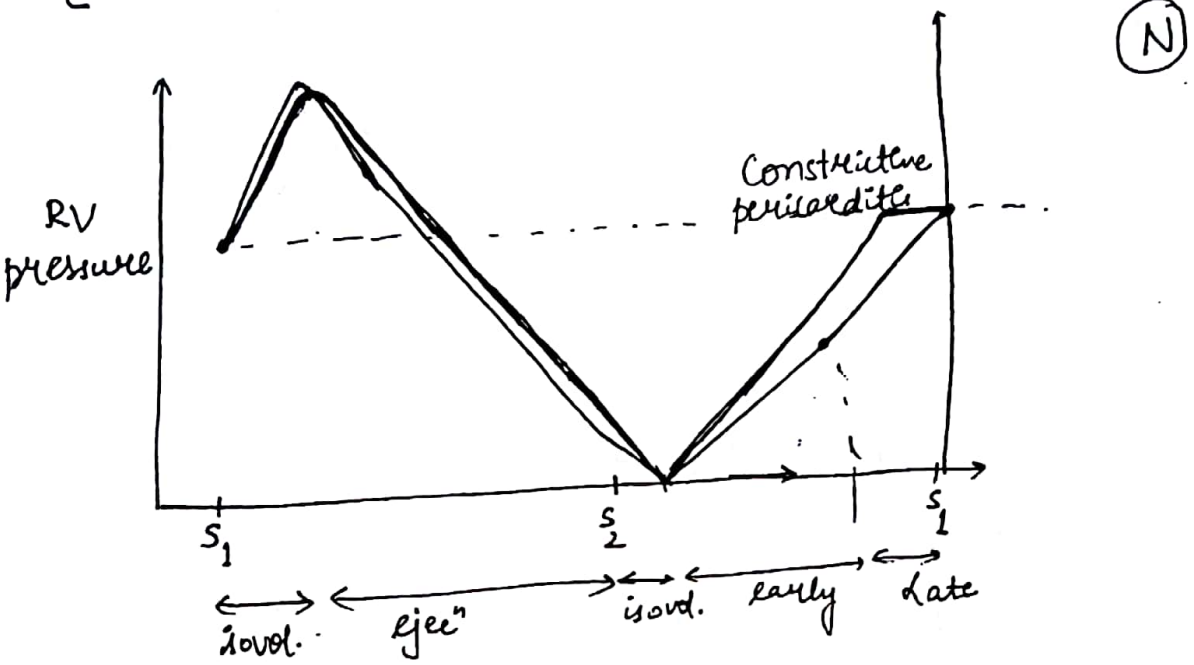
Signs	Description	Best Δ
1) Auenbrugger's Sign	Epigastric Bulging	Massive pericardial effusion
2) Beck's Triad	↓ BP + ↑ JVP + soft HS	Tamponade
3) Ewart's Sign.	compress (L) side airway ⇓ Collapse of distal lungs ⇓ Bronchial Breath sound (L) Infrascapular area	Massive Pericardial effusion

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

4) Broadbent's sign — systolic retraction of apex due to fibrous pulling — Constrictive Pericarditis.

"Square root" sign → Constrictive Pericarditis.

[Pressure changes in RV]



LMR

SYSTEMIC HTN

Classification [AHA guidelines NOV 2017]

	SBP		DBP
1) Normotensive	<120	AND	<80
2) Elevated	120-129	AND	<80
3) Stage I HTN	130-139	(OR)	80-89
4) Stage II HTN	≥140	(OR)	≥90

Causes

I. Essential / 1° HTN (no identifiable cause)
M/C cause

II. 2° HTN (identifiable cause)

↓

1) M/C 2° cause - Reno-Parenchymal
[GN, Chr KD.].
Mc Mech → vol. overload

2) 2nd M/cc of → Reno-Vascular
[Renal artery stenosis]

Mech - ⊕ RAAS

DOC - ACE-I in U/L stenosis

3) Activating Mutation of Sodium channel of tubules.

↓ DCT - Na^+ channel
Δ GORDEN'S SYNDROME

↓ CD = ϵ Na^+ channel
Δ - Liddle's Syndrome

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

DOC - Thiazide DOC = Amiloride.

47. Endocrine causes.

Endocrine	Type of HT	Edema
a) Hypothyroid	DBP ↑ (Compress bld. vessels ←	⊕ Myxoedema
Conn's Syndrome b) Chr. ↑ aldosterone ↳ vessels fibrosis	DBP ↑	⊖ ANP released ↓ "Escape" Mechanism
c) Hyperthyroidism	SBP ↑ (due to ↑CO)	⊖
d) Phaeochromocytoma	SBP + DBP ↑ sustained HT > Episodic HT	⊖

5) Miscellaneous Causes

a) M/C Cong. CV cause of HTN ⇒ Coarctation of Aorta

b) Systemic HTN ← sympathetic ↑ ⇒ Obstructive sleep Apnea

+

Pulm. HTN ← hypoxia

c) PCOD = Insulin resistance [acanthosis nigrans]

d) Drug NSAIDS by ↓ GFR

Corticosteroid

estrogen

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Cocaine → Aorta Dissection
- HTN
- Angina
- MI

Symptom

1) M/c - Dyspnoea [due to LHF]
   M/cc of CHF = HTN

2) M/c symp due to HTN → Occipital Headache

3) Sign :) LVS_4 + (due to LVH)

I_X -

ECG Changes

1) LVH signs
2) LA enlargement
3) LAD

R_X

Stable ≥2 reading on ≥2 occasions should be ↑ to Δ HTN

R_X
- Normotensive → not required
- Elevated BP → Lifestyle modification only → reassess 3-6 months
- Stage I → atherosclerotic vasc. disease
  - (−) → Lifestyle modification → reassess 3-6 months
  - (+) → LSM + Drug → Reassess 1 month
- Stage II → LSM + Drugs.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Lifestyle Modification

1) wt. reduc"
2) ↓ Na ≤ 1.5gm/day
3) ↑ K 3.5-5gm/day cause smooth M/s relaxation
4) DASH DIET
   Dietary Action To Stop HTN
   ↓ Na^+, ↓ Fat dairy product,
   ↑ Fruits & Veg., ↓ saturated fat
5) Brisk Walk / Exercise ≥ 150 min/wk
6) Alcohol ♂ < 30g/d ♀ < 15g/d

Other Terms

1) Resistant HTN
   if BP ≥ 140/90 despite ≥ 3 drug (one of c is diabetic)
   or
   if BP < 140/90 c ≥ 4 drug
   H/cc → Non-compliance

2) White Coat HTN
   Incidence if SBP > 20 &/or DBP > 10 from non clinical readings.

3) HTN Emergency = if BP > 180/120 c Target Organ Damage

I.v. Labetalol	← 1) Haemorrhagic Stroke
I.v. ~~Nitro~~ NTG or Nicardipine	← 2) Ac. cardiogenic Pulm. Oedema
I.v. NTG	← 3) Ac. MI
I.v. Esmolol	← 4) Aortic Dissec"
Nimodipine	← 5) SAH

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Mean BP reduction → 25% from presentation value
  $\left[DBP + \frac{1}{3} PP\right]$ < 1-2 hrs.

* **DOC for HT Emergency = I.V. Nicardipine**

* 4) HTN Urgency = BP > $\frac{180}{120}$ + no target organ damage

  R_x = combination of oral drugs.
  [OPD]

5) Orthostatic Hypotension
  ↓ SBP ↓ by > 20] ∵ in 3 min of standing
  ∴ DBP ↓ by > 10]

  M/C cause → Hypovolemia

  2° HTN associated ∵ ortho static HTN = **Phaeochromocytoma**

  Chr. vol. depleted
  ↑
  due to chr. vaso constrict°.

IHD

	Stable Angina	Unstable Angina	Non-ST ↑ MI (Subendocardial)	ST ↑ MI [Transmural]
Duration	= 2-10 min	20 min	20-30 min	> 30 min
Pain at rest	⊖	⊕	⊕	⊕
ECG at rest	Ⓝ	ST depression [except Prinzmetal Angina]	ST depression	ST elevation.
Troponins	Ⓝ	Ⓝ	↑	↑

Symptoms M/c → chest pain

Painless MI → Autonomic Dysfunc^{n} [DM, elderly]

↓

'Angina' equivalent symptoms

a> Unexplained sweating

b> " Dyspnoea

c> Sense of impending Doom

Signs M/c → LEVIN SIGN [Holding Palm or Fist against retrosternum]

Pulse - if tachycardia = Ant. wall

Bradycardia = Inf. wall

JVP - if Kussmall sign = RV MI.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

S_2 = if split is wide = RVMI [late P_2]

if split is reversed = LVMI [Late A_2]

poor prognosis — S_3 - if ⊕ → indicate systolic failure [Infarct >40%]

S_4 - ⊕

[more common than S_3]

Murmurs -

- Papillary M/s Necrosis → Acute MR → Early Systolic
- Septal Rupture of ventricle → VSD → Pansystolic

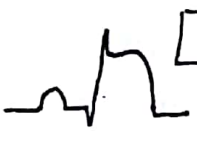
Ix

(1) ECG

Sequence of changes — Mech

1) Tall T Wave — Leakage of K^+ [Similar to hyperkalemia]

(>50% of R wave height)

2)  ST ↑ (convex) Pardees Sign — Early Repolarisation of infarcted m/s

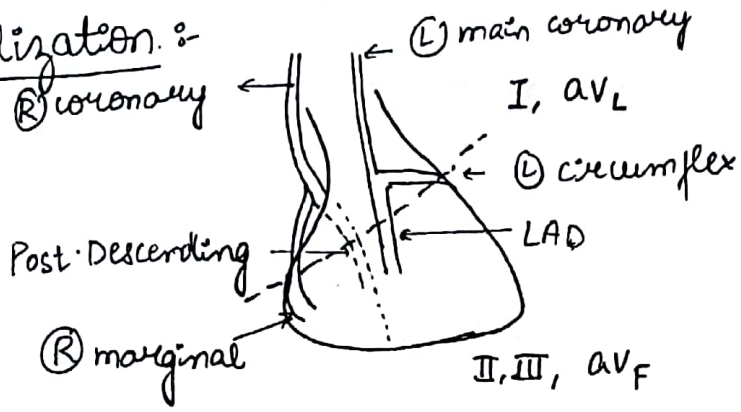
3) T↓ — Non-specific

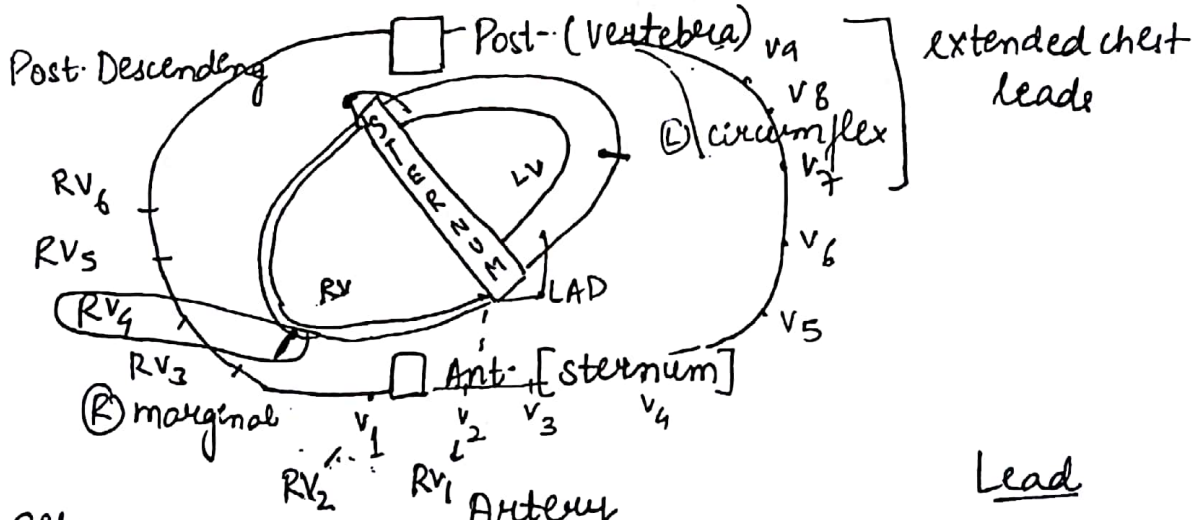
4)

Pathological Q wave — **Necrosis**

NO use of thrombolytic therapy

Localization :-





extended chest leads

Site	Artery	Lead
① Ant. septum	LAD	V_2 (V_1 or V_3)
② Ant. wall [LV]	LAD	V_3 V_4 (V_2)
③ Lateral wall	Ⓛ circumflex	V_5, V_6, I, aV_L
④ Post-wall	Post. Descending	V_7 - V_9 - ST ↑ or V_1 - V_4 → reciprocal ST ↓
⑤ RV MI	Ⓡ marginal	RV_4

⑥ Inf wall — ® coronary via post descending — II, III, aVF

⑦ Antero-Lateral MI — © main coronary — $V_1 - V_6$, I, aV_L

R_xOC = CABG (not PCI)
↓
not feasible

(II) Cardiac Markers	Time to ↑ in blood (after symptoms)	Time to (N)
1) Heart Type FA Binding Protein	2 hrs	24 hrs
2) Myoglobin	3 hrs	24 hrs
3) Troponin I [Best] T	6 hrs	10-14 days
4) CPK-MB	6 hrs	72 hrs

↳ Preferred over Troponin if re-infarc" 3-10 days

Troponin can be used in re-infarc".
if >20% ↑ from previous.

Rx ① ST ↑ MI

Initial Rx

Role

1> **Aspirin** [non-enteric coated] — Essential in all
Dose - 325mg chewed

2> **O_2 inhalation** ⟶ if O_2 saturation is ↓

3> **I.V. Morphine** ⟶ Analgesic
+
Ac. cardiogenic Pulmonary oedema

4>

C/I in **RVMI**
[↓ Preload → further ↓ CO]

4> **Nitrate** ⟶ coronary vasodilatation.
+
If BP ↑

C/I - **RVMI**

5>

5> **β blocker metoprolol** ⟶ ↓ workload
CI - Asthma
PR interval > 0.25 sec

6> **ACEI.** ⟶ All pts. for initial 48 hours
↓
continue if HT (+)

7> **High Dose Statins** ⟶ Anti-inflammatory +
Plaque stabilising Property.
Atorva 80mg/d.

8> **Clopidogrel** ⟶ if pt undergoing procedure
300mg loading Dose PCI.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Definitive Rx of = PCI > Thrombolysis

If ST↑ MI Presented to

after initial t/t

PCI - center
↓
do PCI
Ideal Door to Ballon Time < 90 min

Non-PCI centre
↓
If delay in shifting to PCI centre

< 120 min.
↓
Shift the pt

> 120 min
↓
do thrombolysis.
Ideal Door to Needle Time < 30 min

if symptom < 12 hours duration.
+
ST↑

If ST↑ MI + ↓BP

RVMI
(causing RVF)
Lung no crepts
Immediate Rx
I.V. fluids to ↑ preload.

Definitive Rx
PCI is done when pt is haemodynamically stable

LVMI / Ant wall MI.
(causing LVF)
Lung crepts +
↓
Intra-aortic Baloon Pulsation (IABP)
↓
PCI

Rx (II) Non-ST ↑ MI / Unstable Angina

Std. Rx

1> Anti-platelets = aspirin + clopidogrel

+

2> Anti-thrombotic agents = LMWH or Thrombin (-)

+

(3) Nitrate

+

(4) β blocker

↓ if there is no relief

Add CCB

↓ if no relief

PCI

(III) Stable Angina

1> Aspirin Life long

2> Sublingual dinitrate

3> Rx risk factors

PRINZMETAL ANGINA

Cause - Idiopathic vasospasm of epicardial coronary artery. [non-atherosclerotic]

M/c artery affected → (R) Coronary

C/F -

1> Smoker + young age

* Associated symptoms = Raynaud's phenomenon

* Pain = 12 AM to 8 AM.

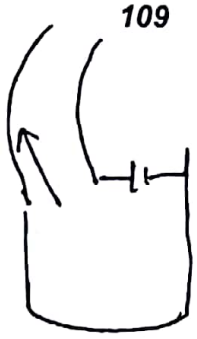
I_x - ECG - [ST ↑]
Troponin = (N)

R_x -
1) Acute → vasodilators = Nitrate → [CCB α-Blocker]
2) Maintainance → (CCB)
3) [C/I → aspirin] → (−)/Lower vasodilator PG
[β blocker] → ppt. vasospasm

Q. In intraoperative [MI] ≤ drug not used.
→ Best ECG Lead [V_5 or V_4]
(a) Heparin
(b) Atropin if AV Block
(c) CCB
(d) NTG.

LMP.

AORTIC DISSECTION



[auses -

1) M/c → HTN

M/c site → ascending aorta ® Lateral wall

2)

2) Large vessel vasculitis
   Takayasu
   Giant cell arteritis.

3) Atherosclerosis [M/cc of aortic aneurysm]

4) Drug - Cocaine

5) ♀

Types

A/c to Site Of Origin [Stanford classificaton]

- (A) Ascending aorta — more common, more fatal
- (B) Descending aorta

A/c to Extension [DeBakey classificaton]

- I — to descending aorta also
- II — Limited to ascending aorta
- IIIA — Above diaphragm
- IIIB — Below diaphragm.

Symptom M/c – Chest pain

Retrosternal + Tearing Pain + Radiation to interscapular area

Sign Asymmetrical Pulses

Acute Aortic Regurgitation [due to type A dissec"]

Ix

1) CXR → Wide mediastinum
+
Ⓛ sided Pleural effusion (20%)
⇓
D/D of Oesophageal Rupture
↓
H/o vomiting

2) Unstable pt. → Trans oesophageal ECHO.

3) If pt is stable → CT

4) Gold Std. Ix → MR angio

Rx

Initial Rx → BP

High or Ⓝ → (Target SBP 100–120 mm Hg)
I.V. ESMOLOL

Low → I.V. fluids.

Definitive Rx

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Type

A
Urgent surgical Repair.

B
Conservative
do surgery if
* Impending rupture
* Limb/visceral ischaemia

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

RHEUMATOLOGY

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

IMMUNE SYSTEM

INNATE

1) ANATOMICAL BARRIER

2) PRR's (pattern recognising Receptors)
Inflammasome Proteins (SENSORS)

3) Anti-Microbial Peptides (AMPs)
Lyzozymes - Tears/saliva

4) NK cells (BOUNCERS)
Largest WBC
Regulated by Tcells (IL-2)
Immune & Tumour surveillance
Non-immune mediated action
Only Immune cell → non-MHC restricted action.
(virus infected/mutated cells are also checked by these cells)

5) MONOCYTE - MACROPHAGE SYSTEM (Police)

6) Dendritic cells
(Most Potent APC's)

7) GRANULOCYTE SERIES (N, B, E)

8) COMPLEMENT CASCADE
regulators of immune response

9) CYTOKINE

ADAPTIVE

1) Bcells (HUMORAL)
- express $CD_{19,20}$ on surface
- when activated
↓
PLASMA CELLS
↓
Immunoglobulins (antibodies)

2) Tcells (cell mediated)
CD_4 (Helper) & CD_8 (cytotoxic)
Most Potent level of Immunity

IMMUNE EXCESS DISORDERS

INNATE (AUTOINFLAMMATORY)

FAMILIAL MEDITERRANEAN FEVER (FMF)
(Recurrent Poly-serositis)*

EPID → 10-20yrs, ♂>♀

ETIOPATH → Inherited defect of MEFV gene
↓
Overexpression of the PRR's
INNATE EXCESS ~~FEVER~~ STATE

C/F → Recurrent Febrile Illness
(each last for 6-8 weeks)
Constitutional symp:- Anorexia
wt. loss
myalgia

Mlc ↓

Pleuritis	Peritonitis	Arthritis	Pericarditis
D/D - TB	D/D - Appendicitis	D/D Juvenile RA	D/D Rheumatic fever

Dx:- Clinical suspicion → GS (Genetic testing MEFV gene)

Rx:- COLCHICIN - Favourable response + longterm remission.

Dreaded complication :- 2° Amyloidosis - Nephrotic syndrome
High Mortality

ADAPTIVE
(AUTOIMMUNE DISORDER)

A) Organ SPECIFIC
Myasthenia Gravis
Grave's
Pernicious Anaemia

B) SYSTEMIC
= RHEUMATOLOGY
Study of systemic autoimmune disorders.

Recurrent Febrile Illness ō Unconfirmed Infection
= Rheumatology

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

ANTIBODY TESTING

INDEX

LUPUS group
(Skin rash)
"Wolf-Bite"

1> SLE
2> Systemic sclerosis
3) Sjogrens (Sicca)
4) M.C.T.D.
5) Rhupus

ARTHRITIS
Approach.

1) RA
2) Spondylo arthropathy
3) Crystal induced
4) CHARCOT's joint (neuropathic)

VASCULITIS

1) Misc. Pain syndrom
- fibromyalgia
- chronic fatigue syndrome

ANTIBODY	CLINICAL SIGNIFICANCE (Best screening)
ANA	M/c Ig found in autoimmune Disorders (>98% of case) MOST SENSITIVE Ig

ELISA ← METHODS → **If** (Preferred)

Qualitative Result (+/-)
Hence it is non specific

1) Quantitative (Result in titres)
   - <1:160 = ⊕ in 20% Healthy population
   - >1:160 = SIGNIFICANT (More specific)

2) IF PATTERN (due to the Δ)

IF PATTERN	ANTIBODY	DIAGNOSIS
M/c - SPECKLED	Anti-Ro/La [SSA/SSB]	SICCA SYNDROME.
Homogenous Rim pattern	Anti-dsDNA - M/c in SLE Anti-smith - Most specific for SLE	SLE
Centromere	Anti-centromere (specific)	→ Localised Systemic Sclerosis
Nucleolar Pattern	Anti-topoisomerase-1 (SCL-70 commercial)	→ Systemic Sclerosis

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

ANTIBODY	CLINICAL SIGNIFICANCE (Astie Role in SLE)
Anti-Sm (not preferred)	MOST SPECIFIC for SLE Only in 10% (lacks sensitivity) NO correlation ~ disease activity
Anti-ds DNA (preferred)	Ⓑ Sensitive & Specific correlates ~ disease severity Associated ~ ↑ Risk - nephritis/CNS involvement.
APLA (phospholipid	Present in 60-70% cases of SLE Associated ~ vascular thrombosis [fetal Loss Most recent to be ~~incl~~ included in Δ criteria of SLE.
Anti-Histone (specific for Drug induced SLE)	CVS (HIC) ACEI, β blockers, Thiazides, Statins Methyldopa, Hydralazine, Procainamide
	Anti-microbial: INH, Dapsone, Sulfonamides
	CNS: Phenytoin, carbamazepine
	GIT: ~~Sulfono~~ Sulfasalazine, Endo: Propylthiouracil Misc: d-penicillamine New: Interferons Anti-TNFα

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

ANTIBODY	CLINICAL SIGNIFICANCE (Prognostic Role)	
Anti (Ro)/La → crosses placenta	↑ Risk of congenital Lupus ↓ risk of maternal Nephritis	SSA/SSB (120) Astic Role in SICCA syndrome
Anti-Ribosomal P	↑ Neuro-psychiatric convulsion + Psychosis	↑ Risk of CNS Lupus
Anti-Neuronal Ab	↑ Neuropathy R, Painful, AXONAL	
Anti-erythrocyte	Hemolytic anaemia	↑ Risk of hematological involvement
Anti-platelet	Thrombocytopenia	

ANTIBODY	CLINICAL SIGNIFICANCE	
Anti-centromere	Localised Scleroderma (CREST syndrome)	Astic Role in SSc
Anti-SCL70	Diffuse SSc	
Anti-U_3 RNP	↑ Risk of PAH + RPGN	Prognostic Role in SSc.
Anti-U1RNP	Specific for Mixed connective Tissue Disorder	
Rheumatoid factor (RAF) IgM Ig against Fc portion of IgG	Best screening Test for RA (~~Prot~~ (SENSITIVE) Correlates - Risk Bone erosions (PROGNOSIS) Non-specific for Δ	

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

ACPA / Anti-CCP (Most specific for R.A.)	Anti. cyclic citrullinated Protein Ab. (Acts Role in RA)	
ANCA (anti-neutrophil cytoplasmic Ag)	Vasculitis (Acts Role)	
	cANCA Anti-PR3 (proteinase-3)	pANCA Anti-MPO (myeloperoxidase)

SLE

M/c autoimmune disorder

Epid- 20,40 yrs. ♀ > ♂

cause- Idiopathic M/c

Risk factors - 1> GENETIC - TREX-1 gene defect
2> CHROMOSOMAL - Klinefelter's syn.
3> INFECTIONS - EBV
4) TOXINS - UV Rays, silicosis

Manifestation	Clinical Description.
1> Cutaneous	a> Acute :- MALAR RASH b> Chronic :- DISCOID RASH
2> Oral ulcers (considered as SLE)	excluding - a) nutritional b) Infective c) Behcet's disease
3> alopecia (considered as SLE)	excluding - a) Nutritional (Iron, Zn) b) Endocrine - thyroiditis (Hypo) c) Drug induced
4) Synovitis (90%) (Nonerosive arthritis)	(M/c) Symmetrical polyarthritis NEVER DEFORMITY / Bone Disease

5) RENAL	Proteinuria > 3+, Granular/ RBC Cast
6) CNS	Neuropsy., Neuropathy
7) ANAEMIA →	Hemolytic - Hb ≤ 10g/dL
8) LEUCOPENIA →	WBC ≤ 4000 or Lympho ≤ 1000
9) Thrombocytopenia →	Platelet ≤ 1,00,000

Δ:- SLICC Criteria (Systemic Lupus International collaberative Clinics)

9 clinical	6 Immunological	≥4 confirms SLE (atleast 1 of each)
ABOVE manifestations	1) ANCA 2) Antism 3) Anti Ds DNA	4) APLA 5) Direct Coombs Test+ve 6) Low serum C_3 Levels

Rx

ACUTE SLE FLARE

⇓

Life-threatening features / causes of ACUTE MORTALITY IN SLE

1) Lupus Nephritis (Type 3,4)
2) Neuropsychiatric manifestations
3) Coagulopathy / Pancytopenia

(+) → Autoimmune Crisis

(−) → MILD FLARE

Rx. IV Methyl Prednisolone PULSE ⟹ Oral Prednisolone
1 gm/day = 3-5 days
1-2 mg/kg/day

⇓

Add Steroid Sparing
MYCOPHENOLATE MOFETI
(Lifelong)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Approved alternatives to methylprednisolone

RITUXIMAB (MAb ⊖ CD_{20})

BELIMUMAB (MAb ⊖ BAF)

POOR ~~PROGNOSIS~~ PROGNOSIS

Affects Productive age group	unpredictable course of the disease	High cost of therapy	Long Term Adverse drug Rxn of immuno suppression	NO CURE (lifelong therapy

ACUTE ← MORTALITY IN SLE → CHRONIC/ Longterm

1) Thrombotic events - cardiac failure
2) Opportunistic Disease

SCLERODERMA → SYSTEMIC SCLEROSIS

124

Sclerosis | Skin ⊗

>98% have systemic involvement.

Epid - 30-50 yrs, ♀ > ♂

Cause - M/c - Idiopathic

Risk factors → 1) INFECTION → CMV, Parvo B19

2) TOXIN EXPOSURE - Silicosis, "Toxic Oil Syndrome"

C/F ← M/C

1) RAYNAUD'S → can precede skin changes ≥ 10 yrs

↓

2) SKIN changes : Hands & face

	HANDS	FACE
a) OEDAMATOUS	Puffiness of fingers	& Face
b) INDURATIVE	claw hand deformity	Mask-like
c) SCLEROSIS (most specific) (HOST SPECIFIC)	Autoresorp" of terminal phalanx ⇓ shortening of Digits	"FISH-MOUTH" appearance

CLASSIFICATION - Based on Extent of Skin Involvement

ONLY SKIN (<2% cases)	Restricted to face	Proximal - elbow	only organ.
MORPHIA	Distal to elbow	Trunk ⊕	SCLERODERMA SINE SYNDROME (Least common)
En-coup-de-sabre Lesion	↓ → SSC ← ↓		
	Localised	Diffuse	

sickle

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Suspected → SSc

Face + Distal to elbow LOCALISED SSc	Proximal to elbow DIFFUSE SSc
ANti-Centromere ⊕	SCL-70/Topoisomerase-1 Ab ⊕
⇓ Also called 'CREST' ✓Calcinosis ✓Raynaud's (DOC = CCB) ✓Eso. dysmotility (GERD) ✓Telangectasia s → sclerodactyly Above features are M/c E localised >> Diffuse	⇓ More risk of organ involvement Lung:- M/c type of ILD in autoimmune disorder NSIP (non-specific interstitial pneumonia) ↳ DOC = steroids • Iso. Pulmonary artery HTN (DOC - Iloprost) • RPGN (Renal crisis) (DOC - captopril)
Rx = ONLY PALLIATIVE, NO CURE Unfavourable Prognosis	

SICCA SYNDROME
(Sjogren's Syndrome)

M/c manifestation — Dryness of Eyes & Mouth.
Lymphocytic infilteration of exocrine glands

CAUSES

1° SICCA (Idiopathic) **Rare**

[SICCA - is the Disease]

- High Risk → systemic (extraglandular manifestations)
- High titres → SSA/SSB Ab
- High Risk → LYMPHOMA (M/cc of death in SICCA)
- Majority → Immunosuppressants.
- POOR PROGNOSIS

M/c 2° SICCA

[underlying disease]

- SLE, SSc, MCTD, RA, vasculitis
- 1° Biliary Cirrhosis
- chr. autoimmune Hepatitis

- only Glandular symptoms
- Low titre - SSA/SSB
- NO risk of Lymphoma
- Rx - only palliative

FAVOURABLE PROGNOSIS

C/F

GLANDULAR.

Involved	C/F	TEST	Rx
Lacrimal Gland	Dry eye	Schirmer	Artificial tears
	corneal or conjunctival erosions	Rose Bengal Test	Protective glasses
Salivary	Dry mouth	Ionto phoresis	Hydration
Pancreas	Malab" Syndrome	stool FAT estimation	Enzyme replacement

SYSTEMIC

LUNGS - M/c - NSIP
Isolated PAH

Renal - M/c.
- Distal RTA.
- Interstitial nephritis

Liver - Cirrhosis

CNS - neuropathy

LYMPHOMA - most dreaded

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

℞ 2° SICCA → only palliative

1° SICCA → Depend on organ involvement

GOOD PROGNOSIS (majority are 2°)

POOR PROGNOSTIC FACTORS

1> Elderly onset (>40). ♀

2> B/L parotid enlarged

3> systemic ⊕

4> High titres of SSA/SSB.

OVERLAP SYNDROMES

Epid = 10-20yrs, ♀ >> ♂

C/F = (SLE/ SSc/ SICCA) + (R.A.)

Screening = Ab → ANA +ve; RAF +ve

Specific Ab

- U1RNP +ve → MCTD
- ACPA/Anti-CCP +ve (RA + lupus) → RHUPUS
- NONE → overlap Syndrome

℞

SLE Dominant	RA Dominant
Immunosuppression	DMARDS
Non-erosive arthritis	Erosive arthritis

PROGNOSIS – Better than individual disease

Better response to therapy

APPROACH TO JOINT DISORDERS

TRUE ARTICULAR	PAIN	PERI-ARTICULAR
✓	Active	✓
✓	Passive. Movement	✗

INFLAMMATORY	Morning Stiffness DURATION	DEGENERATIVE
>30 mins		<30 mins
Resolves	AFTER ACTIVITY	Worsens → OSTEOARTHRITIS

APPROACH TO INFLAMMATORY ARTHRITIS

- MONO (1 joint)
  - → N/E Trauma
  - → Septic
  - → GOUT
- OLIGO (2-4 jts)
  - PSEUDOGOUT
  - ↑ Crystal
- POLYARTHRITIS (≥5 jts)
  - AXIAL
    - Ankylosing Spondylitis
  - APPENDICULAR - dominant
    - Symmetrical (small)
      - RHEUMATOID ARTHRITIS
      - PSORIATIC ARTHROPATHY
        - (Early DIP +)
    - Asymmetrical (Large)
      - ENTEROPATHIC ARTHROPATHY
      - REACTIVE ARTHRITIS
        - Predominantly wt. bearing jt.

Spondyloarthropathy → (4) = AS + above 3

M/c Pattern of Joint Involvement in Diseases

↓

Most Imp parameter for Diagnosis of arthritis

RHEUMATOID ARTHRITIS

Epid- 30, 50yrs; ♀ > ♂

M/c - Idiopathic

Risk Factors - 1) GENETIC - HLA-DR4 (Most cases = Sporadic)

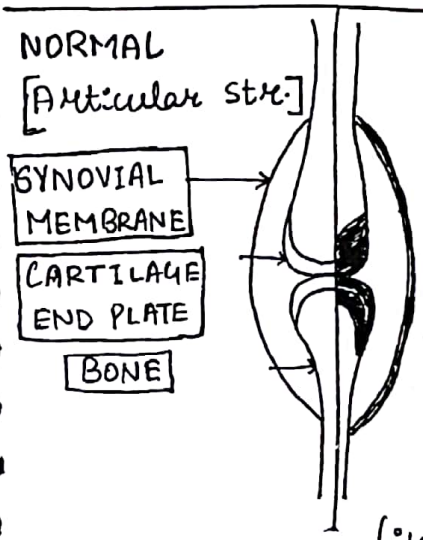
2) INFECTION - Mycoplasma, EBV.

C/F

ARTICULAR (predominant)

- Inflammatory Poly. arthritis
- Appendicular Dominant
- Spine involvement - Rare
  - ↳ M/c - Atlanto-axial jt.
- Symmetrical, small jts. of hand
  Wrist, MCP jt & PIP jt

NORMAL
[Articular str.]



STAGE-RA

1) SYNOVITIS

2) PANNUS FORMATION

3) BONE EROSION
↓
Jt. Destruction
Jt. Deformity
(irreversible stage of Disease)

EXTRA-ARTICULAR

EPISCLERITIS

LUNG: M/c Usual Interstial Pneumonia (UIP)
M/c → ♂

Pericarditis
Valvular M/c → MR

MUSCULO-SKELETAL
↓ Myopathy
↓ Osteopenia
Fast progress - OA

FELTY's (RA + Spleen)
↓
Anaemia / Neutropenia
Risk of Lymphoma
Least common
≤ 1% - advanced RA
Early DMARD Rx

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Δ :- EULAR (European League against Rheumatism) Guideline - A scoring system

Ⓐ PATTERN of joint involvement (Max : 5)

- 1 jt (Predom. Large) → 0
- 2 - 10 jt → 1
- 1 - 3 jts → 2
- 4 - 10 jts (Predom. small) → 3
- > 10 jts → 5

Ⓑ SEROLOGY (Both RAF & ACPA) [Max = 3]

NEGATIVE → 0

MILD ⊕ [< 3 × upper normal limit] → 2

STRONG ⊕ [> 3 × upper limit] → 3

Ⓒ DURATION

< 6 wks - 0

> 6 wks - 1

Ⓓ ACUTE PHASE REACTANT

NEGATIVE → 0

ELEVATED → 1

Δ = ⩾ 6 confirms RA.

RADIOLOGY ⊗ → Not recommended for Ass.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

OLD CRITERIA :- X-Ray Hand = Bone Erosions

X-Ray - Least sensitive test

MRI - MOST SENSITIVE test

↓

Impractical

↓

Late, irreversible stage

Earliest feature of RA

Juxta-articular osteopenia

↓

NON-SPECIFIC.

℞ Most preferred method → STAGE the severity

CDAI (Clinical Disease Activity Index)

2.8 - 10	10 - 22	>22
MILD RA	MODERATE RA	SEVERE RA
Single DMARD	COMBINATION DMARD →	Early use of Biologicals

Prognosis :- Favourable → REMISSION → can be acheived in 60-85% cases

POOR PROGNOSTIC FACTORS :-

1> Elderly (>40)

2) ♀

3> >10 jts @ onset

4> High titres of RAF

5> Delay in initiation of DMARD ≥ 3 months

DMARDS	InD"	ADR	Follow-up
METHOTREXATE (MTX)	1st choice (B) single or combination.	BM ↓, Hepatotoxicity (Dose dependent S/E)	CBC, LFT - 3 monthly
	Back bone of Biologicals	MTX induced ILD unpredictable Permanent C/I to MTx use	CXR, PFT Baseline & Annually
		Teratogenicity	Counseling
HYDROXY-CHLOROQUINE	Safest in ♂ ♀ 2nd choice	Bull's maculopathy (Irreversible)	Fundus, Exam', Perimetry Baseline & annually SOS
SULFASALAZINE	Safe in ♂ ♀ 3rd choice	Gastritis Hepatotoxicity	LFT - Basaline & 3monthly
LEFLUNAMIDE	Approved as Mono Rx completed Family MODEST efficacy (limited use)	No synergy ⊂ other DMARDs 6X ↑ Hepatotoxicity Teratogenicity	Stop ≥2 ovulatory cycles before conception.

BIOLOGICALS = Pathophysiology of R.A.

↑↑↑ Pro-inflammatory cytokines

TNFα most potent (MOST PREFFERED) Anti-TNFα agents + **IL-1** → **ANAKINRA** → Stimulates T cell → MODULATOR = ABATERCEPT

IL-6 → **TOCILIZUMAB** → Stimulates B-cell → RITUXIMAB

\+

Intracellular signalling pathways of Inflammation

eg. ~~JACK~~ JAK - Janus associated Kinases

TOFACITINIB - Tyrosine kinase ⊖ of JAK. - 1st oral Biological

ANTI - TNF α AGENTS — ADALIMUMAB, GOLIMUMAB — S/C every 2-3 wks

~~ETANER~~ ETARNACEPT	INFLIXIMAB	PEGYLATED CERTOLIZUMAB → S/c every 6-8 weeks
Chimeric form Mab against TNF α receptor	Chimeric Mab against TNFα itself	Fully Humanised MAb against TNFα. itself
Limited efficacy	Excellent efficacy	Equal efficacy
	Anaphylaxis	Safety

~~COMMON~~

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Common ADR ⇒ Reactivation of TB.

Hence, Screening for active/ dormant TB is mandatory before Anti-TNF α agents.

Tuberculin (MANTOUX)	WHO → In countries (BCG vacc)
→ MOST SENSITIVE.	Best screening Test is
→ BCG vaccination. (false +ve)	Interferon γ assay (TB-GOLD/ ~~quantification~~ quantiferon)

SPONDYLOARTHROPATHY

Group of Disorders characterised by

COMMON FEATURES

1) Seronegative — RAF -ve
2) HLA B27 +ve — Strong family History
3) 1° site - "Enthesis" — Junc" Btw Bone & Tendon.
4) Axial Involvement is not Uncommon.
5) Extra articular manifestations predominate
6) Excellent response to NSAIDS → 1st Line of Rx

SpA are D/D - Inflammatory Polyarthritis

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(I) ANKYLOSING SPON. / BECHETROW's / MARIE-STRUMPELL DISEASE

Epid- 10-20yrs, ♂ > ♀, 90% - HLA B27

C/F

ARTICULAR (Axial Dominant)		EXTR-ARTICULAR (Predominates)
Sacro-iliac Joint - M/C	LBP (non-specific) always B/L But asymmetrical	70% → Recurrent U/L ANT. UVEITIES
Lumbar spine	Restricted ~~resp.~~ ~~movement~~ forward bending	
Thoracic spine	Restricted resp. movement	
Cervical spine	Highest risk of # in Lower part of Cx spine	

Δ

BEFORE

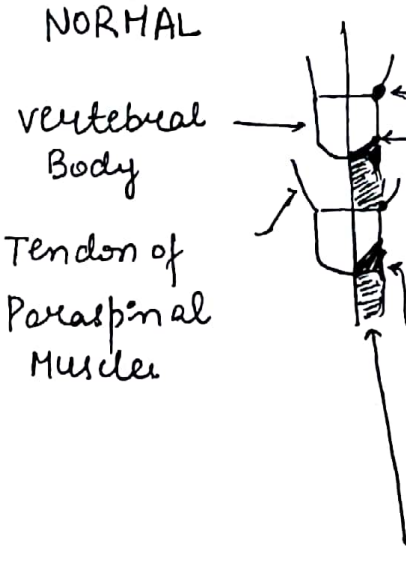
HLA-B27 → (+ve) → ≥2 common features of SpA (confirms A.S.)

HLA-B27 → (-ve) (X)

Spine Involvement

AFTER

MRI proven sacroileitis → ≥1 common features of SpA



STAGES	Rx
ENTHESIS	NSAIDS
MARROW EDEMA	BEST TIME for Biologicals
MARGINAL SYN DESMOPHYTES (unique feature)	DMARDS Biologicals (All TNF α agents)
FUSION (ANKYLOSIS)	

MRI is mandatory

Only Test → Detect the stage of A.S.

Rx - UNFAVOURABLE

unlike RA only 10-15% active complete Remission

(II) PSORIATIC	(III) ENTEROPATHIC	(IV) REACTIVE
M/c- "Guttate" / Pustular type of psoriasis	M/c - U.C./Crohn's Disease	Post-infective
	Common Pathology	F./UTI — CHLAMYDIA URBAN — S.Typhi Travel Diarrhoea — Shigella
	Bowel Disease & activity — Severity of arthritis	
M/c - ONCHOLYSIS (nail pitting) Skin Lesions 10% Uveitis ant ⇓ Symmetrical poly-arthritis (Predom - small jts) mimic RA - 5-10% pts arthritis > skin changes	M/c - Diarrhoea Most-specific → Pyoderma gangrenosum (Unique in U.C.) ⇓ Asymmetrical poly arthritis (Predom - Large jts	M/c → Febrile illness → KERATODERMA BLENORRHAGIA (Keratotic, Painless plaques - sole + Palm) ⇓ Asymmetrical - polyarth (Predom - wt. bearing jts)

Early x-Ray → ⇓ DIP jt ⊕ pencil in cup deformity • MTX • Anti-~~TFα~~ TNFα agents • Tofacitinib.	Sulfasalazine Anti-TNFα	CHICKENGUNYA ARTHRITIS Hydroxychloroquine (additional anti-inflammatory action)

CRYSTAL INDUCED

	GOUT	PSEUDOGOUT
Crystal	Mon.sodium urate (M.S.U.)	Ca^{2+} pyrophos. dihydrate (C.P.P.D)
Epid	30-50 yrs ♂ > ♀	>50 yrs ♂ > ♀
Etiopath	90% - Renal Defect in Urate excretion. 10% - Diet/Drugs (Pyrazinamide/Thiazide	90% - Jt. Degeneration. 10% - Hypercalcemia = severe so, early PTH adenoma Paraneoplastic Syn
C/F	Acute - Inflammatory MONO-ARTHRITIS (M/C - 1st MTP, ankle jt)	Acute, inflammatory OLIGO (M/C - Knee, Hips, shoulder)
Screening	Serum Uric Acid — NON-SPECIFIC NORMAL VALUE DOESN'T Exclude	S. Ca^{2+}
Synovial Fluid Analysis	NEEDLE SHAPED	RHOMBOID SHAPED
Polarising microscopy ↓ Demonstrate crystals ← Gold Std.	STRONG -ve Birefringence	MILD +ve Refringence

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Rx	← NSAIDs	
Acute Attack	Colchicine Canakinumab (MAb IL-1β)	
Renal Failure	FEBUXOSTAT (X-O-I) Hepatic excretion. Additional anti-inflammatory	Intra-articular Steroids
Chronic Prevention	TARGET Uric acid < 6mg/dL 1st Line: X-O-Inhibitors (Allopurinol, Febuxostat) ↓ Refractory cases PEGLOTICASE Pegulated uricase debulking action on tubules	Encourage Physio therapy Avoid unnecessary Ca^{2+}/vit D_3 supplements In elderly Majority require Jt. replacement Sx.
Prog	Favourable	Unfavourable

CHARCOT'S

1st described - Tabes (Neurosyphilis)

Associations :- H/c DM, Leprosy, Amyloidosis

Pathophysio

NEUROVASCULAR	NEURO-TRAUMA
Autonomic neuropathy	Sensory neuropathy
↓	↓
Disrupts Micro-circulation	Recurrent Microtrauma

→ DEGENERATION

⇓ +

Loss of pain sensation (neuropathic jt)

M/C Forefoot Jt → Hind foot Jt → Ankle Jt

Δsis XR → 'Loose Bodies' in jt. cavity

Only Rx Strict Immobilisation → Total rest

⇓

facilitate recovery of Jt.

Only palliative → Unfavourable Prog.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

VASCULITIS

(A) Based - Pathological Mechanisms

ANTIBODY (ANCA) MEDIATED	IMMUNE-complex MEDIATED	T. cell mediated
Wegener's (W.G.)	Hep. B - PAN	Giant cell arteritis
Churg strauss (C.S.S.)	Hep C - Cryoglob	Takayasu's
M.P.A.	H.S.P.	W.G.
microscopic polyangiitis	(Henoch-Schonlein Purpura)	C.S.S.

(B) Based - Size of vessel affected (Preferred)

LARGE	MEDIUM	SMALL
Giant cell arteritis	Polyarteritis nodosa	
Takayasu	Kawasaki	

SMALL: ANCA +ve		SMALL: ANCA -ve
Anti-PR3	Anti-MPO	H.S.P. vs Hypersensitivity
W.G.	M.P.A.	Cryoglobinemia
	C.S.S.	BECHET's Disease

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

G.C.A.

>50 yrs, ♀ > ♂

C/F → Artery Involved (Carotid)

Br. of EXTERAL CAROTID	Br. of INT. CAROTID	PATHOLOGY
H/c - Sup. Temporal	1st Br - Ophthalmic A.	Polymyalgia Rheumatica
Headache (worse - supine)	End artery -	Myalgia, fever, Anorexia, wt loss ≥ 3 months
± Diplopia	No collaterals	
± Jaw claudication Pain	⇓	
± Paraesthesia over Jaw	Permanent BLINDNESS	

ESR (screening) >60 (significant)

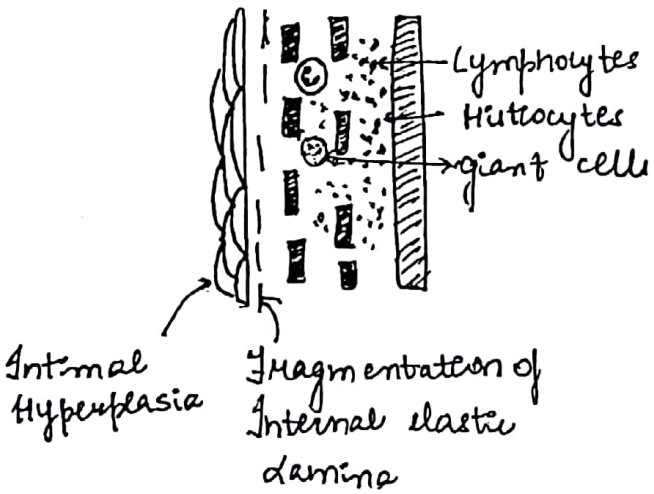
Gold Std →

↳ Temporal A. Biopsy → Minimum ≥ 2 cm Length.
→ HPE - Granulomatous vasculitis

Rx - Steroids → Relief of symptoms

↳ only Drug ∈ prevent dreaded complication = BLINDNESS

Early Rx = GOOD ℞ PROGNOSIS



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

TAKAYASUS / AORTIC ARCH SYNDROME

Epid- 10-20yrs, ♀>♂

C/F- Depend on artery Involved = All direct Br. of AORTA

SUBCLAVIAN (M/C)	CAROTID VERTEBRAL	COELIAC	RENAL	CORONARY <1%
U/L claudication	Recurrent	Chr. mesenteric	Refractory HTN	Acute Coronary Syndrome
Unequal/ABSENT	TIA/Stroke	Insufficiency	(RAS)	
PULSELESS DISEASE				

Δ - CT- AORTOGRAPHY Gold Std

Rx - Immunosuppression (Specific) + Angioplasty (Palliation)

POOR PROGNOSIS

KAWASAKI'S / Mucocutaneous L.N. Syndrome

M/c vasculitis ; <5yrs, ♂>♀

Replaced R.H.D. → M/C cause of cardiac death in children due to Acquired heart Disease

AHA Guidelines

M/c manifestation → Febrile episode

Any Fever - on/after 4th Day (min. dur 5days) DD

Dx - 4/5 of following features are ⊕

1) 90% B/L non-exudative conjunctivitis
2) Erythema over extremities
3) Peri-anal Rash
4) Strawberry Tongue
5) non-suppurative single, cervical L.N.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

℞- IvIg + Longterm Aspirin prophylaxis

- Relieve symptoms
- Reduces risk of coronary involvment to 4-6%
- cannot reverse coronary aneurysm

Dreaded : CORONARY ANEURYSM complication

RUPTURE (4-6% case) ⇓ Elective angioplasty prevents.

THROMBOSIS 95% of case

Prognosis - FAVOURABLE

ULINASTATIN :- Neutrophil elastase Inhibitor. (New, approved only IvIg refractory case

	PAN / SYSTEMIC NECROTISING VASCULITIS	MPA (Part of PAN prior to 1999)
Epid	30-50 yrs, ♂ > ♀	
Etiology	Classical H/C - Idiopathic 30% Chr. Hep B infection	
Pathology	Immune complex Mediated ↓ Fibrinoid necrosis Bifurcation of Medium vessel ↓ Microaneurysm formation	ANCA - mediated vasculitis ↓ Small vessel predominant ↓ 70% Anti-MPO +ve.
C/F	H/C 90% arthralgia HEMATURIA - ↓ out GN (rupture of micro aneurysm)	- always due to GN
CNS-	Mononeuritis + multiplex (Neuropathy)- asymmetrical	
SKIN-	Raynaud's phenomenon	

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Digital gangrene, LIVEDO		Purpuric Rash
Gonadal arteries mimic torsion	Pulmonary Spared But bronchial may be involved	Alveolar H'ge (ANCA +ve ⇒ D/D - Good Pasture's Syndrome

Δsis - Exception

Renal angio-
micro aneurysm @
Bifurcation of vessels.

Biopsy - Gold std

Rx Immunosuppressants → Favourable Prognosis

WEGENER'S GRANULOMATOSIS

Or chronic Granulomatous angitis

30-50 yrs, ♂ > ♀

Closest D/D → Good Pasteur's.

C/F

Pulmonary		Renal	Eyes
M/C	M/C	RPGN	M/C - Pan-uveitis
Lungs	URT is specific		
• B/L abscess	M/C - chr. sinusitis		SKIN
• Multiple thin walled cavity	• Nasal bridge deformity		Purpuric Rash over L.L.
• Alveolar H'ge	• Serous otitis media (GLUE)		
	• Subglottic stenosis (change in timbre of voice		

Serology (SCREENING) 70% Anti PR3 +ve (Wegener's Antigen)
30% Anti MPO +ve

~~Anti~~: Absence cannot exclude W.G.

BEST TEST → LUNG BIOPSY

Rx cyclophosphamide → favourable response
GOOD & PROGNOSIS

~~CHU~~
CHURG STRAUSS (Eosinophilia & granulomtous angitis)

30-50yrs. ♂>♀.

C/F

PULMONARY		RENAL	SKIN involvement
LUNG	URTI	RPGN	Purpuric/ urticarial rash
Late onset asthma	allergic rhenitis		

W.G. can be differentiated by ocular involvement

Dia- ~~Short course of steroid~~
Lung Biopsy /Skin Bx = Eosinophilic Vasculitis

Rx- Short course of steroids
favourable Prognosis, Long term remission
GOOD & PROGNOSIS

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

H·S·P· (ANAPHYLACTOID PURPURA)

>90% cases - occurs <10yrs age M>F.

ADULT H·S·P. — HYPERSENSITIVITY VASCULITIS

EPID - 20-40yrs, ♂ > ♀

Etiopath Post Infective H/C - preceded by URTI

C/F	PALPABLE PURPURA	
LL + Buttocks	Distribution	Generalised
Common Abd. pain, Malaena	Mucus memb. involvement	Uncommon
3-5% - IgA deposits on GBM - Gross Hematuria	Renal involvement	NEVER OCCURS
Capillaries	Site - Biopsy (Gold std)	Post capillary venule

Rx - Reassurance/ Self Limiting Disease.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

ESSENTIAL MIXED CRYOGLOBULINEMIA (EMC)

↓
Usually indicate Idiopathic cause

Majority = 90% = 2° cause
- Multiple myeloma
- Chr. Hep. C., Hep B
- Lymphoproliferative states

Pathophy:- Exposure to cold ($T < 37°C$) → Cryoglobulins ppt (Ig ± ppt.)

↓	↓
H/C - Skin capillaries	Renal tubulus
98% - multiple areas of skin necrosis	A.T.N. (Direct toxicity)

Δ sis - Incubate plasma in cold bath → ppt. ⊕

Rx + Prog - underlying cause (unfavourable)

BEHCHET'S DISEASE → HLA B5 1 148

Epid- 30-50 yrs, ♀ > ♂ (worser in ♂)

MAJOR	MINOR
Recurrent, painful, oral aphthous ulcers	1> Recurrent superficial thrombophlebites 2> B/L Hypopyon 3> Erythema nodosum 4> Painful genital ulcers 5> Pathergy Test +ve Skin Prick > 5mm deep ↓ Induration (+)

Dx - MAJOR + 2 MINOR — confirms.

Rx - Steroids - excellent response

Favourable Prognosis

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

FIBROMYALGIA (Pain Sensitivity Syndrome)

Epid - 30-50yrs, ♀ > ♂

Risk - Stress

Pathophy - ↓↓ Blood flow to Thalamus

(MINOR) ↓↓ Cortisol response to stress

C/F - • Multiple aches & pains (somatic complaint)
≥ 3 months

• Associated c Defect of NREM sleep

Asi - Clinical - 18 point pain testing (screening)
(>11/18 +ve tenderness → significant)

MR spectroscopy - gold std.

Rx - Pregabalin.
Gabapentin
TCA
SSRI.

Unfavourable Prognosis → Prone to analgesic abuse
Poor Q.L.I.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

CHRONIC FATIGUE SYNDROME

20-40yrs, ♂ > ♀

e/F - FATIGUE ≥ 6 weeks

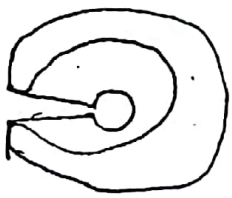
Asu - of exclusion

1> OBesity

2> Substance abuse

3> All medical causes
- 1) Nutritional
- 2) Endocrine — Hypothy, DM.
- 3) Chr. Infection
- 4) autoimmune
- 5) neoplasm

Rx = Lifestyle Modification



RESPIRATORY

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

LUNG DEVELOPMENT

5 stages

1) Embryonic stage → Lung buds
2) Pseudoglandular stage - upto terminal Bronchole
3) Canalicular - Alveolar ducts
4) Saccular - Primitive alveoli
5) Alveolar - Mature alveoli

BRONCHOPULMONARY SEQUESTRATION

Def^{n}. Separation of part of lung during development from tracheobronchial tree & separate blood supply.

TYPES

EXTRALOBAR	INTRALOBAR (M/c)
Separated & having separate covering	separated part in adjacent lung & covered by lung's pleura

M/c site → (L) lower lobe post basal segment

M/c Blood supply → Thoracic aorta

IOC :- CT Angiography or MR angiography

Rx - Resection if pt. is symptomatic

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

SURFACTANT

1) Dipalmitoye Phosphatidyl choline / Lecithen.
2) Produced by Type II pneumocytes
3) also by clara cell.
4) Removed by Alveolar macrophage
5) Functions :-
   a) surface Tension ↓
   b) maintain alveolar stability / FRC
   c) Compliance
6) Surfactant induc" starts at **20wk**
   Peak at **35wk**

So, if < 35 wk ⇒ Respiratory distress syndrome
or
Hyaline membrane Disease.

Pathophysiology of RDS

surfactant deficiency → ↓ collapsed alveoli → To open collapsed alveoli → ↑ work of Breathing → Respiratory Distress

↓ energy resources

Hypoxemia + Met. acidosis

↓

Pul. vasoconstric"

↑ (R) sided Pr.

Patent foramen ovale

R-L Shunt → CYANOSIS

Pul. vasoconstric" → Damage to alveolar cell → Form Hyaline Layer → HYALINE MEMBRANE DISEASE

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

X-Ray findings :-

1) Reticulo ~~granular~~ granular pattern
2) Ground glassing
3) White out Lungs
4) ↓ lung volume (↓↓FRC)

Inv :-

Lecithin / Sphingomyelin > 2 ⇒ MATURE LUNG

Rx :-

mild to moderate ⇒ O_2 + CPAP

Severe ⇒ Invasive Mech. ventilation + Surfactant ~~Deficien~~ Replacement

~~Surfacto~~ [Hyaline appears Pink on Biopsy]

PULMONARY ALVEOLAR PROTEINOSIS

Surfactant clearance is impaired

Etiology :- 1° form (M/C) → Auto Ab against GM CSF

2° form → ✓ Acute Silicosis
✓ Haematopoietic malignancy
✓ Immunodeficiency

Silica particles are toxic to alveolar macrophage
Chr. Silicosis pt are prone to TB.

In malignancy, macrophages are not matured enough to carry out func".

In immunodeficiency, macrophages ↓

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Pathophysiology-

↓ Diffusion for O_2 → Hypoxemia.

Δ :-

1) Broncho alveolar Lavage → milky white

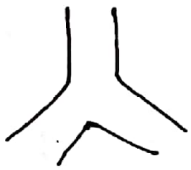
2) BAL → PAS +ve

3) CT Chest → CRAZY PAVING PATTERN

Rx- Whole Lung Lavage

WIEBELS LUNG MODEL

Trachea —23 Generation→ Alveoli



Trachea
↓
Principal Bronchus
↓
Lobar Bronchus
↓
Segmental Bronchus
↓
Terminal Bronchiole
↓
Respiratory Bronchiole
↓
Alveolar duct & Sac

Functional / ventilatory unit /
Acinus = Distal to terminal Bronchiole

Radiological unit / 2° Pulmonary Lobule
= Group of acinus (5-7)
↑
involved in EMPHYSEMA

upto terminal Bronchiole = Conducting Pathway

Ⓡ Main Bronchus	Ⓛ Main Bronchus
Aspiration is more common this side as it is short, stout, straight	Bronchiectasis more common in Ⓛ lower part → narrow angulated & drainage

BP Segments + ASPIRATION PNEUMONIA.

M/c segment involved in Asp. Pneumonia :
- ® Lower Lobe superior seg or ® upper Lobe Post

M/c segment involved in Asp. Pneumonia in supine

" " " Asp. Pneumonia in sitting/standing = ® Lower Lobe posterior Basal

" " " Asp. Pneumonia in Bending forward ® middle Lobe

Best Inv:- **Bronchoscopy**

HEMOPTYSIS

Lung
- High Pr. Systemic circulation ⇒ Bronchial artery
- Low Pr. Pulmonary " ⇒ Pulmonary artery

M/c source of hemoptysis → Bronchial artery

M/c source of massive hemoptysis ↑

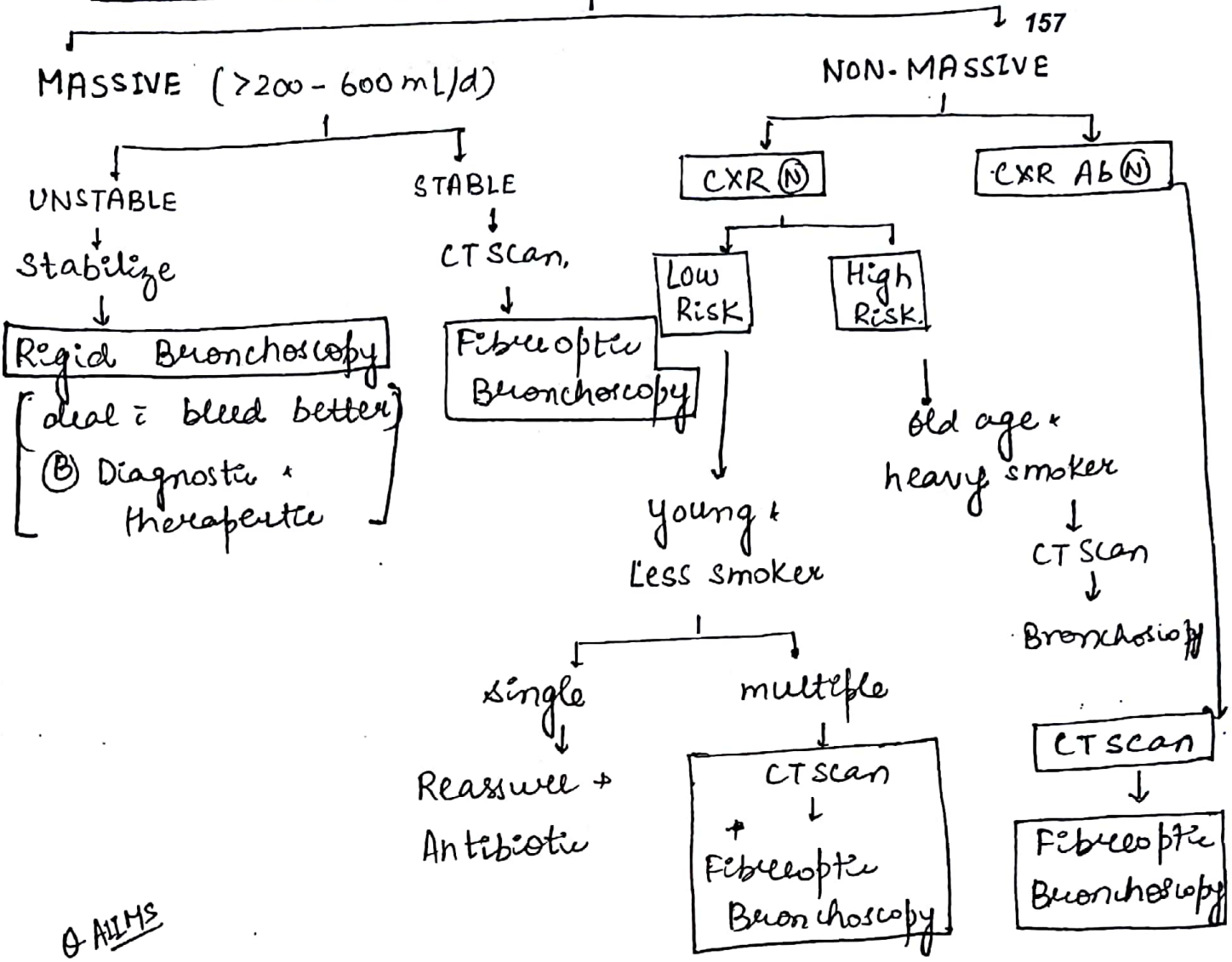
M/cc of hemoptysis in India → TB

M/cc of " worldwide → TB

M/cc of Death in ↓ hemoptysis (massive) → Asphyxiation. ∵ Blood clot.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

APPROACH TO HEMOPTYSIS



AIMS

PERSISTENT CASES-

- Br. artery embolisation
- Resection of affected lobe

Source of hemoptysis in Mitral Stenosis = [Rupture of Pulmonary Bronchial venous connection → Br. veins]

Source of hemoptysis in Pulmonary embolism → Pulmonary artery

M/C Source of hemoptysis in TB → Br. artery

~~Rasmosen's~~ aneurysm → Pulmonary artery
Rasmussen's

organism that causes pseudohemoptysis
: Serratia ~~marcescens~~ marcescens

INTRA PLEURAL PR.

Lung always tries to collapse to centre ⟶

Chest wall always tries to move outward ⟵

↓

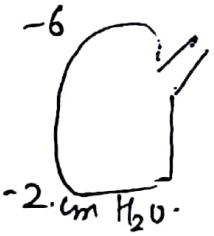
There is a Balancing Force Between the 2

↓↓

-ve Intrapleural Pressure (IPP)

[Usually -ve during (N) respiration
Maintains equilibrium Lung volume ⇒ FRC / Relaxing volume]

(N) Value = -2 to -6 cm H_2O.



More -ve IPP
Deep Inspiration
Pulley
Collapse
Fibrosis

Less -ve IPP / +ve IPP
1) Forced Expiration
* cough, valsalva manoeuvre
2) Pushing Lesions
3) * Tension Pneumothorax
* Mass " "

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

COMPLIANCE

→ Stretchibility of Lung.

→ Change in unit volume per unit change in pressure

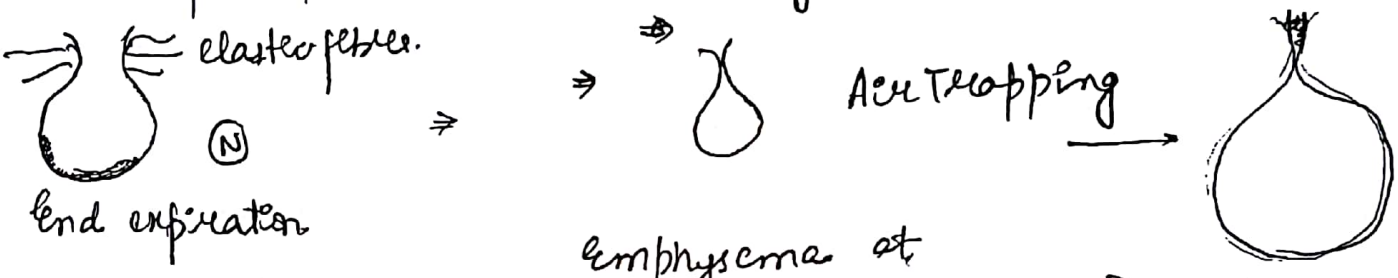
$$C = \frac{\Delta V}{\Delta P}$$

Static compliance = air flow & resistance not considered

Dynamic ,, → air flow & resistance considered

EMPHYSEMA PATHOPHYSIOLOGY

Insp: Exp. = 2s : 3s



early closure

If elastic febres Damaged. → Emphysema at end expiration.

↓ diameter of airway

↑ Airway resistance

↓ Dynamic compliance in emphysema

Loss of elastic febres → ↑ static compliance

CXR

1) B/L ~~Tra~~ Hypertranslucency
2) Flat Diaphragm
3) Tubular Heart
4) Barrel shaped chest wall

Emphysema –
RV ↑
FRC ↑
TLC ↑

↓ compliance

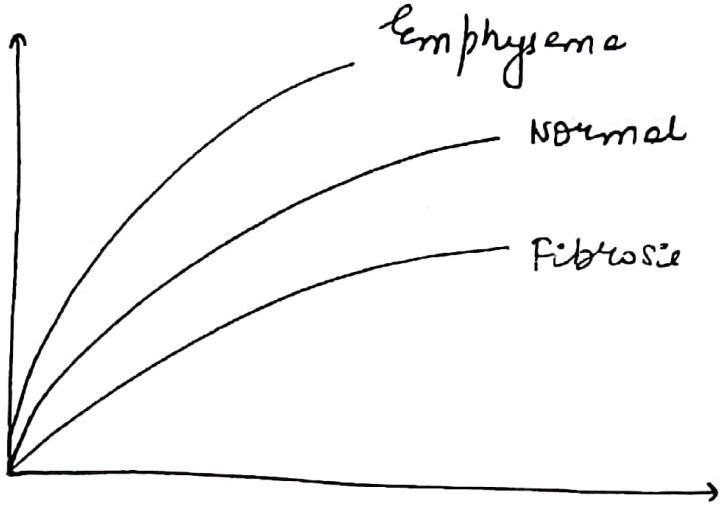
1) Surfactant Deficiency
2) ARDS
3) Pulmonary oedema
4) Fibrosis [ILD
5) 100% O_2 damage

↑ Compliance

1) old age
2) emphysema

Static comp ↑

Dynamic comp ↓ (↑ airway resistance)



HOOVER'S SIGN → Paradoxical inward movement of lower ribcage during inspiration

severe COPD ↓

since diaphragm is not there, thats why.

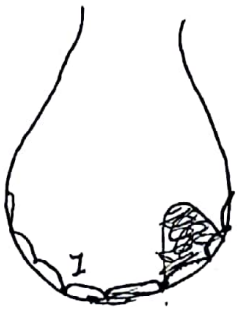
HISTOLOGY OF ALVEOLI

TYPE I

Pavement epithelium

Vulnerable to damage

More surface area



TYP II

Secretes surfactant

Can divide & reconstitute Type I cells

More No.

ZONES OF LUNG

Vertical regions based on hydrostatic Pressure

P_A = alveolar pressure

P_a = arterial "

P_v = venous "

Zone 1 = $P_A > P_a > P_v$

2 = $P_a > P_A > P_v$

3 = $P_a > P_v > P_A$

$P_A > P_a > P_v$

$P_a > P_A > P_v$

$P_a > P_v$ P_A

(N) Lung = combination of Zone II & III.

DEAD SPACE =

Area ventilated but no sufficient gas exchange (blood flow)

Anatomical D.S.

Ext. nares upto Terminal Bronchiole.

Measured by Fowler's method

N_2 used

Physiologic D.S.

PDS = Anat DS + Alveolar D.S.

In (N) Alveolar D.S. = 0

(N) P.D.S. = Anat D.S.

* Bohrs equation

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

↑ Anat D.S.

1> Neck extension
2> Bronchodilation
3> old age

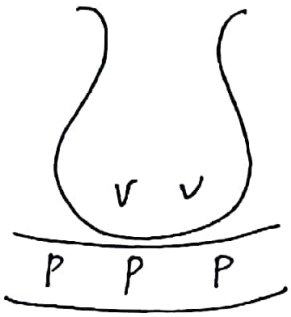
↓ Anat D.S.

1> Neck Flexion
2> Bronchoconstriction
3> Orotracheal intubation / Tracheostomy

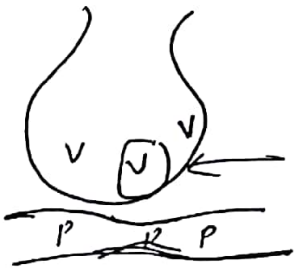
Bypass nasal airway

Bypass oral, nasal airway.

↑↑ Alv. D.S–

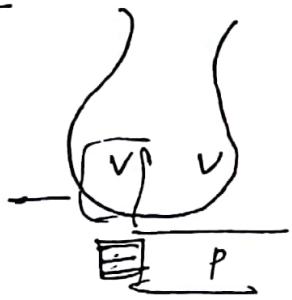


COPD



wasted ventilation =

P. Embolism



In P. Embolism, predominant Defect is in Perfusion

MECHANISMS OF HYPOXEMIA

(I) V/P mismatch (M/C)

(II) Shunt

(III) Diffusion Defect

(IV) Hypoventilation

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(II) SHUNT-

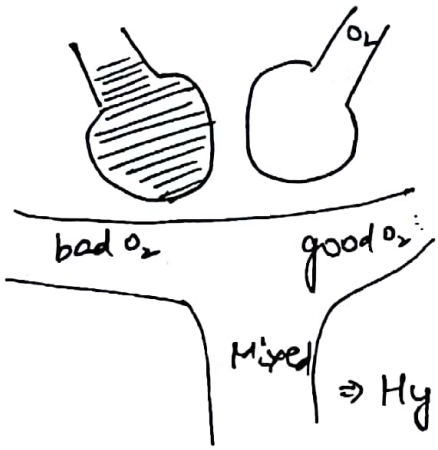
Bypass of (Diversion) blood ↓out Oxygenation.

INTRACARDIAC

(R) → (L) shunt

INTRAPULMONARY

1) Sev. Pneumonia
2) ARDS



⇒ Hypoxemia

Less responsive to supplemental O_2.

R_x = Mechanical Ventilation.

R_x infection.

Cure pathology.

$\frac{V}{P}$ Ratio

BASE
- Max. Ventilation
- Max. Perfusion
- Min. V/P ratio

APEX
- Min. ventilation
- Min. Perfusion
- Max. V/P ratio

	V	P	V/P	PAO_2	$PACO_2$
APEX	2L	0.5L	4.	130	28
MIDZONE	4L	5L	0.8	104	35
BASE	6L	10L	0.6	92	42

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

1° TB ⇒ Mid & Lower Lobe

2° TB ⇒ Apex.

↳ active disease due to proliferation of Bacilli

Reason

↑ O_2 tension ↑ V/P ratio.

DIFFUSION CAPACITY OF LUNG (T_{CO}) (DLCO)

↓ DLCO

1) Fibrosis / ILD
2) Severe emphysema
3) Pneumonia
4) ARDS
5) Sarcoidosis

(1–5: No blood for exchange)

6) P. Embolism
7) Anaemia
8) Pul. HTN

(6–8: No blood for exchange)

↑ DLCO

1) Polycythemia.
2) Exercise (↑ Blood flow)
3) Alveolar H'ge
   ↳ good pasteur's
   Wegeners
4) B Acute Asthma
   ↑ sed eosinophil inflammation
   ↓
   No produc"
   ↓
   P. vasodilatation
   ↓
   ↑ DLCO

New
FeNO = Test for Acute Asthma

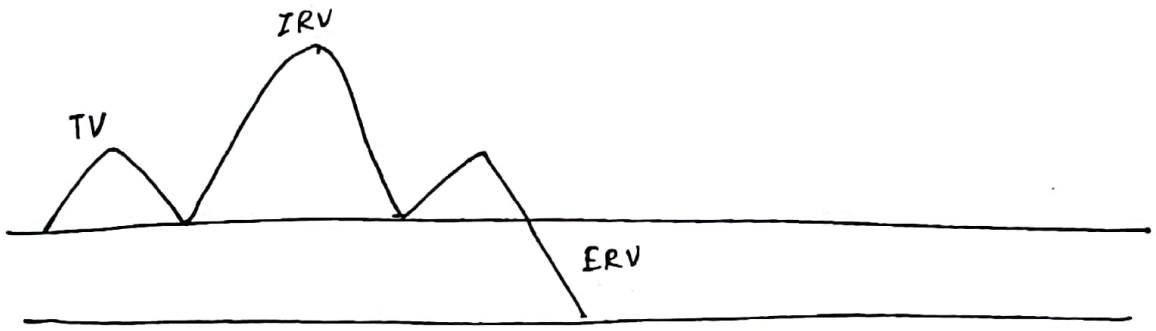
SPIROMETRY

Tidal Volume = Normally in/out = 500 mL

IRV = air accomodated ē effort after ↑ Tidal inhalation = 3000 mL

ERV = air expelled ē effort after Tidal expiration = 1100 mL

RV = Air that remains after ~~flex~~ forcible expiration = 1200 mL



VC = Volume expelled forcibly after max. inhalation.

TV + ERV + IRV

IC = TV + IRV

FRC = ~~E~~RV + RV

TLC = TV + IRV + ERV + RV

VC = TV + IRV + ERV

IC = TV + IRV

FRC = ERV + RV

Conventional Spirometer = can't measure
- → RV
- → FRC
- → TLC

Methods for RV, FRC, TLC } He Dilution Method
N_2 washout
Body Plethysmography. (Best)

DYNAMIC LUNG VOL

1) Forced Vital Capacity = Rapid + forcible VC

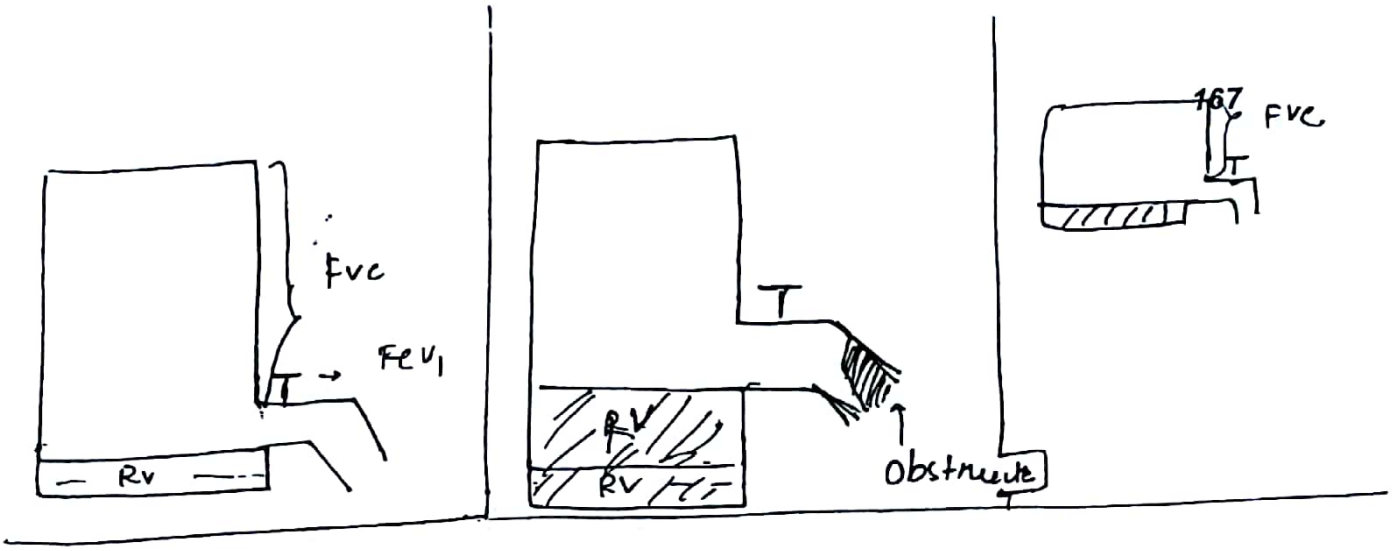
2) Timed Vital Capacity:
- → FEV_1 = FVC @ end of 1st sec = 80%
- → FEV_2 FVC @ end of 2nd sec = 90%
- → FEV_3 FVC @ end of 3rd sec = 98%

3) PEFR = Peak expiratory Flow Rate
- → Peak of FVC
- → Indicates [Large] airflow flow
- → 400-500 mL/min

4) MEFR → Avg. velocity during mid portion of exhalation.
- → sensitive indication of [small] airway function
- → 300mL/min

(N)	OBSTRUCTIVE	RESTRICTIVE
FVC (N)	FEV_1 ↓↓	FEV_1 (N)/↓
FEV_1 (N)	FVC (N)	FVC ↓↓↓
$\frac{FEV_1}{FVC}$ = (N)	$\frac{FEV_1}{FVC}$ = ↓↓	$\frac{FEV_1}{FVC}$ = ↑/(N)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397



OBSTRICTIVE

1) Asthma
2) Bronchiectasis
3) COPD → Chr. Bronchitis
   → Emphysema

RESTRICTIVE

Intrensic RLD
Pul. parenchyma involved

1) Fibrosis
2) Pneumonia
3) Sarcoidosis
4) Occupational lung disease
5)

Extrensic RLD
Pul. parenchyma uninvolved.

1) Kyphoscoliosis
2) Neuromuscular Disease
   a) GBS
   b) Polio myelitis
   c) Myasthenia Gravis
   d) Amy. Lat Sclerosis
3) Diaphragmatic Dysfunction

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

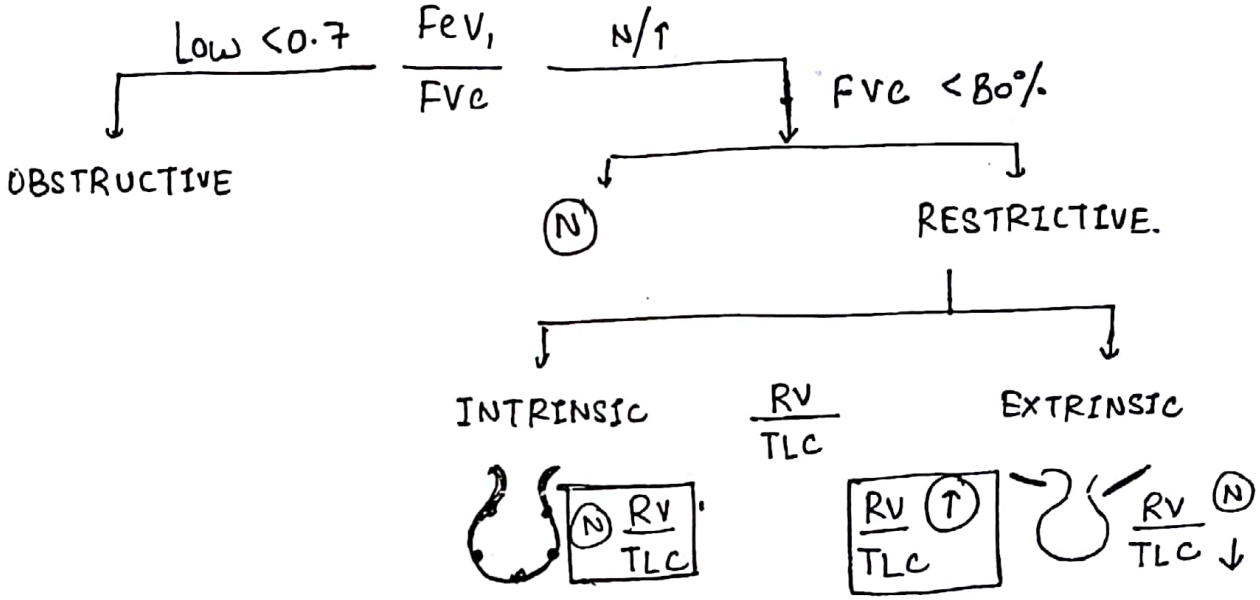
EMPHYSEMA

1) Obstructive
2) $\frac{FeV_1}{FVC}$ ↓↓
3) RV ↑, FRC ↑, TLC ↑
4) Compliance
   - Static (↑) — DLCO ↓
   - Dynamic (↓)

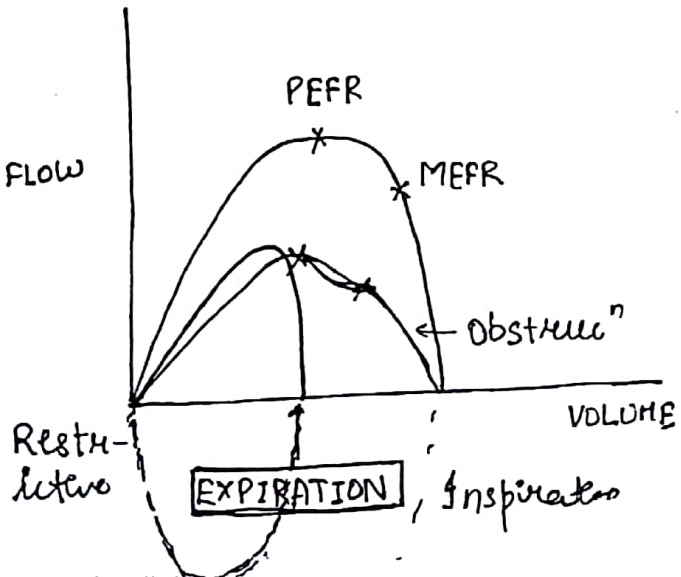
FIBROSIS / ILD

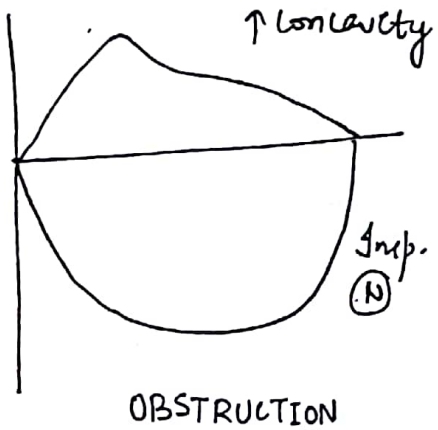
1) Restrictive
2) $\frac{FeV_1}{FVC}$ ↑/(N)
3) RV ↓, FRC ↓, TLC ↓
4) Compliance ↓
5) DLCO ↓

INTERPRETATION OF SPIROMETRY

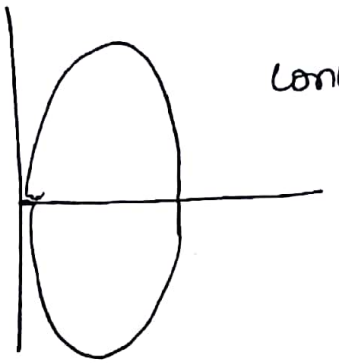


FLOW VOLUME LOOPS

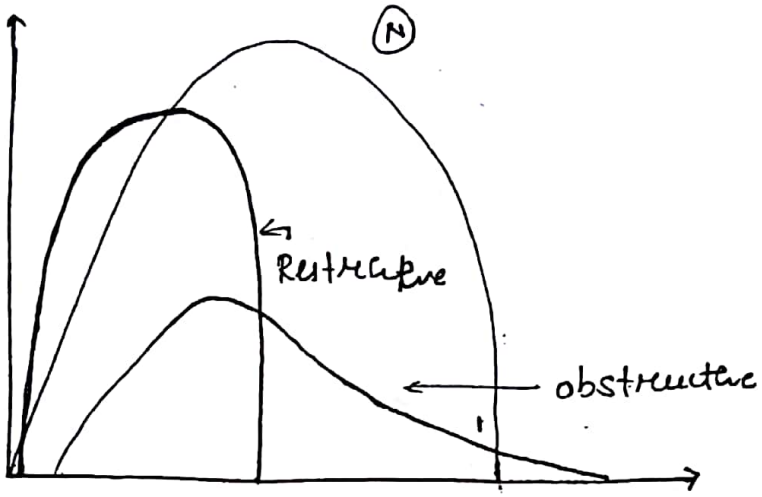




http://mbbshelp.com
WhatsApp: +1 (402) 235-1397



RESTRICTIVE



♀ FeV_1 (N) . ~~FEV~~ FVC (N) . $\frac{FeV_1}{FVC}$ (N) ⇒ ~~N~~

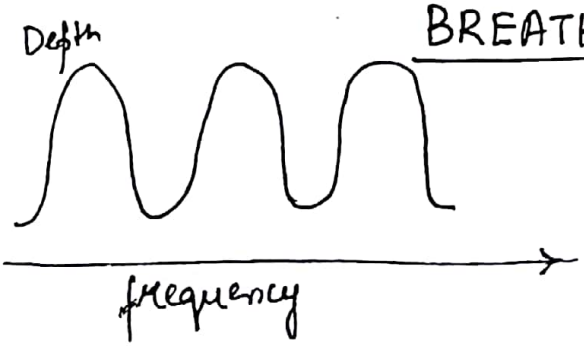
↓ spO_2 on ~~exam~~ exertion

↓ DLCO (young ♀)

⇓

↑ Pulmonary HTN

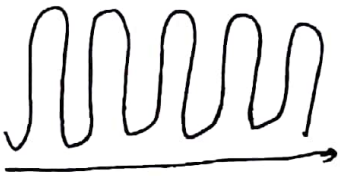
BREATHING PATTERNS



(N)

1) KUSSMAUL'S BREATHING :-

Rapid + Deep Breathing

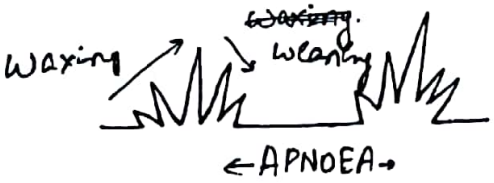


http://mbbshelp.com WhatsApp: +1 (402) 235-1397

eg. sev. Metabolic acidosis → DKA, Uraemia

2) CHEYNE STOKES BREATHING.

→ Periodic Breathing ∵ cyclical Pattern.



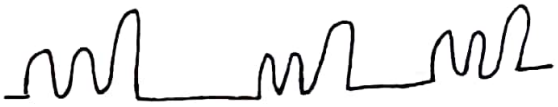
→ altered response to CO_2.

eg CHF, narcotic overdose, Head injury

3) BIOTS BREATHING

- Irregular respiration ∵ Apnoea

eg. Meningitis
↑ ICP



4) ATAXIC BREATHING

Irregularly irregular resp^n ∵ ↑ Apnoea

till pt. goes into resp. arrest

eg. Brainstem injury.

BREATH SOUNDS

(N)

→ Vesicular Breathing

→ Similar to sounds of rustling of leaves

→ Low pitch, soft

I:E = 3:1

No pause

Ab (N)

Bronchial Breathing

Similar to tracheal sound

High pitch, Harsh

I:E = 1:1

pause

1) Tubular Breathing → Consolidation

2) Cavernous " → Cavity

3) Amphoric " → Metallic quality

eg. Bronchopleural fistula

ADVENTITIOUS BREATH SOUNDS :-

WHEEZE (musical)

Produced when airflow past an obstruction due to vibration of airways

Monophonic	Polyphonic
Local involvement	Diffuse involvement
eg. Bronchial Tumour	eg. Asthma, COPD

Rhonchi :- Low pitch wheeze

CREPTS/ CRACKLES/ RALES

Non-musical sounds

1) When air flows into secretions

⇒ Bubbling noise

↓

cause crepts

Bronchiectasis

2) when alveoli suddenly pop open during inspiration

ILD

Velcro crepts

Fine crepts

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(B) Fine & Course Crepts

1) P. Oedema (fine >> course)
2) Pneumonia
3) TB

STRIDOR:- Loud, audible, inspiratory & expiratory wheeze due to Laryngospasm
F.B.
Laryngeal oedema
Subglottic stenosis

~~LES~~ -

PULLING	NO PULL/PUSH	PUSHING LESION
Collapse Fibrosis	Consolidation	Pleural effusion Pneumothorax
Percussion = Dull in collapse Impaired in fibrosis	Dull note	Stony dull in P. eff. Hyper-resonant/Tympanic in pneumothorax
Ascultation		
BS ⊖ in collapse BS ↓↓ in fibrosis	Bronchial Breathing ⊕	BS ↓ to ⊖
CXR		
collapse – Homogenous white	Air Broncho gram	Pl. eff = White meniscoid fluid level.
Fibrosis - Heterogeneously white		Pneumothorax = Black ō compressed lung margin

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

	PLEURAL EFFUSION	HYDROPNEUMO THORAX
Straight line of Dullness	⊖	⊕
Shifting Dullness	⊖	⊕
Succussion splash	⊖	⊕
Sound of coin.	⊖	⊕

RESPIRATORY FAILURE

Low pO_2 < 60 mm Hg (HYPOXIA), High $Paco_2$ > 45 mm Hg. (HYPERCAPNIA)

Type I RF - Hypoxemic RF

Type II RF - Hypercapnic RF

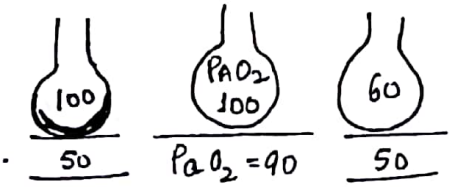
Type III RF - Perioperative RF due to lung atelectasis associated with general anaesthesia

Type IV RF - due to hypoperfusion of respiratory m/s due to shock.

TYPE I

Diffusion Defect

↓ Transfer of O_2.



$P_{A-a}O_2$ = 10 mm Hg

P_AO_2 = (N)

$Pa O_2$ = ↓

$P_{(A-a)}O_2$ = ↑↑

P_{aCO_2} = (N)/↓

TYPE II

Hypoventilation

↓ Resp. Effort

P_AO_2 = ↓

PaO_2 = ↓

$P_{(A-a)}O_2$ = (N)

P_{aCO_2} = ↑

pH ↓↓ (Resp. Acidosis)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

CAUSES

Pneumonia
ARDs
ILD
Pulmonary oedema
P. thromboembolism [Highest $P_{A-a}O_2$]

Rx O_2 + Rx of underlying disease

If pt. not improving
Pneumonia
ARDs

Invasive +ve pressure ventilation preferred

CENTRAL CAUSE

Narcotic use
Head injury

OBSTRUCTION

. F.B.
Severe COPD

PERIPHERAL

Neuromuscular Disorder

DIAPHRAGM CAUSE

Palsy

⇒ COPD - pneumonia

O_2 + Rx underlying cause

If pt not improving [COPD / NMD]

Non-invasive +ve pressure ventilation is 1st choice

NIPPV [BiPAP (NIV commonly used), CPAP]

If no response ⇒ IPPV

C/I of non-Invasive ventilation

1) altered sensorium
2) ↑ chances of aspiration
3) cardiac arrest
4) Hemodynamically unstable
5) Un co-operative pts.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

6) Claustrophobic

7) Active GI Bleed

8) Recent Facial Trauma or Sx

ARDS

Defn :- Acute shortness of Breath + Hypoxemia + Diffuse Pulmonary infiltrate

Causes:-

DIRECT	INDIRECT
1) Pneumonia	1) Sepsis (M/c)
2) Aspirating gastric content	2) Severe trauma
3) Lung contusion	3) ~~Blood~~ multiple Blood Transfusion.
4) Near drowning	4) Severe Burns.
5) Toxin inhalation	5) Pancreatitis

OTHER NAMES :-

1> Noncardiogenic Pul. oedema

2> ↑ permeability Pul. "

3> Low pressure Pul "

4> Diffuse Alveolar Damage (most characteristic)

5> Shock Lung

6> Wet Lung

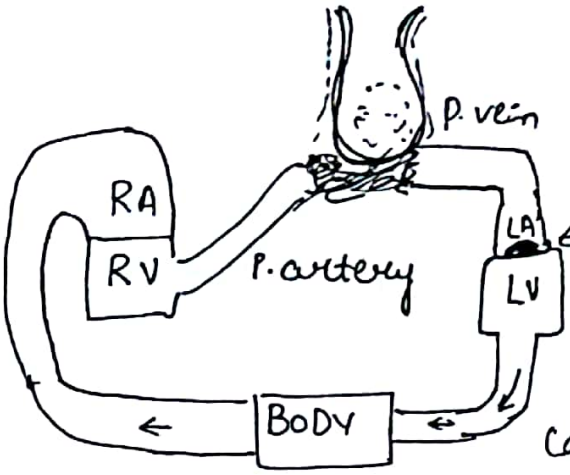
Pathogenesis

Cardiogenic P. oedema

Non-cariodgen P.Edema

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

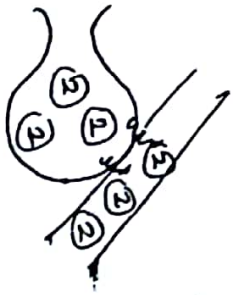
CARDIOGENIC P. Edema



↑ pr. in Heart (LA)
↓
↑ Pul. Capillary Pr.
↓
Pul. oedema
↓
↑ PA. HTN
↓
RHF

PCWP = ↑ in CPE.

NON - CARDIOGENIC



Damage to capillary endothelium & alveolar epithelium.

↑ Neutrophil entry = inflammation.

& damage = ↑ inflammatory exudate.

SHOCK LUNG.

PCWP / Pul. Arterial Occlusion Pressure

→ Swanzganz Catheter used

→ Indirect measure of LAP

→ In CPE PCWP > 18 mm Hg

In NCPE PCWP < 18 mm Hg

Dx:- Berlin 2012 Definition

1) Acute Onset < 7 day

2) Origin of oedema ⇒ non-cardiogenic & PCWP < 18 mm Hg

3) B/L diffuse infiltrate in CXR - PA

4) $\frac{PaO_2}{FiO_2} < \frac{60 mm Hg}{0.2} = < 300$.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

$\frac{PaO_2}{FiO_2}$ 200 - 300 = Mild ARDs

$\frac{PaO_2}{FiO_2}$ 100 - 200 = Mod. ARDs

$\frac{PaO_2}{FiO_2}$ < 100 = Severe ARDs

℞ Most Recommended Strategy / Beneficial :-

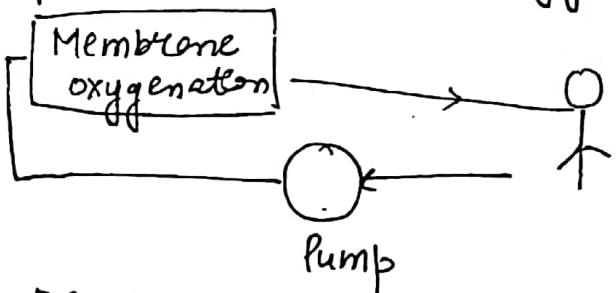
1) Low Tidal Volume Mechanical Ventilation (4-6 mL/kg Body wt.)
- Assist control mode to avoid ventilation associated Lung Injury

2) Adequate +ve End Expiratory Pressure

3) Gluco-corticoid may be helpful.

*Newer Ventilation Mode :-

1) Extra corporeal Membrane Oxygenation.



Mech :- Blood is pumped into membrane oxygenator ⇒ oxygenated blood is sent back into body.
Beneficial in severe ARDS.

2) Prone Ventilation.

MECH:- In prone ventilation. diaphragmatic Pressure on lower alveoli ↓ ⇒ ↑sed alveoli for oxygenation

~~at wt. of abdomen ↓~~

For Benefit ⇒ Done for 16 consecutive hours.

→ Helpful in improving oxygenation in pts c severe Hypoxemia.

→ Not helpful in pt. c pre-existing chest wall deformity/ severe fibrosis.

3) High Frequency Oscillator Ventilation

→ Low tidal volume are given c more frequency

→ Beneficial in few studies

TRALI

(Transfusion Related Acute Lung Injury)

→ Occurs in or during 6hr of transfusion.

→ Donor Plasma antibodies Vs Recipient leukocyte

→ Mediator release

→ Feature of ARDS

Rx: supportive

H/c of Transfusion related fatalities

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

P. THROMBOEMBOLISM (M/c of Cor. Pulmonale)

Migration of thrombus ∫ into Pulmonary artery

M/c source: Pelvic veins.

CAUSES

1°

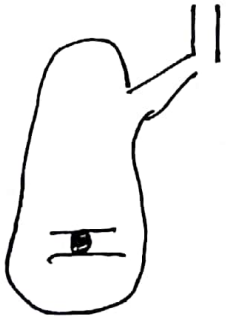
1) Protein C, S deficiency
2) Factor V Leiden mutation.
3) Lupus anticoagulant
4) Antiphospholipid antibody syndrome
5) Hyper homocysteinuria

2°

1) Prolonged immobilisation
2) Recent Trauma. Sx
3) High estrogen state
   eg. ♀,
   estrogen containing pills
4) malignancy
5) Nephrotic syndrome

PATHOPHYSIOLOGY

LUNG

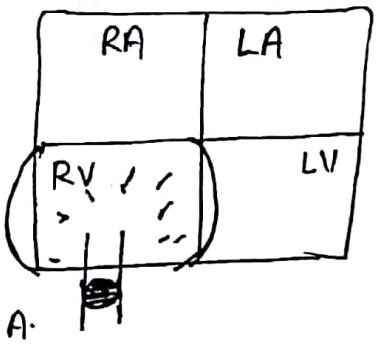


1) ↑ Pul. arterial Pressure
   ↳ rupture of vessel
   ↓
   Hemoptysis

2) ↑ Alv. Dead space = Hypoxemia
   ⇓
   Shortness of Breath.

3) ↑ Serotonin by platelets
   ↳ Bronchospasm → airway ↑ Resistance

HEART



↑ R.V. Pressure
RV Dilatation
RV Hypokinesia
Movement of septum into LV ⇒ Ventricular Interdependence
⇓
SHOCK

[COR Pulmonale]

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

4) Lung ischaemia → ↑ infl. mediators

5) Pleuritis → chest pain

6) Pleural effusion → Exudate >> Transudate

TRIAD

1) Chest pain
2) SOB (M/C symptom)
3) Hemoptysis.

COR PULMONALE :- alteration in str. & function of Ⓡ ventricle due to 1° disorder of Resp. System excluding disease of Ⓛ heart

M/C of chr. cor pulmonale → COPD

M/C of Acute " " → Massive PTE ⇓ present c shock

DIAGNOSIS

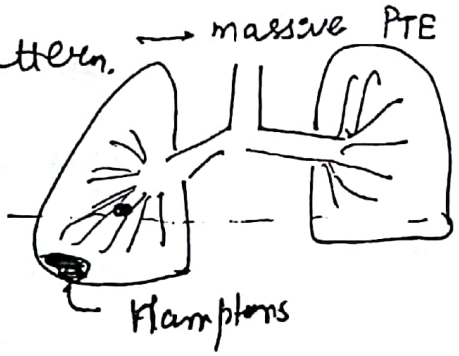
1) ABG → Type I Resp. Failure

2) ECG → M/C → Tachycardia, T wave inversion $V_1 - V_4$

3) Most specific → $S_1 Q_3 T_3$ pattern.

4) CXR → Ⓝ M/C

FOCAL OLIGEMIA (Westermark Sign)



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

2) Wedge shaped deformity above diaphragm
Hampton's hump

3) Palla's sign - Dilatation of (R) Descending Pul. artery

4) D-Dimer :-
Fibrin Degradation product
Elevated in PTE
Sensitive not specific
poor predictive value but good neg. predictive value

5) Ioc ⇒ CT Pulm. Angio

6) Gold Std ⇒ Invasive Pul angiography

7) V/p scan. - outdated
used in ♀ Contrast intolerance.

Rx

MASSIVE PE
↓
Shock + RV Dysfunc"
↓
Thrombolysis >
Surgical Embolectomy

SUBMASSIVE PE.
↓
(N) BP + RV dysfunc"
↓
Individual Rx
Thrombolysis /
Anticoagulation

MINIMAL PE
↓
(N) BP + (N) RV function.
↓
Anti-coagulation.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

PULMONARY HTN

MPAP > 25mmHg @ rest

MPAP > 30mm Hg ↑ exercise

MECH. ↓ WHO CLASSIFICATION

Group I - Direct involvement of Pul. artery

a) Heritable cause/ 1° Pul HTN - mutation in $BMPR_2$

↓

↑ smooth m/l proliferation

↓

young ♀.

Biopsy → Plexiform lesion.

b) Connective Tissue Disorder.

M/C cause ⇒ scleroderma, SLE.

c) Drugs/Toxin - Fenfluramine.

Toxic rapseed oil

Group 2 - Due to (L) Heart Disease

Group 3 - Due to Resp. diseases.

COPD/ ILD / Bronchiectasis/ OSA

Hypoxemia → Pulm. vasoconstriction → P. HTN → Cor Pulmonale

Group 4 - Due to chronic thromboembolic events in Pulm. circulation.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Group 5 - Miscellaneous / unclear cause

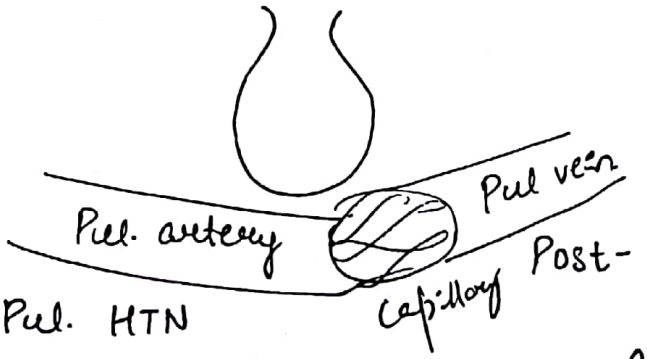
Sarcoidosis

Sickle cell Disease

Langerhans cell histiocytosis / Eosinophilic granuloma (misnomer)

~~Lymphangiomatosis~~

Lymphangioleiomyomatosis



Pre-cap Pul. HTN

↓

Group ①, ③, ④

MPAP > 25mmHg

PCWP < 15mm Hg

Post-capillary Pul. HTN

↓

GROUP ②

MPAP > 25 mm Hg

PCWP > 15mm Hg

℞

GROUP ① + Refractory cases from other groups

1) CCB - Nifedipine (now not used frequently)

2) PDE 5 Inhibitor

Sildinafil

Tadafil

3) Endothelin Receptor antagonist

Bosentan

Ambrisentan.

Other Groups

℞ underlying disease

4) Prostacyclin -
Epoprostenol (IV)
Iloprost (Inhaled)

5) Guanyl cyclase activator
Riociguat

DOC for Low Risk Cases :- Initial monotherapy of Less Symptoms either PD5 Inhibitor or ETRA ↓ followed by combination Rx.

DOC for High Risk / Emergency :- Prostacyclins (Symptoms at Rest)

PNEUMONIA

Acute resp illness characterised by Radiological Pulmonary shadowing.

CLASSIFICATION -

COMMUNITY-ACQUIRED P.	HOSPITAL ACQUIRED P.	VENTILATOR ASSOCIATED P.
→ Occurs in ambulatory individuals.	Occurs after 48 hrs of hospital stay.	Occurs 48-72 hrs after endotracheal intubation + Mech ventilation
→ <48 hrs of hospitalisation		
M/Cc CAP → Strept. pneumonia	Mcc HAP	
Mcc CAP - Hospitalisation ↑ ↓ ICU Admin	Gram-ve Bacilli > Staph. aureus	

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

VAP

<5d | >5day

Early

↓

M/C Strept. pneumonia

H. influenza

Drug sensitive org.

So, good response

Late

↓

Drug resistant org

M/c ↓

Pseudomonal

Staph. aureus

Acinetobactor

↓

Poore response

CLINICAL CLASSIFICATION

TYPICAL

Fever + Productive cough

Predominant neutrophilic leucytosis

Gram staining → reveal organisms

CXR → Alveolar exudates

M/c - Strept. Pneumoniae

Staph. aureus

Klebsella

Pseudomonal

ATYPICAL

Interstitial Inflammation

Fever + cough ⇒ scanty sputum

Mild Leucocytes

Gram staining → no organism

CXR - NO alveolar oxidation

- Interstial pattern

M/c - Mycoplasma

Legionella

Coxiella

Chlamydia

Viral Pneumonia

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

TYPICAL PNEUMONIA

(I) STREPT

Risk Factors — M/c
- Smoker
- alcoholic
- DM

c/F Red rusty Sputum

CXR Localised involvement of lobe/segment

(M/c) pattern in CAP

Rx - β lactams

(II) STAPH

IV drug users pneumonia

Fatal pneumonia post viral illness

mucopurulent sputum

CXR

Bronchopneumonia

B/L, patchy involvement

(M/c) pattern in nosocomial Pneumonia

Pneumatocele + cavety + Lung abscess may be seen

Rx MRSA = Vancomycin

VRSA = Linezolid

(III) KLEIBSELLA

Alcoholics
DM
malnourished

Red currant Jelly Sputum

CXR

Bulging fissure sign

- cavities
- Dense consolidation
- Lower lobe involvement seen if hematogenous spread

Rx -
Blactam + Aminoglyoside

(IV) PSEUDOMONAS

→ Frequently occurs as VAP

→ occur as Recurrent pneumonia in → Structural Lung disease, cystic fibrosis, Bronchiectasis

→ Fever, mucopurulent secretion, Leucocytosis.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

- B/L infiltration of CXR

Rx - Two Anti pseudomonal ABs of 2 different class.

Antipseudomonal ~~ABs~~ β lactam + FQ (or) Aminoglycoside

ATYPICAL PNEUMONIA

MYCOPLASMA / Walking P.

M/c atypical pneumonia

Eaton agent pneumonia

Man → Man transmission.

Extrapulmonary features

1) CNS - GBS
peripheral neuropathy

2) Ear - Bullous myringitis

3) Blood - ↑ cold agglutinins
Heamolytic anaemia

4) CVS - Myocarditis
Pericarditis

5) Skin - Erythema Nodosum

No cell wall (+)

Rx - Macrolide / FQ / Tetracycline

LEGIONELLA

M/c mode of Transmission -
micro aspiration > Aerosolization

Spreads through contaminated water

Limited man to man transmission

Special Features :-

1) Associated GI features : diarrhoea

2) " CNS features :-
confusion, headache,
high grade fever

3) Altered LFTs

4) S. Na^+ < 130 meq

Gram staining → no Organism

Poor response to β lactams

Old age, Immunocompromised

occurs in 10 days discharge from hospital

Rx - FQs / Macrolide / Tetracycline

↓

Resp FQs - Levo / Moxi

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

PNEUMOCYSTIS PNEUMONIA (PCP)

M/c opportunistic infection in HIV = TB

M/c pneumonia in HIV = TB

M/cc pleural effusion in HIV = TB

M/cc fungal pneumonia in HIV = PCP

R/F:-

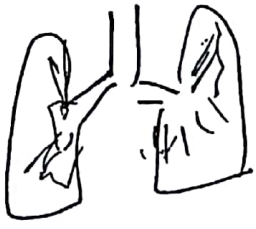
1) $CD_4 < 200$ /μL in HIV
2) Long Term Immunosuppressive Rx
3) Organ Transplant
4) 1° Immunocompromised

C/F:-

Subacute onset
Fever
Shortness of Breath
Hypoxemia

CXR:-

Perihilar infiltrates
Diffuse interstitial infiltrate
In few - pneumatocele
Complicate a Pneumothorax



Δ:- Visualize the cyst → Wright - Giemsa
→ Gomori - methamine stain.
Broncho-alveolar lavage (Best sample)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

℞ - COTRIMOXAZOLE (Septran)

If sulpha allergy → 1) Clendamycin + Primaquine
2) Trimethoprim + Dapsone
3) Pentamidine
4) Atovequone

DOC for Prophylaxis → COTRIMOXAZOLE
↓
DOC for NOCARDIOSIS.

VIRAL PNEUMONIA

BIRD FLU (H_5N_1)

- Avian Influenza
- Less M → M transmission
  Epidemic not pandemic

DOC - Oseltamivir

SWINE FLU (H_1N_1)

- ↑↑ M → M transmission
- Epidemic + Pandemic

DOC - Oseltamivir
75mg BD for 5 days
(neuraminidase Inhibitor)

Doc prophylaxis - Oseltamivir
75mg OD for 10 day

other drugs - Zanamivir
Peramivir

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

ASSESMENT of SEVERITY_

C onfusion

Urea > 7 mmol/L or > 20 mg

RR > 30/min

B - SBP. < 90 mm Hg DBP < 60 mm Hg

65 Age age > 65

0-1 ⇒ Home Rx ē antibiotic

2 ⇒ Hospitalization . Rx

3-5 ⇒ Consider as severe pneumonia , may require ICU admincon.

EMPIRICAL REGIMEN FOR HOSPITALISED Pt OF PNEUMONIA

⇛ TYPICAL + ATYPICAL

β lactam + Macrolide

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

LUNG ABSCESS

1° ~~ABS~~ form

M/c type

Due to aspiration

M/c organism - oral anaerobes

↓

Rx - IV. Clindamycin.

2° form

Occurs due to pre-existing disease process in lung

Bronchial obstruc"

Immuno deficiency

Staph, Klebsiella

Rx - Broad spectrum ABs

Strategies to Prevent VAP :-

1) Elevation of Head of Bed 30°-45°

2) Oral Decontamination ⊂ Chlorhexidine

3) Sedation vacation (↓ sedation)

4) Assesment of readiness to extubate daily

5) Use of NIV wherever feasible

X Frequent change of Tubex

ORAL ANAEROBES-

→ Peptostreptococci

→ Fusobacterium

→ Bacteroide

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

PLEURAL EFFUSION

TRANSUDATE (H/c) — LIGHT's CRITERIA — EXUDATE

Ple. fluid. Protein / S. protein < 0.5

Pl. fluid LDH / S. LDH < 0.6

> 0.5, 0.6.

Cause-
1> CHF (H/cc overall)
2> Hepatic Hydrothorax
3> Nephrotic Sx

Cytology = ? malignant cells
Cell count
Gram staining ? infection
TB marker = ADA, Interferon γ

Special Features

1> Low glucose ple. fluid (< 60 mg%)
a> Empyema
b> Malignancy
c> RA
d) TB (Rare)

2> High Amylase
a) Pancreatitis
b) Oesophageal rupture
c) malignancy

3> High Lipid Ple. Eff / White coloured

Chylothorax
Accumulation of Chyle due to disrup° of thoracic duct
H/c - Surgical Trauma, Malignancy
Pl. TGA > 110 mg%

Pseudochylothorax
Accumulation of cholesterol crystals in long standing eff.
TB, RA, Ch. empyema, myxoedema
cholesterol > 200 mg%.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Parapneumonic Eff
H/c of exudative Pleural Eff
Eff associated c Pneumonia
Bronchiectasis
Lung abscess

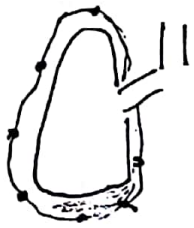
Milky white BAL
193
Alveolar Proteinosis

Indications of ICD insertion in parapneumonic Eff :-

1) Pus in pleural cavity
2) pH < 7.2 (pleural fluid)
3) Ple f. glucose < 60mg%
4) Loculated pleural effusion
5) Gram staining reveals organisms

TB Effusion

- H/c exudative effusion in India
- Occurs due to hypersensitivity response to TB Bacilli in Pleural Tissue



- Exudative — Lymphocyte predominant
  ADA > 40 IU
  IFN γ > 140 pg/mL
  ↓ mesothelial cells
- Pleural Fluid for AFB only positive in 20-30% cases.

Gold Std — Thoracoscopic pleural Biopsy + Culture for M. tb.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

PNEUMOTHORAX & PNEUMOMEDIASTINUM

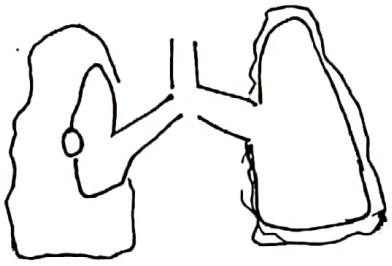
Classification of Pneumothorax :-

- SPONTANEOUS
  - 1°
    - No underlying Lung disease
  - 2°
    - Pre-existing lung disease
      - COPD (Mcc of 2° spon. pneumothorax)
      - Bronchiectasis
      - ILD, TB
- TRAUMATIC
  - Iatrogenic
    - 1) Transthoracic needle aspiration (Mc)
    - 2) Mech. ventilation
    - 3) Insertion of subclavian catheter
  - Chest wall injuries
    - RTA.

TENSION PNEUMOTHORAX

1> Large air leak

2> Air Leak serves as Ball valve (or) one way valve mechanism



3> ↑↑ Positive intrapleural Pressure

4> Compressing adj lung + mediastenal vessels

↓

↓ VR

↓

Shock (medical emergency)

5> Rx- Next step / Best step- Insertion of wide bore needle @ 2nd I.C.S. anteriorly mid clavicular line on affected side followed by ICD insertion.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

High Inspiratory Pressure alarm on ventilator can suggest Tension Pneumothorax.

Pneumo Mediastinum

Air in mediastinum

C/F - Shortness of Breath
Chest pain
HAMMAN'S Crunch → Crunching sound synchronous c heart Beat

CXR - Continuous Diaphragm Sign.
Subcutaneous Emphysema

ASTHMA

Characterised By recurrent symptoms due to variable & reversible bronchoconstric" caused due to airway hyper-responsiveness to variety of stimuli

COPD - characterised by persistent symptoms & airflow limitation due to airway & alveolar abN caused by significant exposure to noxious stimuli.

ASTHMA	COPD
Allergan related	Smoking related
Reversible airflow limitation	Persistent airflow limitation
Early Presentation	Delayed presentation
Relief c Bronchodilators	only partial response

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

TYPES & PATHOGENESIS

EXTRINSIC / ATOPIC / ALLERGIC	INTRINSIC / ~~NONALLERGIC~~ NONATOPIC / IDIOSYNCRATIC
Allergan related	Viral infection ⇒ TRigger
S. IgE ↑	S. IgE (N)
Skin test +ve for allergan	Skin test -ve ~~for~~
Mild form	Severe forms
Young onset	Late onset

M/c allergen world
↳ HOUSE DUST MITE / Dermatophagorde

Pollen → cause Thunderstorm Asthma

Δ :-

1) SPIROMETRY

obstructive

Bronchodilator reversibility = ↑ FeV_1 > 12% (or) 200cc after SABA.

FeV_1 65% $\xrightarrow[15\,min]{SABA}$ FeV_1 80%

2) PEFR variability

>20% diurnal variation.

3) METH. CHOLINE challenge Test / Broncho provocation Testing

fall in FEV_1 > 20% after meth. choline.

for airway hyper-responsiveness

4) FeNO > 50 PPb ≈ Eosinophilic inflammation.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

ACUTE SEVERE ASTHMA.

C/F-

1) Pt. speaks in words
2) can't recline
3) RR > 30/min
4) HR > 120/min
5) B/L Wheeze
6) Accessory muscle use
7) Pulsus Paradoxus → [Rapid change in intrapleural pr. causes this]

Functional Parameters :-

1) PEFR < 50% predictive value.
2) SpO_2 < 90%
3) PaO_2 < 60mmHg

→ Type I Resp. Failure

~~First~~ Type 2RF can occure in severe cases
↳ due to fatigue of resp. muscles.

* Life Threatening Asthma :-

1) Patient - altered sensation
2) Silent chest
3) ↓ Respiratory effort
4) PaO_2 < 60mmHg
5) $PaCO_2$ ↑↑

Rx - 1) O_2 +
2) SABA + (salbutamol) + Inhaled corticosteroid
· SAMA (Ipratropium)
2) I.V. Steroid ← ↓Inflammation
↑ sensitivity of β_2 receptor to bronchodilator

3) Theophylline now not used routinely

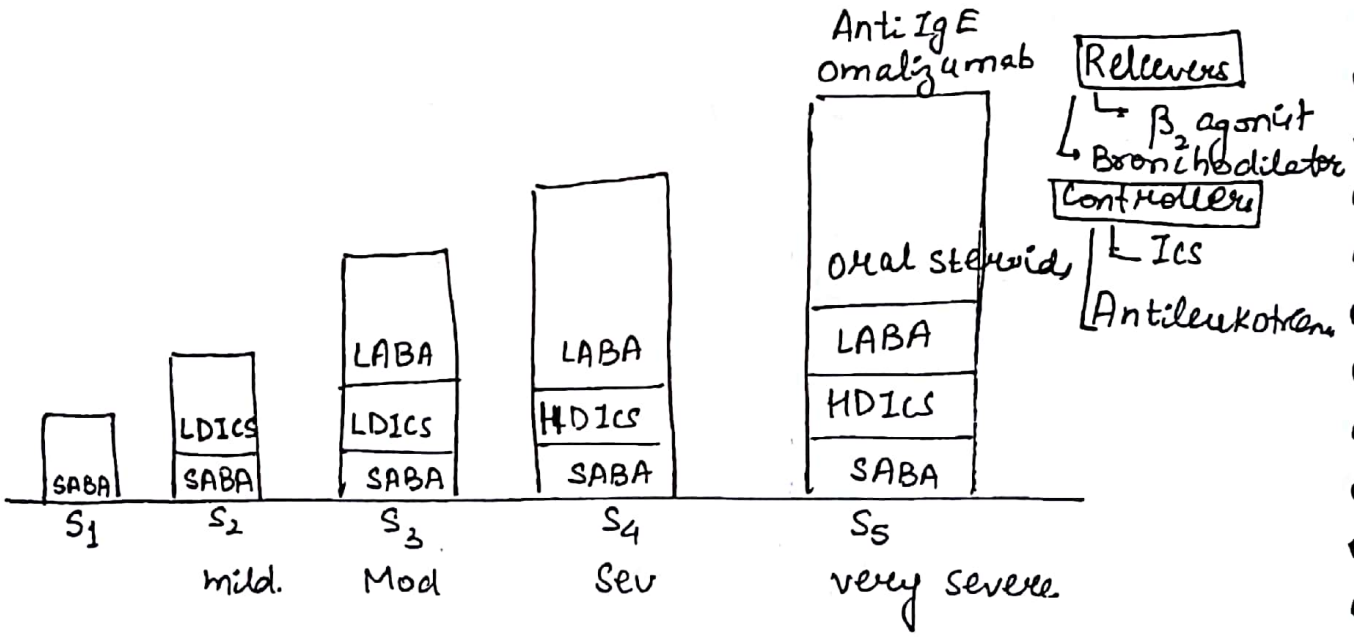
4) In few cases **IV $MgSO_4$** given

5) In deteriorating / life threatening case ⇒ **Invasive**
Mech. ventilation.

High inspiratory flow ← → ↑ Expiration Time
I:E = 1:3 or 1:7.

Step Wise Therapy & Classification

	Intermittent	Persistent		
		Mild	Mod	Sev
Day Time Sx	< 2/week	> 2/week	daily	through-out day
Night time awakening	< 2/month	> 2/month	> 2/week	daily



LDICs → low dose ICs.

HDICs → High dose ICs.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Most Imp. in Asthma management is pt. ~~self~~ education & active self Mx. 199

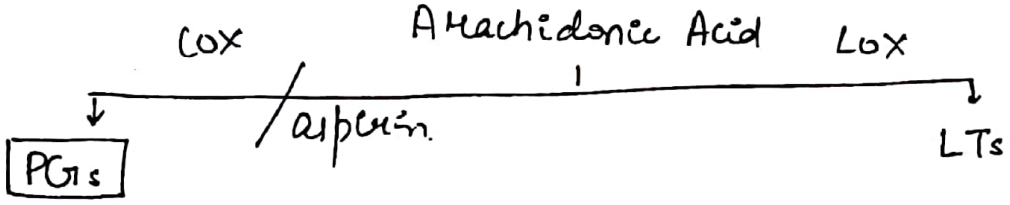
EXERCISE INDUCED ASTHMA

In susceptible individuals, exercise can induce asthma more frequent during cold & dry climate > hot humid condition.

DOC for short term prophylaxis = SABA > Anti-leukotriens / Mast cell stabilizer.

DOC for Long term prophylaxis & overall control of disease } Corticosteroids

ASPIRIN INDUCED ASTHMA



Samter's TRIAD–

Nasal polyposis + Aspirin sensitivity + Asthma

In susceptible individuals. aspirin blocks COX pathway & shifts balance towards LOX pathway ⇒ ↑ LTs ⇓ Bronchospasm.

Rx = ICS + ~~Aspirin~~ SABA + Anti-leukotrienes + Aspirin desensitization.

BRITTLE ASTHMA

Unstable Disease ∴ frequent exacerbations

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(N)	Type 1 Brittle	Type 2 Brittle
Lung function	Persistent fluctuation in lung functions	Near normal Lung function → Rapid fall + death.
	Difficult to Rx asthma * Oral corticosteroids + continuous infusion of β_2 agonist	Localized anaphylaxis ↓ Laryngospasm DOC :- Subcutaneous epinephrine + Adrenaline

CORTICOSTEROID RESISTANT ASTHMA

Poor response to Rx after 2 weeks of oral corticosteroids (40mg/day) Rx

steroid sparing drugs can be used.

Anti IgE = **Omalizumab.**

Anti IL5 = **Mepolizumab**

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

COPD

CHR. BRONCHITIS:-

Cough ± sputum for >3 months in 2 consecutive years

EMPHYSEMA:-

Destruc" distal to terminal bronchiole.

R/F:-

1) Smoking
2) α_1 AT Deficiency
3) Indoor + outdoor pollution.
4) ~~Cold~~ exposure coal.

→ young age
→ Less smoking H/o
→ Family H/o - Chr. 14, AR.
→ B/L Lower predominant
→ Bronchiectasis
→ Unexplained Liver Disease.

TYPES OF EMPHYSEMA

	CENTRIACINAR	PANACINAR	DISTAL ACINAR
occurence	Smokers M/c overall. Upper lobes	α_1AT Def. More severe in LL	Adjacent to fibrotic foci. Upper 2/3rd of Lung
Pathology			
	RB involved alveolar duct + Sac spared	Resp. Bronchiole + Alv. Duct + Sac involved	Resp. Bronchiole spared Alv. duct + Sac involved

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Δ:- 1) SPIROMETRY

$\frac{FeV_1}{FVC} < 0.7 \approx$ Obstructive

No significant Bronchodilator reversability

GOLD Staging (Global Iniative for obstructive Lung Disease)

I Mild $FeV_1/FVC < 0.7$ FeV $\geq 80\%$ Pred FeV_1

II Mold. " " " FeV_1 50-79 % " "

III Severe " " " FeV_1 30-49% " "

IV very severe " " " $FeV_1 < 30\%$ pred. value

Prognosis Index

BMI

Obstruction (FeV_1)

Dyspnea (MRC scale)

Exercise Capacity ⇒ Distance covered in 6 minute walk test

Low score ⇒ Good Prog.

High score ⇒ Poor Prog, ↑ mortality

CHARACTER	BLUE BLOATER	PINK PUFFERS
PATHOLOGY	Chr. Bronchitis.	Emphysema.
SYMPTOM	Cough ± expectoration	Shortness of Breath
APPEARANCE + POSTURE	obese + comfortable at rest	lean + tachypnoeic at rest
Breath sounds	Rhonchi - Noisy	Less noisy
CXR	↑ Interstitial Marking	Hyperinflated Lung
PFT	obstructive	obstructive

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Rx :-

1> Smoking cessation. → most imp. intervention.

2> BRONCHODILATORS

A> LABA

Ultra LABA → O.D. Dose

- ✓Indacetrol
- ✓Vilanterol
- ✓Oladetrol

B) LAMA

- Tiotropium
- Umiclinidium
- Glycopyronium.

3> STEROID :-

a) Inhaled

↓ freq. of exacerbation

b) Systemic

During exacerbation.

4> SELECTIVE PDE_4 INHIBITOR :-

Roflumilast

5> ANTIBIOTICS :-

During exacerbation (H. influenza)

6) MUCOLYTICS -

N Acetyl cysteine

7) If Hypoxemia → Long Term O_2 therapy (15 hours a day)
low flow O_2

8) Lung volume Reduction surgery

9> LUNG TRANSPLANTATION (M/c Indication for lung transplantation is COPD)

10> During exacerbation, 1st choice - non-invasive ventilation.
> Invasive ,,

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

BRONCHIECTASIS

Ab (N) Permanent Dilatation of bronchi due to loss of muscle & elastic tissue.

Initiating event
↓
Altered mucociliary clearance
↙
obstruction.

Vicious Cycle Theory

↘
Recurrent infection → Inflammation → Destruction & dilatation → Altered mucociliary clearance

C/F :-
copious sputum
coarse crepts

ETIOLOGY & MECH :-

I) BRONCHIAL OBSTRUCTION

a) Intramural

Tumours - Carcinoid
Sq. cell carcinoma
Small cell carcinoma

b) Extrinsic Compression.

Enlarged TB hilar LN can compress (R) middle Lobe Bronchus → (R) middle Lobe collapse & bronchiectasis
⇓
BROCK'S SYNDROME.

II> BRONCHIAL INJURY

A) Infection

TB, adenovirus

B) Altered Immune response

→ Connective Tissue Disorders

→ Allergic Bronchopulmonary Aspergillosis (ABPA)

III> TRACTION BRONCHIECTASIS in ILDs

IV> GENETIC CAUSES

A> 1° ciliary dyskinesia

B> Cystic fibrosis

C> Cartilage Defect

- William campbell S.
- Mounier Kuhn syndrome

D) Yellow Nail Syndrome

Cong. Lymphoedema + Yellow nail + Pleural Effusion + Bronchiectasis

CYSTRIC FIBROSIS

Inheritence - AR

Chromosome 7q

Gene - CFTR

Channel - Cl^-

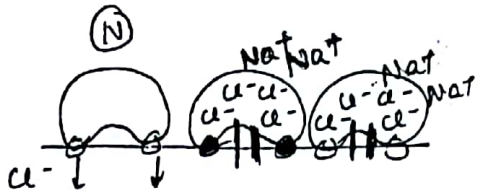
Mutations - Class I - VI

M/c class II, ΔF508

" Thick secretions "

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(I)



Resp. Tract
GIT
Reproductive Tract

watery secretions

Thick viscid secretions dehydrated

ENaC → responsible for pathophysiologic process

(II)

Sweat Gland

SCREENING Test
↑ Sweat Cl^- > 60 mEq.

Other Inv:-

1) DNA analysis for mutations

2) ↑ Nasal Pot^n Difference

3) CFTR Gene sequencing :- Gold Std.

SYSTEMIC MANIFESTATIONS:-

1) Respiratory Tract -

URT
↓
Recurrent infections
Sinusitis

LRT
↓
Recurrent pneumonia
(M/c pseudomonas), steph.
Bronchiectasis, Lung abscess
Empyema, P. thrombosis,
Resp. failure, Hypoxemia,
P. HTN, Cor Pulmonale

2) GIT
neonate Meconium ileus.

Liver → Biliary cirrhosis,

http://mbbshelp.com
WhatsApp: +1 (402) 235-1397

GB - Gall stone

Pancreas

- Exocrine insufficiency - early manifestations
- DM, → occurs later.

3) Reproductive Tract -

♂ In utero occlusion of vas Deferens by thick secretions → AZOOSPERMIA. → infertile

♀ Thick cervical secretions

℞

1) CFTR Modulators :-

Ivacaftor - G551D mutation class III

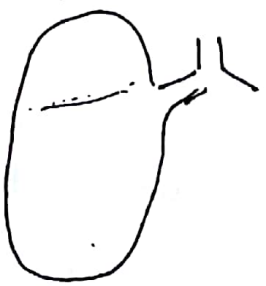
Lumecaftor + Ivacaftor - tried in class II

TYPES OF BRONCHIECTASIS -

H/c - Cylindrical Varicose Saccular

SITES of B'XIs -

1) Upper Lobe



1) Cystic fibrosis
2) TB
3) Post radiation BXIs

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

2) Lower Lobe

1) Interstial Lung Disease
2) Chr. recurrent aspiration
3) Immunodeficiency state

3) Middle Lobe - non-tubercular mycobacterium.

Mycobacterium avium complex (MAC)

Rx of B'XIS-

1) Airway clearance.

Mucolytics ← → Chest Physiotherapy.

2) Antibiotics

During exacerbation

Prophylaxis

- Long term Azithromycin (6 months)
- Inhaled Tobramycin (1 month on-off)

3) Bronchodilator + ICS beneficial in some

4) If Hypoxemia ⇒ O_2.

5) Localised Disease → Sx

6) Diffused " → Lung Transplantation.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

High flow O_2 not recommended. Y ?

1> Abolition of Hypoxemic resp. drive

2> High O_2 given can cause release of CO_2 from RBC
↳ HALDANE EFFECT.

IOC :- HRCT Chest

EOSINOPHILIC LUNG DISEASES

[Peripheral eosinophilia + Lung infilterates]

CLASSIFICATION

Unknown cause	Known cause
1) Acute eosinophilic pneumonia	1> PARASITIC INFESTATIONS (Nematods)
2) Chronic " "	Loeffler's pneumonia
3) Hypereosinophilic syndrome	2) ABPA
4> Churg strauss Sx	3) Drugs :- Nitrofurantoin, sulfonamides, Isoniazid, Pencillamine

Hypereosinophilic Syndrome -
Persistent (6 months) eosinophilia > 1500/mm^3.
& end organ infilteration.

CHARACTER	Ac. EP	Chr. E. P.
Smoking H/o	+++, new onset smokers	±
Asthma H/o	--	++
CF - Radiology	Acute shortness of Breath + Hypoxemia + B/L diffuse infilterates.	Cough + wheeze. Peripheral opacities
Peripheral eosinophilia	Initially not seen but seen during later course of disease	Usually seen

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

	AEP	CEP
BAL eosinophilia	BAL > 25% eosinophil	BAL > 40% eosinophil
Rx	steroid	steroid

ASPERGILLUS & LUNG

I> HYPERSENSITIVITY RXN. → DOC :- steroid

Type I ⇓ Asthma

Type I, III, IV ⇓ ABPA

II> PNEUMONIA IN IMMUNOCOMPROMISED → DOC :- VORICONAZOLE.

= Invasive Aspergillosis

Transbronchial angioinvasion. → may develop hemoptysis
· Fever + SOB.

DOC for (I) & (IV) ⇒ STEROID.

DOC for (II) ⇒ VORICONAZOLE

III> COLONISATION IN PREXISTING LUNG CAVITY

Aspergilloma / Fungall BALL

CXR → 1) Air crescent Sign.
2) Ball changing its position :- decubitus.

Rx - Resection if pt. is symptomatic

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

CRITERIA FOR ABPA

1) Predisposing cond^{n} - ✓Asthma
✓Cystic Fibrosis

2) Peripheral **Eosinophilia**

3) S. IgE → **> 1000 IU**

4) Aspergillus specific IgE & IgG will be +nt

5) Skin test +ve **aspergillus fumigatus.**

6) CxR - **fleeting opacities** → upper zone

7) Central (or) Proximal **B' XIs**.

Doc:- Systemic steroids.

CT chest -
- ✓Finger in glove
- ✓Toothpaste

HYPERSENSITIVITY PNEUMONITIS
or Extrinsic Allergic Alveolitis

Type III + IV HSN

S. IgE → (N)

No. peripheral eosinophilia

BIOPSY → non caseating granuloma + cellular bronchiolitis + Interstitial inflammation.

~~Eg~~s.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

DISEASE	EXPOSURE	ANTIGEN
1) Farmar's Lung	Moldy hay	Micropolyspora faeni / Thermoactenomyces Sacchari (Thermo actenomyete)
2) Bagassosis	Sugarcane dust	
3) Bird fancier Lung	Pigeon excreta	Avian protein
4) Malt worker Lung	Mouldy Barley	Asp. clavatus
5) Hot tab lung	Contaminated water	Non-Tuberculer mycobacterium

Astic CRITERIA :-

1) Exposure to known antigens
2) Presence of serum precipitins against offending Ag.
3) Occurence of symptoms in 4-6 hrs of exposure
4) Reoccurence of symptoms on exposure
5) Inspiratory crepitation.
6) wt. loss

TYPES

	CT Chest
ACUTE - hours to days	Ground glass opacities
SUBACUTE - week.	Centrilobular nodules
CHRONIC - Month	Fibrosis (upper zone)

Rx - Most Important → Avoidance of allergen
Systemic steroids

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

ILD

Def":- Group of Disorders characterised by predominant involvement of interstitium progressing to fibrosis & vary in mechanism & magnitude.

ETIOLOGY:-

I> Inhalational ILD

- Organic Dust → Hypersensitivity Pneumonitis
- Inorganic Dust → Silica, Asbestosis

II> Drugs / Radiotherapy
- Amiodarone
- Methotrexate
- Busulfan

III> Connective Tissue Disorder
- Scleroderma
- RA
- SLE

IV> IBDs

V> Infections - TB

VI> Malignancy

VII> Sarcoidosis

VIII> Idiopathic

PATHOLOGICAL PATTERNS:-

1> Usual Interstitial Pneumonia (UIP)

2> Non-specific " " (NSIP)

3> Acute Interstitial Pneumonia (AIP)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

4) Cryptogenic Organising pneumonia (COP)
5) Respiratory Bronchiolitis (RBILD)
6) Desquamative Interstitial Pneumonia (DIP)
7) Lymphocytic " " (LIP)

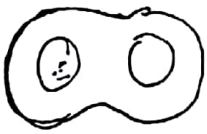
IOC :. ~~CT~~ HRCT chest

Confirmatory Test :. Surgical Lung Biopsy

RADIOLOGIC PATTERNS

Reticular Pattern.

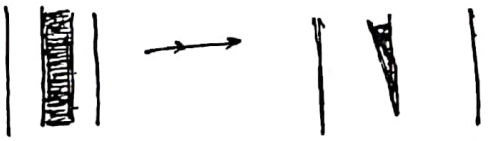
CT Chest



Mild opacity = Ground Glass opacity

Used density = consolidation.

↓ Fibrosis



TRACTION BRONCHIECTASIS

fibrosis ↑↑↑
↓ Lung volume

Honey combing

Subpleural involvement (near to pleura)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

	Usual Interstitial Pneumonia (M/C form) or Idiopathic Pul. Fibrosis	NSAIP. (M/c form of connective tissue disorder associated ILD) 215
C/F.	50-60yrs ♂ > ♀, Smoker. insidious, Auscultation - Inspiratory crepts. Exam - clubbing	40-50yrs ♀ > ♂ Non-smoker, subacute onset.
Biopsy	Heterogeneous involvement Fibroblastic foci	No fibroblastic foci Lymphocytic inflammation
Radiology	- B/L Lower zone & - subpleural involvement - Minimal Ground glass opacity - Significant Traction B'XIS - Honeycombing	B/L ground glass opacities Minimal Traction Bronchiectasis Rare honeycombing
Rx + Prognosis	Poor response to Pirfenidone Nintedanib	Good response. ī ⊙⊙ steroid

ACUTE INTERSTITIAL PNEUMONIA / HAMMAR RICH SYNDROME

Pt- present ī acute SOB + Hypoxemia + Diffuse infiltrate

Idiopathic ARDS

Rx- supportive. High mortality

CRYPTOGENIC ORGANISING PNEUMONIA / BRONCHIOLITIS OBLITERANS ORGANISING PNEUMONIA (BOOP)

1) Pneumonia like illness
2) Proliferation of granulation tissue in airway ⇒ MAISON BODIES

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

3) Presence of Interstial infilterate.

CXR :- B/L Peripheral Consolidation.

Rx :- STEROID.

SMOKING AND ILD:

Resp. Bronchiolitis associated ILD

Desquamative Interstitial Pneumonia

Adult Pulmonary Langerhans cell histocytosis

Acute eosinophilic pneumonia

Pulmonary heamorrhage syndromes

Idiopathic pulmonary fibrosis

ILDs Less Prevalent In Smokers :-

1) Sarcoidosis

2) Hypersensitivity pneumonitis

SARCOIDOSIS

Multisystem Disorder characterised by non-caseating Granuloma.

Etiology :- 1) Autoimmune

2) Propionibacterium

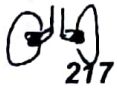
3) Mycobacterium

4) unknown.

5) Genetic susptibilty - HLA DRB, 1101

M/C → Pul. Involvement.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Scadding Staging I- Hilar adenopathy 

II- " LN↑ + Lung infilterates

III- Lung infilterates alone

IV- Fibrosis

Upper zone predominant Disease

PHENOTYPES

1> LUPUS PERINIO-

Cutaneous involvement → Bridge of nose
area beneath eyes + cheeks

2> LOFGREN SYNDROME-

Erythema nodosum, Hilar LN↑
Uveitis (MC - Anterior), Arthritis

3> UVEO-PAROTID FEVER

Uveitis + Parotiditis + Fever + CN 7th Palsy

Δ:-

1> (IG) → release ACE. + $1,25(OH)_2$ Vit D

Non-caseating granuloma → ↑S.ACE >2times (N) → Hypercalcemia

2> Blood :- Peripheral Lymphopenia - sequestration of lymphocytes into lung

3> Bronchoscopy :-

BAL - Lymphocytes $\frac{CD4}{CD8}$ ↑

4> Biopsy - Non-caseating granuloma

IOC → Incompatible clinical scenario ⇒ Biopsy of involved organ showing non-caseating granuloma is s/o Sarcoidosis

http://mbbshelp.com WhatsApp: +1 (402) 935-1207

5) CT chest → Lung infiltrates
LN ↑

In TB LN → Caseating ⇒ Central hypodensity ± peripheral rim enhancement

Sarcoidosis → uniform density

6) Gallium scan

a) ↑ uptake by Parotid + Lacrimal gland - b) ↑ uptake by mediastinal LN

"PANDA SIGN"

"LAMBA SIGN"

℞ Steroid + Immunosuppressor.

↑ LEVELS OF ACE

1) Sarcoidosis
2) Leprosy
3) Gaucher's Disease
4) Hyperthyroidism
5) Disseminated granulomatous infec such as
6) miliary TB

Pneumonic. [Sar Le Ga DM ~~Hyper wo~~ thyro wale]

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

CONNECTIVE TISSUE DISORDER • LUNG

RA

M/c pulmonary manifestation → pleuritis

Low Glucose Pleural Effusion

ILD → NSIP, B'xis

Rheumatoid ~~Arthritis~~ nodule

CAPLAN's Syndrome. [RA + Pneumoconiosis]

[silica expo, coal expo]

SLE

M/c pul. manifestation = Pleuritis

Acute lupus pneumonitis.

⇒ Pulmonary capillaritis + Deffuse alveolar H'ge

ILD → NSIP.

Shrinking Lung Syndrome

Diaphragmatic involvement in SLE.

SCLERODERMA

HIDE BOUND CHEST.

ILD NSIP ⟶ UIP, Pul. HTN

MCC of death in scleroderma → Pulmonary cause

POLYMYOSITIS

↑ Anti JO1 ABS (

→ Anti Synthetase Sx.

→ C/F – 1) Fever
2) Myositis
3) ILD
4) Arthritis
5) Mechanic Hands

DIFFUSE ALVEOLAR Hge / Pul HEMOSIDEROSIS

IDIOPATHIC Pul. hemosiderosis

1) Intra alveolar bleed
2) Fe accumulation as hemosiderin in alveolar macrophages
3) Fe deficiency anaemia

Pul. RENAL SYNDROME

1) SLE.
2) Good Pasture Syndrome
3) Small vessel vasculetis
   - Wegener's granulomatosis.
     1) Necrotising granulomatous vasculitis
     2) RPGN
     3) necrotising involvement of
        - URT → Epistaxie, sinusitis
        - LRT → Cavities, Diff. Alv. Hge

OCCUPATIONAL LUNG DISEASES

SILICOSIS

H/C occupational Lung Disease worldwide

< 2.5 μ = Dangerous particles

ASBESTOSIS

occupation Ship building, Construc° worker

Particle ~~ curvy serpentine
>> straight amphibole (carcinogenic)

FEATURES

1) Pleural Plaques
   - Most specific for asbestosis
2) Fibrosis
   - ∝ duration & exposure

SILICOSIS

Sand blasting, quarying

crystalline silica
Amorphous silica
1) Silicotic nodules

2) Merging of nodules → progressive massive fibrosis

COAL-WORKERS PNEUMOCONIOSIS

Coal miners

~~Anthracite~~ ~~Bituminous~~

1) ~~Anthracosis~~
   1) Anthracite
   2) Bituminous
2) Anthracosis
3) Coal macules
3) complicated CWP
4) ↑ COPD

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

3) Benign pleural effusion.

4) M/c malignancy associated c it
⇓
LUNG CANCER
Smoking + asbestosis.
⇒ synergistic

Most specific
↳ MESOTHELIOMA

Lower zone Disease

3) Silico-TB:- Chronic exposure

4) Alveolar proteinosis
↳ acute exposure

5) Malignancy.
CXR - Hilar LN +
egg shell calcification

Upper zone Disease

5) Malignancy

Round Atelectasis

Organised Pleff. around segment
↓
Localised atelectasis
⇓
COMET TAIL appearance

SLEEP APNOEA

Apnoea - Cessation of airflow for atleast 10 sec.

Hypopnoea - >30% reduction in airflow associated c
>3% fall in SpO_2.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

SLEEP APNOEA

CENTRAL

Resp. effort ⊖

Apnoea ⊕

Resp. drive ⊖

eg CHF

Narcotic Abuse

OBSTRUCTIVE

Apnoea ⊕

Persisting Resp. effort

↑ collapsibility of airway at Neck.

R/F for obstructive Sleep Apnoea :-

1) obesity
2) ♂
3) Craniofacial Ab ⊖
4) Hypothyroidism
5) Alcoholism

PATHOPHYSIOLOGY-

H/C Symptom → Snoring.

APNOEA → HYPOXEMIA → Pul. HTN, & Cor Pulmonale

↓

Arousal

↓

↑ Catecholamine Surg

↑ daytime sleepiness, Loss of interest, Depression, Personality changes, RTA ← Loss of quality of sleep

Uncontrolled HTN & Poor glycemic control

CAD, MI, arrhythmia, Sudden cardiac death, CVA.

Gold Std Δ :- Polysomnography

1) EEG
2) EOG
3) ECG
4) EMG
5) SpO_2.
6) Oronasal flow
7) Snoremic
8) Thorax & Abd. movement sensor
9) Body position / Limb movement

Other scales for assesment :-

1) Epworth sleepiness scale
2) STOP BANG Questionaire.

SEVERITY of OSA ⇒ APNOEA HYPOPNEA INDEX (AHI)

$$\frac{\text{No. of Apnoea + Hypopnoea}}{\text{Hour.}}$$

< 5/hr ⇒ (N)

5-14/hr ⇒ Mild OSA → Behavioural Rx

15-29/hr ⇒ Mod. OSA
≥ 30/hr ⇒ Severe OSA
} → Medical Rx of choice
CPAP – mild OSA + Commorbidities

In few case → Uvulo palatopharyngo plasty.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

MALIGNANCY

1° LUNG MALIGNANCY :-

Non-Small Cell Lung Cancer (NSCLC)	Small cell Lung Cancer (SCLCC)
1) Adeno Ca M/C worldwide	1) Small cell Ca / Oat cell tumour.
2) Sq. cell Carcinoma MC in India	
3) Large cell "	

LOCATION & ASSOCIATION OF TUMOURS :-

1) Central Location & Cigerette smoking

⇒ Sq. cell & small cell (strongest association)
Endobronchial Location.

2) Peripheral location & Less ~~no~~ smoking

Adeno Ca (♀, young ♂, Less smoker) & Large cell

3) Cavitation

Squamous & Large.

	ADENO	SQUAMOUS	SMALL CELL
Oncogene	KRAS / EGFR / ALK	FGFR, PI3K	myc, Bcl225
Biopsy	Glandular differentiation	Keratinisation + intercellular keratin bridges	Small round cell ī hyperchromatic nuclei
Features	→ Lepidic pattern	Central	Ⓑ chemo & radio sensitive
	Lung → Lung metastasis	Cigarette	Rapid recurrence
	Scar Ca → Adeno ca ↗ (M/c ca in abbestosis)	Cavity	↑ metastasis
		Calcemia	↑ SVC obstruc"
	↑ Clubbing → Hypertrophic osteoarthropathy	~~Hypo~~ Life threatening	POOR PROGNOSIS
			Clubbing is rare
	Paraneoplastic ↳ Hematologic	↑ parathormone related peptid	↑ Paraneoplastic Syndromes

PARANEOPLASTIC associated ī S'CLC

M/cc of ectopic ACTH ↓ SCLC.

1) Hyponatremia – SIADH
2) Hypokalemia – ectopic ACTH
3) Hypocalcemia – Calcitonin
4) Lambert Eaton Syndrome

CLINICAL MANIFESTATIONS of SCLC

1) Irritation → Cough (M/c symptom)
2) Hemoptysis – tumour infilterates vessel
3) ↑ size & causes → Bronchial obstruc" (Fever, SOB)
4) Pleural involvement ⇒ Pleuritis
Chest pain, Pleural eff → SOB.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

5) Skin & Intercostal n/vs. → Chest pain.

6) Pericarditis / Pericardial effusion.

7) Esophagus → dysphagia

8) Recurrent Laryngeal n/v → Hoarseness of voice

9) SVC obstruction.

10) Stellate Ganglion → HORNER's Syndrome
(sympathetic ganglion)

Migratory thrombophlebitis
= Trousseau's Syndrome
+ clubbing = Adeno Ca

↓

Anhydrosis
Miosis
Ptosis
Loss of ciliospinal reflex
Enophthalmos

11) Distant Metastasis ∴ Brain / Bone / Liver.

H/C site → Brain

Host specific → Adrenals.

INVESTIGATIONS :-

1) CYTOLOGY → Sputum
→ pleural fluid
} malignant cells

2) CXR - PA - Solitary Pulm. nodule
Collapse
LN ↑
Pleural Eff

3) CT - Chest - Precise anatomical Location.

4) Gold Std → BIOPSY < CT guided
Bronchoscopy

5> PET SCAN - staging

6> Bone Scan

Rx

- NSCLC
  - Resectable
    - Stage I, II, IIIA
      - ↓
      - Surgery
  - Unresectable
    - IIIB, IV
      - ↓
      - Medical Rx
        - Squamous
          - ↓
          - Cisplatin + Gemcitabine/Paclitaxel
        - Adeno
          - ↓
          - Cisplatin + Pembrexed.
          - Targeted Rx
            - ↓
            - EGFR Antagonist - Erlotinib, gefotinib
            - ALK Antagonist Crizofinib.
- SCLC
  - ↓
  - Medical Rx
    - Chemo Rx + Radio Rx.
      - ↓
      - Cisplatin + Etoposide

Adeno Ca/ ♀/ non-smoker/ Asian ⇒ EGFR mutation.

Pancoast Tx - usually occurs ε Sq cell
Located at apex.
May involve stellate ganglion.

PANCOAST SYNDROME = 1> Tumour in Lung APex
2> Involve → 1st 2 ribs
→ Stellate Ganglion.
→ $C_8 T_1 T_2$ → Pain, weakness in Ulnar distribution

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

TUBERCULOSIS

Tabes

NOMENCLATURE

Tabes Pulmonale - Pul. TB (M/C)

Tabes mesentrica - Abd. TB

Carries sicca - Shoulder TB

Potts Disease - Spinal TB

Spina ventosa - TB Dactylitis

Scrofula - LN TB (M/c extrapulmonary)

Lupus vulgaris - Skin TB

Poncet Disease - TB Rheumatism

ORGANISM & LAB DIAGNOSIS

1> Direct Microscopy → ZN staining / Led FM

Under ZN staining to visualize each mL of sputum should contain 10,000 bacilli

2> Solid Culture → LJ media 6-8 week

3> Liquid ,, → BACTEC
MGIT
Septi check
} ~~6-8 week~~ 7-10 day +ve result

4> Rapid Molecular Method

a> CBNAAT → / Gene expert → TB Bacilli + Rif. sensitivity 2 hours.

b> Line probe assay / LPA → TB Bacilli + Drug sensitivity (1st Line & 2nd Line drug) = 48-72 hour

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Most Rapid method to identify of TB → Direct microscopy

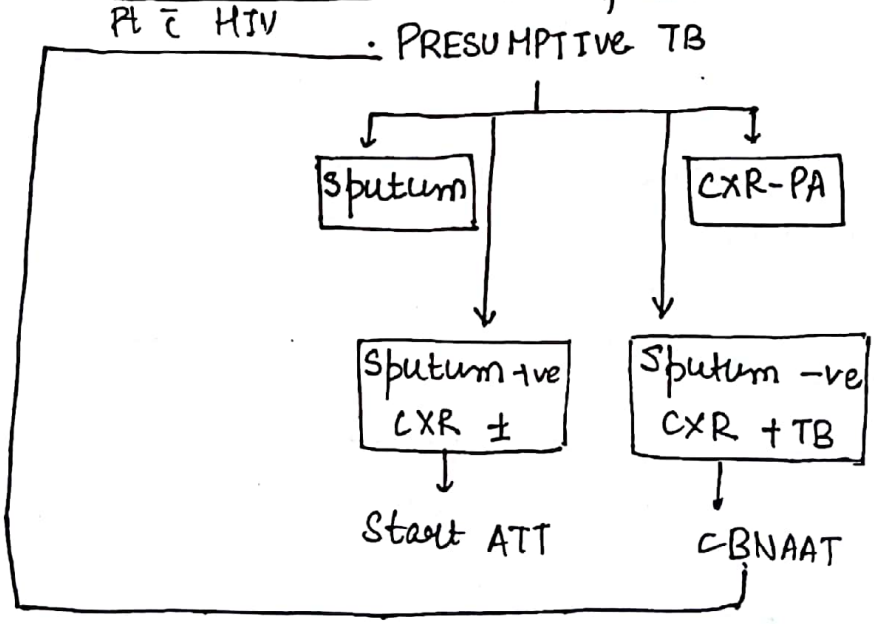
Most Rapid method for Rifampicin sensitivity = Gene expert

PRESUMPTIVE TB

Any one of the following

- Cough > 2 wks
- Fever > 2 weeks
- Hemoptysis
- wt. loss
- Abnormalities on CXR - PA view

ALGORITHM FOR Δ of TB



IGRA / Quantiferon Gold

Advantages :-

1> TB specific Ag → CFP & ESAT used

2> Less cross-reactivity c BCG & Non Tubercular mycobacterium

3> Blood Test

4> Serial Testing can be done c out boosting phenomena

5> Single visit to hospital.

Disadvantage

Can't differentiate Infection vs Active disease

PATHOLOGY

1° TB → unsensitised individual

2° TB → Post 1° TB → sensitised individual → Reinfection / Reactivation

1° TB

→ TB bacilli → mid + lower zone

→ Area of 1st contact

1° focus / Ghon's focus

→ Alveolar macrophage engulf TB bacilli

↓

⊖ Phagolysosome fusion

↓

↑ survival of M.tb.

→ For immunity macrophages reach hilar LN ⇒ LN ↑

Ghon's complex → Ghon's focus + LN ↑.

In LN →

↑ TH_1 response

* ↑ IFN-γ , TNFα

⇓

↑ Killing capacity of macrophage

↓

Limit TB

Memory cells are formed

2° TB

→ TB bacilli reach apex & actively grow.

→ Bodys immune response will try to wall off infection.

→ After few weeks, Delayed Type HSN response produced & destroys TB bacilli & Lung Parenchyma

2° TB is more infectious & it is active disease.

Calcified Ghon's Complex ⇒ Reinke's complex.

TB/HIV

* If ART is started 1st → ↑ Risk of immune Reconstitution Inflammatory syndrome (IRIS)

Start ATT 1st & merge ART in 2 weeks. to 2 months

ATT = Always The Treatment

* If pt. is on TLE regimen. → Rifampicin can be given

If pt. is on Neviparine / Protease Inhibitor

↓

Rifampicin can't be given

Rifabutin is given.

DISSET

DISSEMINATED TB

CLASSICAL MILIARY TB	CRYPTIC MILIARY TB
1°/2° form Hematogenous / Lymphogenous spread. Pathognomic ⇒ Choroidal Tubercles Sputum → -ve CXR - 1-2mm, Bil Symmetric Homogeneous, millet shaped shadowing	Elderly, chr. symptom Fever, wt. loss, anaemia CXR - (N) Sputum → -ve Pt. collapses ⇒ death ∴ autopsy reveals meningeal tubercles This is also miliary TB. but hidden one CXR.

NON-REACTIVE (or) AREACTIVE TB

Rare form

Acute Septicaemic form.

Underlying hematological abnormality

Fatal form

Autopsy shows areas of necrosis ± out granuloma formation

Rx

New Case = 2HRZE + 4HRE = 6 months = DAILY

Previously Rx: 2HRZES + 1HRZE + 5HRE = 8 month = DAILY

HDR TB = Resistance to both H & R = DAILY

6-9 mnth → E + Z + Kanamycin + Levoflox + Cycloserine + Ethionamide

18 mnth → E + Levoflox + Cycloserine + Ethionamide

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

XDR-TB :- MDR-TB + Resistance to 1 2nd Line aminoglycosid + Resistance to 1 FQ

6-12 mnth - Capreomycin + Moxi + PAS + Clofazamine + High dose INH + Amoxyclav + Linezolid

18 months - Moxi + PAS + Clofazimine + High Dose INH + Amoxyclav + Linezolid

(24 - 30 months)

NEWER Anti-TB Drugs

BEDAQUILINE / Sirturo

2012

Diaryl quinolone

MOA:- ATP synthase inhibition

S/E - QT Prolongation

DR TB.

Conditional acces in India

DELAMANID

2014

Nitroimidazole

MOA:- Mycolic acid synthase inhibitor

S/E - QT Prolongation

DRTB

Soon available in India

Dose - 400mg

duration - 24 weeks.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

ACID, BASE, BALANCE & ABG

I) NORMAL VALUES

pH	7.35 - 7.45
$PaCO_2$	35 - 40 mmHg
HCO_3^-	22 - 26 meq
PaO_2	70 - 100 mmHg

pH ≤ 7.35 ⇒ Acidosis

pH ≥ 7.45 ⇒ Alkalosis

(N) $PaCO_2$ = 40

HCO_3^- = 26.

II) Relation Between pH, $PaCO_2$ & HCO_3^-

↳ Henderson Hasselbach Equation

$$pH = 6.1 + \log \frac{[HCO_3^-]}{PaCO_2 \times 0.03} \Rightarrow pH \propto \frac{HCO_3^-}{PaCO_2}$$

$$\downarrow pH \uparrow \propto \frac{HCO_3 \uparrow}{PaCO_2 \uparrow} \Rightarrow \frac{BASE}{ACID}.$$

III) REGULATION OF PH $PaCO_2$ & HCO_3^-

Lungs ↑↓ CO_2 ⇒ Resp. process

Kidneys ↑↓ HCO_3^- ⇒ Met. process

SIMPLE ACID BASE DISORDER

1° process + Adequate compensatory response

Respiratory Acidosis
pH↓ $PaCO_2$↑ HCO_3^-↑

Metabolic Acidosis
pH↓ $PaCO_2$↓ HCO_3↓

Resp. Alkalosis
pH↑ $PaCO_2$↓ HCO_3^-↓

Metabolic alkalosis
pH↑ $PaCO_2$↑ HCO_3^-↑

In simple acid base disorder, always 1° change & compensation move together

In 1° resp. process → change in pH w.r.t. $PaCO_2$ & HCO_3^- in opposite direc"

In 1° met. process – change in pH w.r.t $PaCO_3$ & HCO_3^- in same direction

ROME

resp. opp, met. same direction.

Q pH = 7.33, $PaCO_2$ 60, HCO_3^- 34
↓ ↑ ↑ ⇒ Resp. Acidosis
acidosis

Q pH = 7.48, $PaCO_2$ -26 HCO_3 16
↑ ↓ ↓ ⇒ Resp. Alkalosis
alkalosis

Q. pH = 7.27, $PaCO_2$ 25 HCO_3^- 10
↕ ↓ ↓ ⇒ Met. Acidosis

Q pH = 7.55 $PaCO_2$ 50 HCO_3^- 40
↑ ↑ ↑ ⇒ Met. Alkalosis

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

COMPENSATION

Resp. Acidosis

Acute For every 10mmHg ↑ $PaCO_2$, HCO_3^- ↑ by 1 meq.

Chronic For every 10mmHg ↑ $PaCO_2$, HCO_3^- ↑ by 4meq

Resp. Alkalosis

Acute For every 10mmHg ↓ $PaCO_2$, HCO_3^- ↓ by 2 meq

Chronic " " 10mmHg ↓ $PaCO_2$ HCO_3^- ↓ by 4meq

Q Acute F.B. ingestion ; pH = 7.32, $PaCO_3$ = 70. HCO_3^- - 29.

↓ ↓ ↑ ↑

Acidosis. Acidosis

$40 \xrightarrow{30} 70$ $26 \xrightarrow{3} 29.$

Resp. acidosis ~~with~~ compensatory met. alkalosis

Q Chr. neuromuscular disorder

pH = 7.34 $PaCO_2$ = 60 HCO_3^- 34

↓ ↑ ↑

chr resp. acidosis

$40 \xrightarrow{20} 60$ $26 \xrightarrow{8} 34.$

Ans:- Chr. resp. acidosis ~~with~~ compensatory met. alkalosis.

Chr. compensated Resp. Acidosis.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Metabolic Acidosis

Acute expected $PaCO_2 = (1.5 \times HCO_3^-) + 8 \pm 2$. [Winter's formula]

Q. pH = 7.27, HCO_3^- = 10, $PaCO_2$ = ?

$(1.5 \times 10) + 8 \pm 2$

$15 + 8 \pm 2$

21 - 25 ⇒ compensated

Q. pH = 7.26, $PaCO_2$ = 18, HCO_3^- = 6?

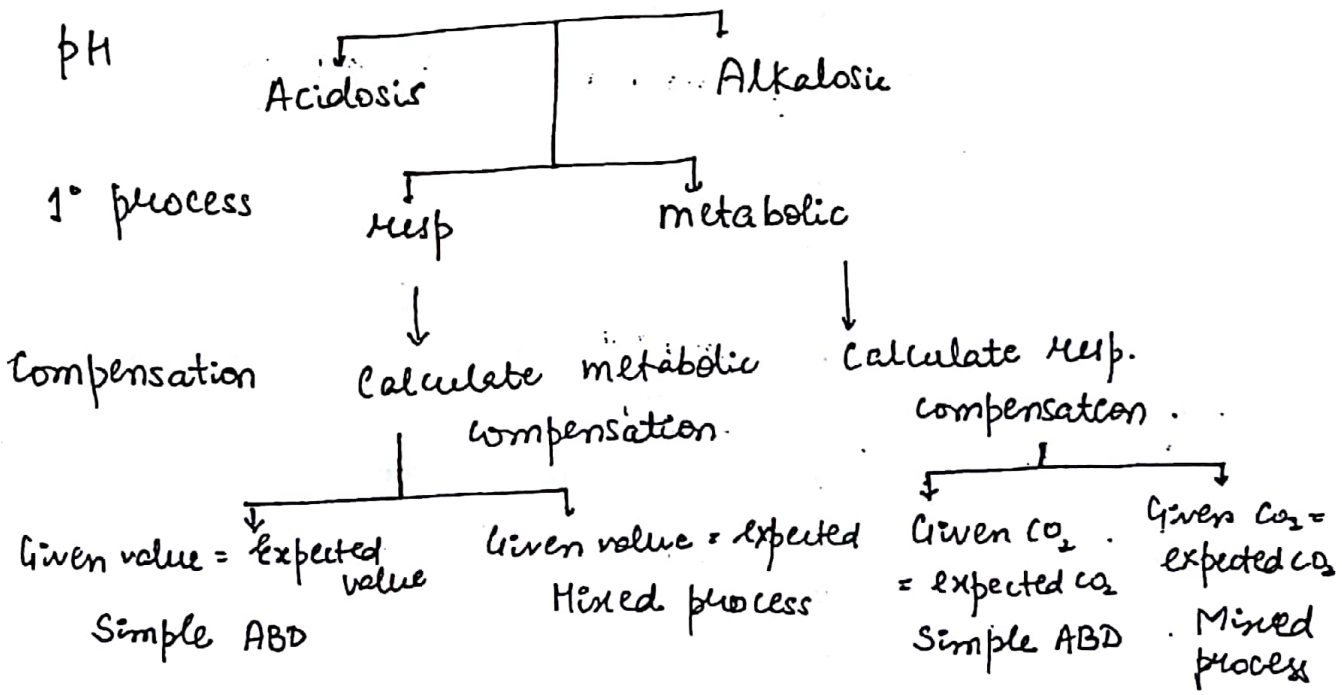
$(1.5 \times 6) + 8 \pm 2$ = ~~9 ± 2~~ ~~9 - 11~~ ~~7 - 11~~.

$9 + 8 \pm 2$ = 17 ± 2 = 15 - 19.

Met. acidosis + compensatory alkalosis

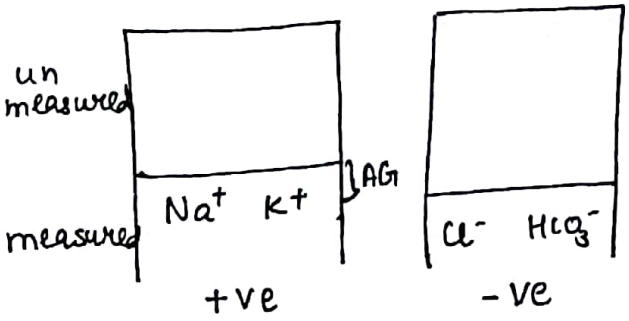
② Metabolic Alkalosis

expected $PaCO_2 = [HCO_3^- + 15]$



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

METABOLIC ACIDOSIS & CONCEPT OF ANION GAP



$(Na^+ + K^+) - (Cl^- + HCO_3^-)$ = Anion Gap.

$(Na^+ + K^+)$ + unmeased cations = $(Cl^- + HCO_3^-)$ + unmeasured anions

$(Na^+ + K^+) - (Cl^- + HCO_3^-)$ = unmeasured anions − unmeasured cations

[Anion Gap] = unmeasured anions − unmeasured cations

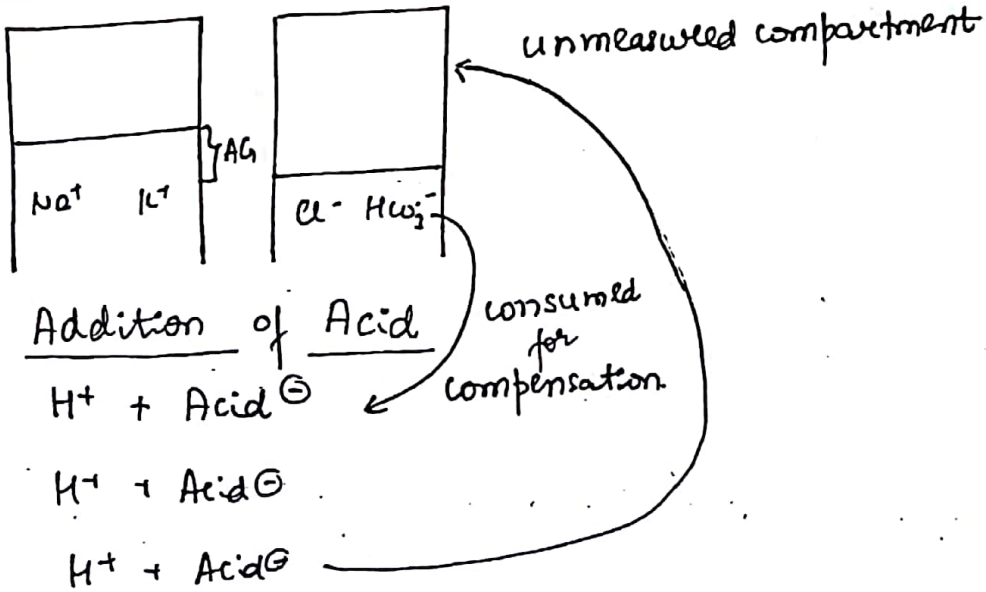
Common cause of ↑ in Anion Gap = ↑ in unmeasured anions

New Formula for Anion Gap

$(Na^+) - (Cl^- + HCO_3^-)$ = AG

8-12 mEq.

HIGH AG METABOLIC ACIDOSIS



In pure High AG Metabolic Acidosis

Rise in AG = fall in HCO_3^-

AG - 10 = 25 - Given carbonate.

$\Delta AG = \Delta HCO_3^-$

CAUSES :-

I) TOXINS / DRUGS - 1) Methanol

2) Paraldehyde

3) Ethylene glycol. / antifreeze
↳ oxalic acid.
Oxaluria

4) Salicylates.

II) Keto acidosis - 1) DKA

2) Alcoholic keto acidosis

3) Starvatation

III) Renal Failure

IV) Lactic Acidosis

a) Type A Lactic Acidosis ⇒ [Hypoxemia / ↓ perfusion]

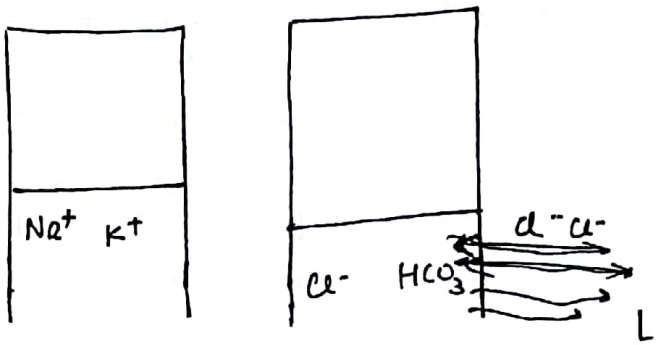
eg. shock
Anaemia
CO poisoning

b) Type B Lactic Acidosis = [Perfusion ⓝ]

eg. Renal failure
Hepatic failure
Drugs - metformin
Zidovudine

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

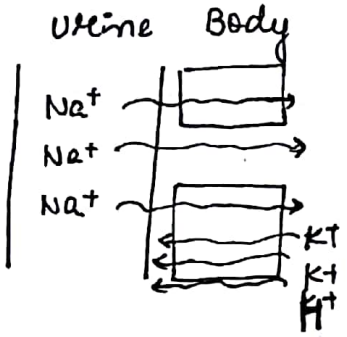
(N) AG METABOLIC ACIDOSIS



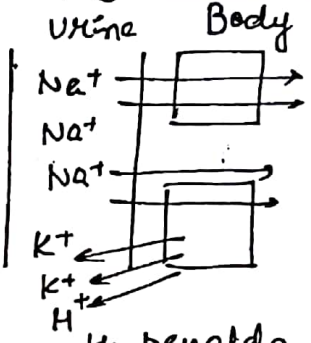
Loss of HCO_3^-

Hyperchloremic Metabolic Acidosis

RENIN - Angiotensin - Aldosterone System in Acid. Base



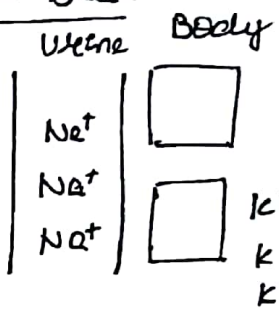
(N)



↑ RAAS

Hyperaldosteronism

Hypokalemia + Met. alkalosis



⊖ RAAS

Hypoaldosterone

Hyperkalemia + Met. acidosis

CAUSES

I) GIT CAUSE

1) Diarrhoea
2) Pancreatic fistula
3) Ureterosigmoidostomy
4) Enterocutaneous fistula

II) RENAL CAUSE

1) RTA
2) Drugs
   - (a) Carbonic anhydrase inhibitor
   - (b) ACEI
   - (c) ARB
   - (d) Aldosterone antagonist

RTA

Type I RTA Type II RTA Type IV RTA

Met. acidosis + hypokalemia

met. acidosis + Hyperkalemia (H/c type)

Causes

Hyporenemic state

Aldosterone resistance

" deficiency

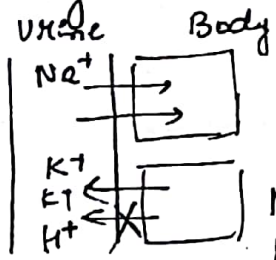
Hyporenemic state

↳ Diabetic nephropathy

Chr. tubulo interstitial

Type I RTA

- Distal RTA
- H^+ excretion Lost at collecting Duct

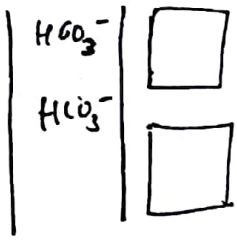


Met. acidosis
hypokalemia

Type II RTA

Proximal RTA

HCO_3^- reabsorption lost in PCT



Bicarbonaturia can induce Kalliuresis

Met. acidosis + Hypokalemia

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Urine anion Gap :-

To differentiate (N) anion gap Met acidosis of diarrhola v/s RTA

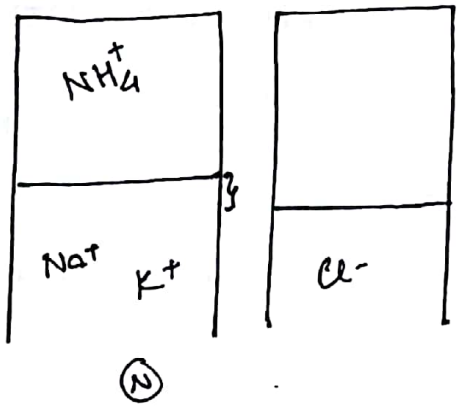
$$UAG = [Na^+ + K^+] - Cl^-$$

(N) value = 0-5.

--- - | +++

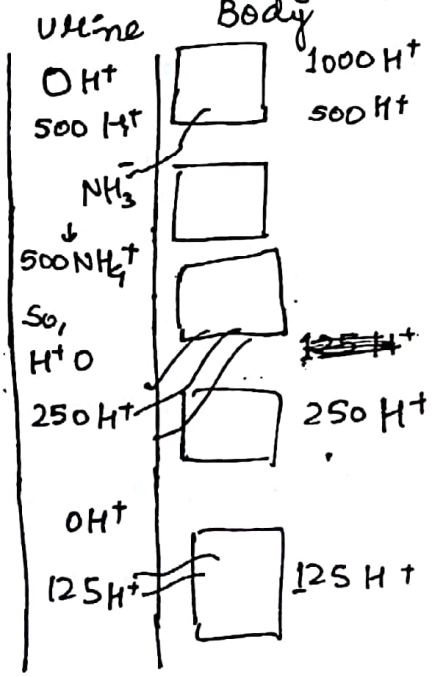
↓ | ↑

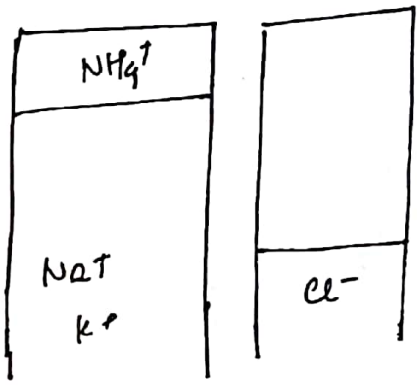
taking 0 as reference level



(N)

Renal Handling of Acid



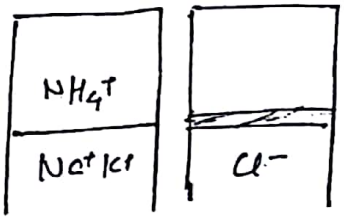


RTA = UAG +ve.

Diarrhola :- Met. acidosis.

10,000 H+

Urinary NH_4^+ is increased.



UAG --ve

~~RTA :-~~

UAG is indirect measure of urinary NH_4^+ excretion.

UAG is negitive in GIT cause diarrhola

GIT

METABOLIC ALKALOSIS

Initiating event	Persisting event
1) ECFV contraction, hypotension	2° Hyperaldosteronism
2) ↑ 1° mineralocorticoid excess	⟶ ECFV expansion & HTN

(Ⓑ initiating + persisting event)

SALINE RESPONSIVE / Cl^- response	SALINE UNRESPONSIVE / Cl^- unresponsive
U_{Cl^-} < 20 meq	UCl^- > 20 mEq
1) vomiting	1) 1° Hyperaldosteronism ⎫
2) Ryle's Tube aspiration	2) Cushing's Syndrome ⎬ HTN
3) Diuretic use	3) Renin secreting Tumour ⎭
4) Post hypercapnic Met. alkalosis	4) Renal artery stenosis ⎫
	5) Liddle's Syndrome ⎭
	6) Bartter Syndrome ⎫ hypo to Ⓝ tension
	7) Gitelman Syndrome ⎭

RESPIRATORY ACIDOSIS

Type 2 Resp. Failure

RESPIRATORY ALKALOSIS

CHRONIC Resp. Alkalosis :

M/c acid Base Abⓝ in critically ill pt

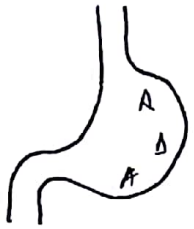
1) Pain, Panic, Psychogenic, Progesterone
⇒ Hyperventilation

2) Aspirin
a) vomiting → met. ~~acidosis~~ alkalosis

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

2) High AG metabolic acidosis. → Resp. alkalosis.

→ When aspirin goes to blood



3) Theophylline

4) Fever, sepsis (change in sensitivity of Resp. centre)

5) CHF → Pul. oedema → stimulate of chemoreceptors

6) Cirrhosis of Liver → ↑ Glutamate

7) Severe ~~Hypotension~~ Hypoxemia ⇒ hyperventilation.

8) ↑ ICP

ICU pts are also prone to Resp. alkalosis due to pain, panic, psychogenic

Q. pH = 7.32, $PaCO_2$ = 60, HCO_3^- : 34. = Chr. compensated Resp. Acidosis.

↓ ↑ ↑

40 → 60 (20) 24 → 34 (10)

Q. pH. 7.35 $PaCO_2$ = 60 HCO_3^- 40.

↓ ↑ ↑ = Given value > Expected HCO_3^-

Chr. Resp. acidosis + Add. metabolic alkalosis

Q. pH 7.28 $PaCO_2$ = 60 HCO_3^- 26

↓ ↑ (N) Given value < Expected HCO_3^-

Chr. Resp. acidosis + Add. metabolic acidosis

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

AG High AG or Normal AG.

In pure High AGMA $\Delta AG = \Delta HCO_3^-$

Rise in AG = fall in HCO_3^-

[Given AG - 10] = [25 - Given HCO_3^-]

Q. Pt. is having DKA.

pts AG = 20 HCO_3^- = 15

$\Delta AG = 20 - 10$ $\Delta HCO_3^- = 25 - 15$

10 10

⇒ Pure HAG Met. Acidosis.

Q. Pt is DKA.

Pt. AG = 20 HCO_3^- = 20

$\Delta AG = 10$ $\Delta HCO_3 = 25 - 20 = 5$

$\Delta AG > \Delta HCO_3^-$ → Additional metabolic ~~acidosis~~ alkalosis

*High

~~Additional~~ AGMA + addition Met Alk

Q. DKA AG = 20 HCO_3^- = 10

ΔAG $20 - 10$ $\Delta HCO_3^- = 25 - 10$

= 10 = 15

$\Delta AG < \Delta HCO_3^-$

High AGMA + (N) AG metabolic acidosis

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Compare ΔAG & ΔHCO_3^- relation.

$\Delta AG = \Delta HCO_3^- \Rightarrow$ Pure HAGMA

If $\Delta AG > \Delta HCO_3^- \Rightarrow$ HAGMA + additional met. alkalosis

If $\Delta AG < \Delta HCO3^- \Rightarrow$ HAGMA + additional met acidosis

Q pH - 7.2 ↓ $PaCO_2$ - 60 ↑ HCO_2^- 19 ↓

~~Alkalosis~~ Acidosis (mixed disturbance)

20.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

NEPHROLOGY

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

PHYSIOLOGY

Kidney performs Diverse func^{n} :-

1) Excretory :- urine formation

2) Homeostasis :- water & acid base balance

3) Hormonal :- erythropoietin synthesis & Vit D activation.

4) ## RENAL BLOOD FLOW

Kidneys are highly vascular.

Receives 25% of c.output

Even in presence of adverse cond^{n} to the renal blood flow -

1) Dehydration

2) Hypotension

3) Renal artery stenosis

↓

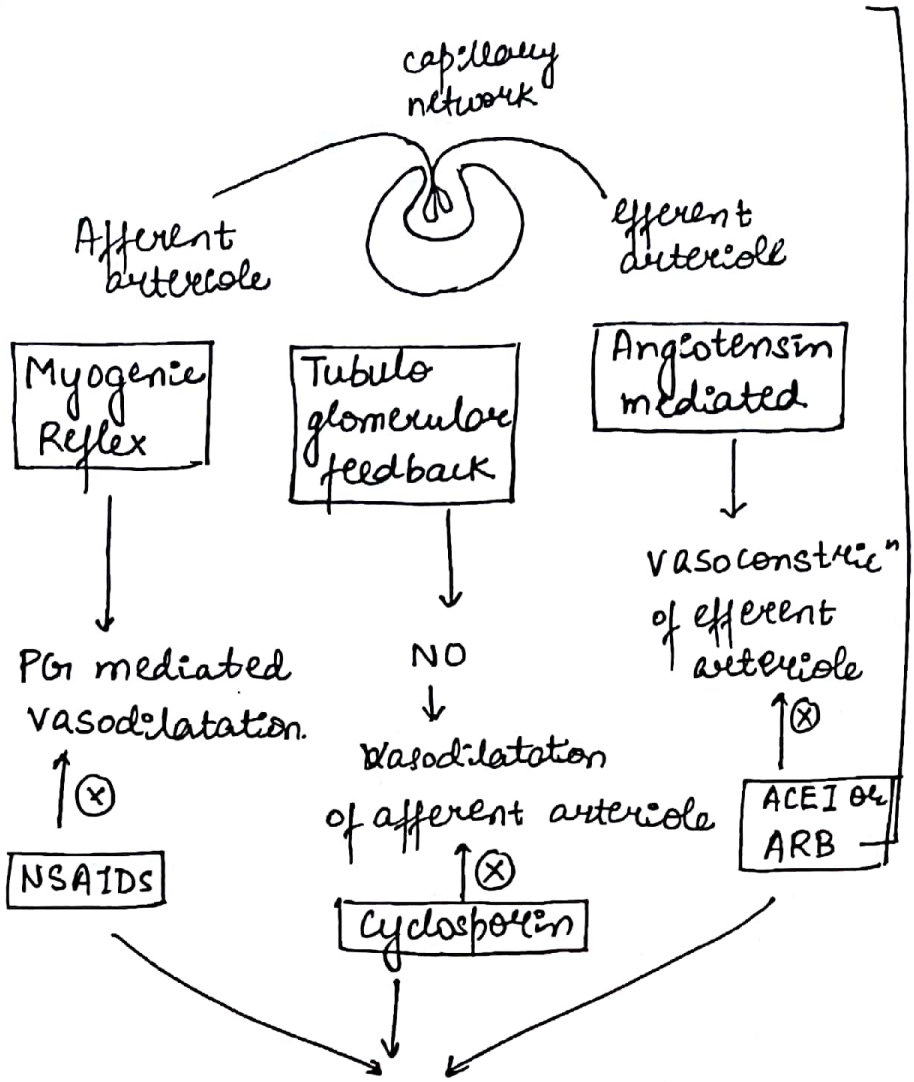
Autoregulatory mechanisms activated

↓

Maintain adequate GFR.

1) ↑ Glomerular capillary Pressure

http://mbbshelp.com WhatsApp: +1 (402) 235-1397



Can Disrupt autoregulation

If used in the presence of adverse ~~cond~~ conditions, these can precipitate hypoperfusion

↓

Pre-Renal AKI

RENAL ARTERY STENOSIS

Cause → 1) 90% → atheros/arteriosclerosis

2) 10% → FMD (fibromuscular Dysplasia)

Pathophysiology →

Activates ~~the~~ RAAs

Vasoconstriction | Na^+/H_2O retension.

M/C C/F → Sy. HTN

[M/C cause - 2° HTN - Renovascular]

ESG GUIDELINES - evaluation & Management

When to suspect/ screen for R.A.S.?

1) young HTN (onset <30 yrs of age)
2) Severe HTN <55 yrs of age (>160/110 mm of Hg)
3) HTN emergencies (sudden ↑ BP ± target organ damage)
4) Refractory HTN (uncontrolled ≥3, 1 is a diuretic)
5) Decline in GFR ≥30% after ACEI therapy (Disrupts autoregulation)
6) Asymmetrical kidneys on USG (Diff. ≥ 1.5cm)
7) Unexplained Renal failure

Screening Tests	Specific
1) Duplex Doppler (Best) >98% sensitivity - Non-invasive, easy available	1) Conventional Renal angiography GRADING % of Stenosis — Severity & Rx <50% (Mild) — No further testing 50-70% (Moderate) — Follow-up >70% (severe) — Always haemodynamically significant → Elective Rx
2) CT-Renal Angiography ↓ C/I → GFR ≤60 mL/min	
3) MR-Renal angiography C/I → GFR ≤30 mL/min	
4) DTPA Scan (radio-isotope) (functional assesment of kidney)	

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

R_x 1st Line → Medical

U/L

ACEI

(only drug ≤ protects (N) Kidney)

B/L

ACEI - C/I

CCB

β blocker

Diuretics

Angioplasty

1) All - severe RAS

2) cause in FMD

(focal stenosis → so, easily R_x ⊂ angioplasty)

3) Refractory Heart failure (Flash Pulmonary Oedema)

MOA of ACEI in U/L RAS.

↓ glomerular capillary pr. → (N) capillary pressure

↓

Renin - angiotensin - Eff. arteriolar vasoconstriction

ACEI (+) → (x) → ↓ Capillary HTN

comes towards NORMAL

↓

Predispose:- glomerulosclerosis

(B) - endothelial injury / GBM injury

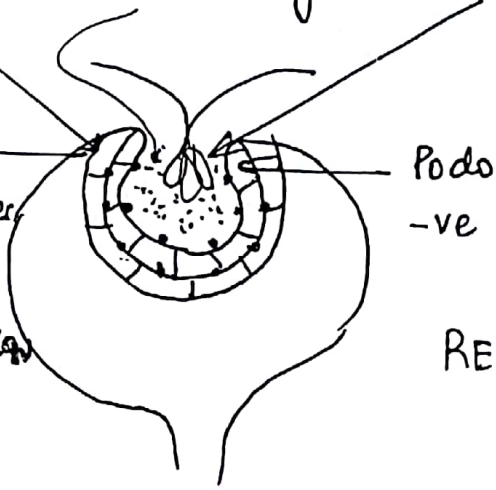
Prognosis -

Favourable

URINE FORMATION

1st step → Ultrafilteration → Glomerulus

Intra-GBM ← Mesangium → outside GBM. (extra-GBM)



GBM

microscopic spaces

Avg = 9-11nm

MECH. FILTERATION

Podocytes (foot processes of GBM)

-ve electrostatic charge

REPEL ANIONS

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

a> All Blood Components RBCs, WBCs, platelets	① Albumin ② Lipoproteins
b> All plasma proteins (except albumin ≃ 4.6 nm)	③ AT-III, Protein S, C

GLOMERULONEPHRITIS

Predominantly affect GBM except Minimal Change Disease (only podocytes affected)

1> Dysmorphic Heamaturia (MPe)	1> NO HEMATURIA.
2> RBC cast - Most specific	2> Selective Proteinuria (albuminaria)
3> Non-selective proteinuria	3> Dyslipidaemia
4> Glomerular range proteinuria [≥2 g/day /1.73 m^2]	4> Hypercoagulable state

TUBULES

Reabsorption & secretion. (concentrating Ability)

Mechanisms:- Tubular transport

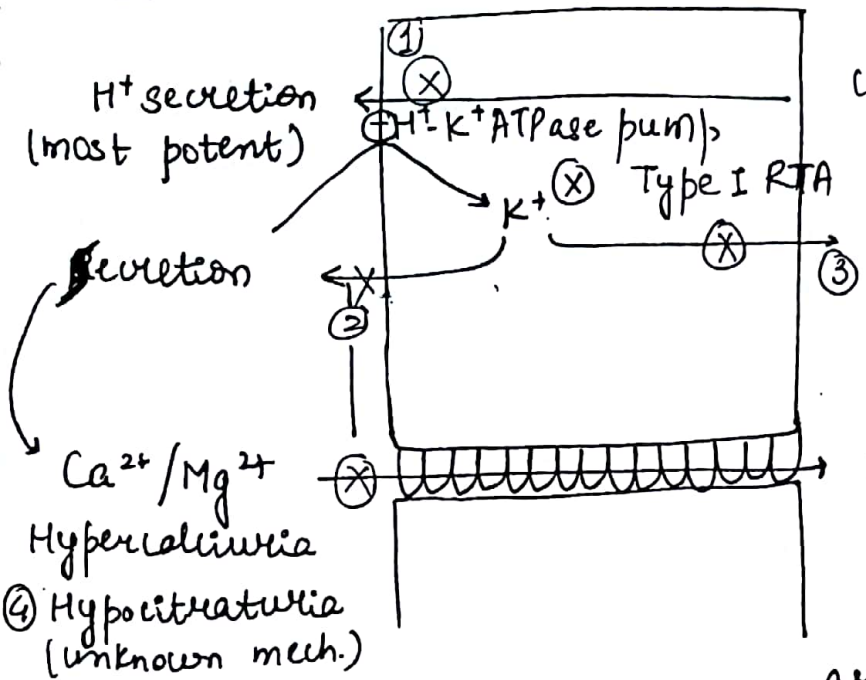
A> Cellular transport (across the cell)	B) Paracellular (in bet' cells of tubule)	
	PCT	DCT
1> ACTIVE → ATPase pumps.	Leaky epithelia ⇓	Tight Junctions ⇓
2> PASSIVE → exchange/ co-transporters.	Allows BULK Transport	Highly regulated

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

DCT

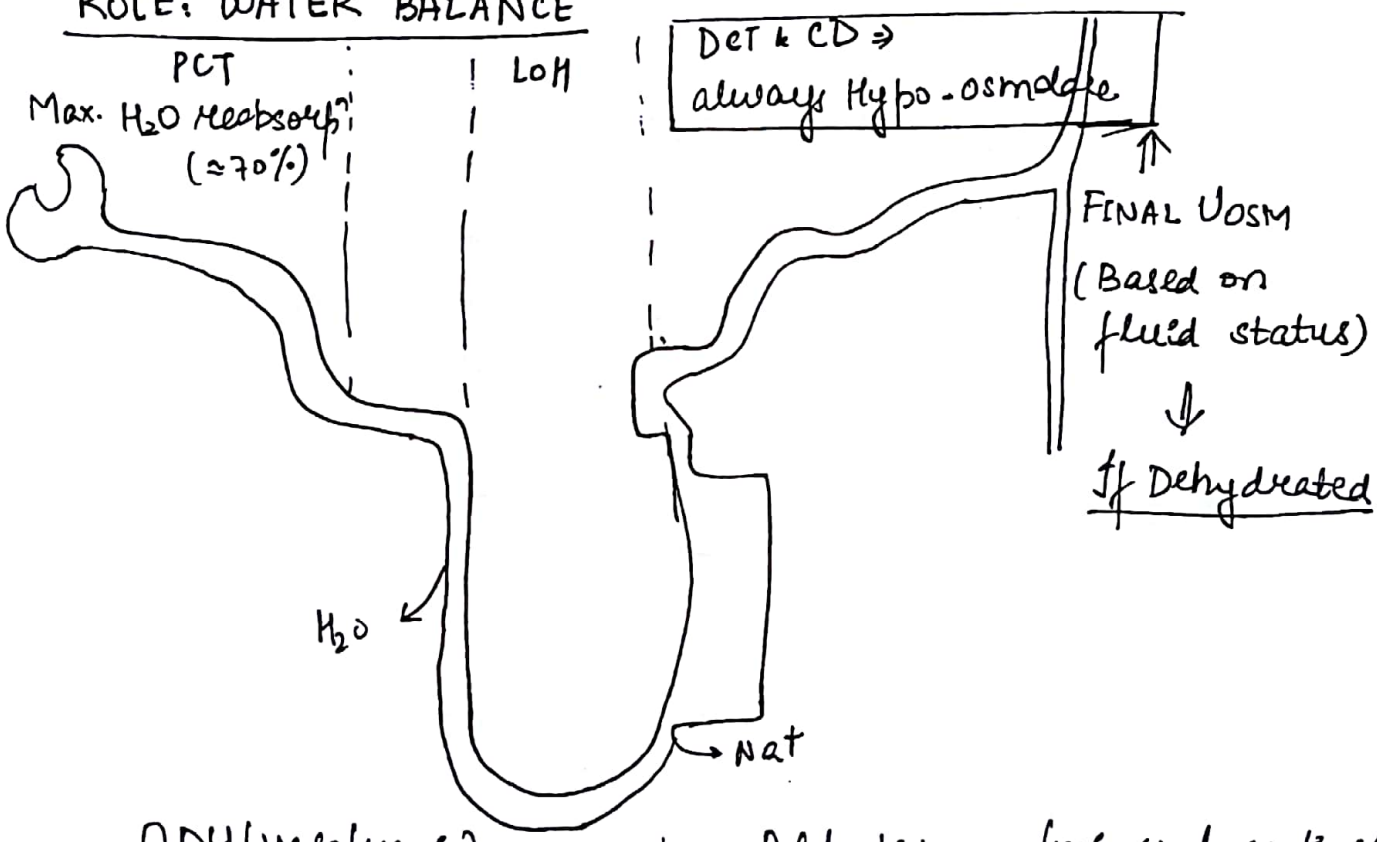
URINE

BODY



ROLE: WATER BALANCE

→ association : Endocrine



ADH (Vasopressin)

V_2 receptors

AQUAPORIN channels

⇓

facilitates H_2O reabsorpn

⇓

Restores plasma volume

Aldosterone (mineralocorticoid)

⇓

upregulates eNa+ channels.

⇓

Na+ reabsorpn ⇓ Secretes

H_2O " H^+ & K^+ in exchange

Def^{n}:- Hypotonic Polyuria (D. Insipidus)	Excess:- oliguria (SIADH)	Def^{n}:- Addisons (GC + MC Def^{n})	Excess:- CONN's ~~Syn~~ CUSHING's Syn. ↓ Hypokalemic Alkalosis

HYPOKALEMIC ALKALOSIS

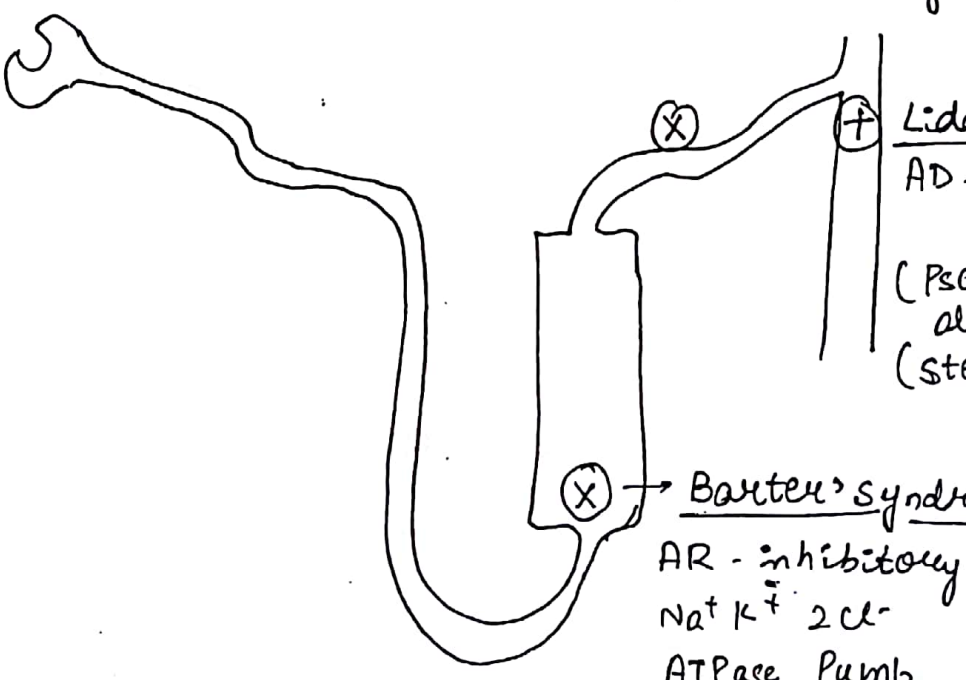
Due to aldosterone excess state

Cause :- 1> Endocrine (MC)

2> Chronic Drug use
- Loop Diuretics
- Thiazides
- Steroids

3) Inherited Channelopathies

INHERITED CHANNELOPATHIES



Gitelman's Syndrome
AR inhibitory $Na^+ Cl^-$ cotransport
(Thiazide)

Liddle's Syndrome
AD - stimulatory
$\uparrow Na^+ C.$
(Pseudo - hyper aldosteronism)
(steroid mimics this)

Bartter's syndrome
AR - inhibitory
$Na^+ K^+ 2Cl^-$
ATPase Pump
(Loop Diuretics)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

	Bartter's Syndrome (6 genetic mut^{n})	Gitelman's Syndrome	LIDDLE's Syndrome
1) Epid	→ I.U.L ⟶ adolescence.	20-30 yrs	20-30 yrs.
2) Patho	$Na^+ - K^+ - 2Cl^-$ pump Ⓧ Ⓧ Ⓧ - severe ⇓ 1) Ⓧ Ⓧ Ⓧ H_2O reabsorp^{n}	$Na^+ - Cl^-$ cotransport Ⓧ Mild ⇓ Ⓧ H_2O reabsorp^{n}	eNa$^+$ c ⊕ Mild ⇓ ⊕ H_2O reabsorp^{n}
3) Plasma volume	↓ ↓ ↓	↓	↑
4) B.P.	↓ ↓ ↓	~~↓~~ Ⓝ	↑
5) Renin Angiotensin	↑ ↑ ↑	↑	↓ ↓ ↓
Aldosterone	↑ ↑ ↑	↑	↓ ↓ ↓
6) Associated Defects	30% - ↓SNHL. (Deaf) ↓ Paracellular Ⓒa transport defect (Hypercalciuria)	Paracellular Ⓜg^{2+} transport Defect	Pseudo-hyperaldosteronism.
(unknown) mech			
7) C/F	1) Polyhydramnios 2) Failure to thrive 3) Hypotension. (syncope) 4) Renal calculi	Muscle cramps Paralytic ileus Cardiac arrhythmias	Asymptomatic Detection - HTN in young
8) ABG analysis	⟵ Metabolic alkalosis. ⟶		
9) S. K^+	⟵ Low ⟶		

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

10) Exclude chr. use	Loop Diuretics	Thiazide	Steroids258
11) Best Test S. Renin	↑↑↑	↑	↓↓↓
12) Rx	← HYDRATION →		✕
	← K+ supplements →		
13) Prognosis	Trial of NSAIDS as majority → ↑PG. hence palliative (slows prognosis)	Mg2+ supplements ↓ minimises symptoms	AMILORIDE DOC ENac antagonist *Safe in ⓟ + Long term use offers cure ✓ BEST Prog
	WORST (no cure)	Favourable	

ROLE OF KIDNEY IN ACID BASE BALANCE

Human Body → "Pro-~~acidic~~ acidic state"

Every living cell requires Energy (ATP)

During ATP Produce" → Acid is ~~di~~generated.

Ⓝ pH = 7.35 - 7.45 (slightly Basic)

MECHANISMS → ABB → Regulate pH efficiently

1) **Buffering**

At tissue level

HCO_3^- (extra cellular)

↓

$[H^+] + [HCO_3^-] \rightarrow CO_2 + H_2O$

BACKUP

PO_4^{--} (Intra cellular (Bones))

Resp mechanism

excretes acid in form of CO_2

Renal Mechanism

Most Potent

↓

Acidification of Urine

Most Imp. form of H^+ Secretion in urine → NH_4^+ ion.

Combines Cl^- → NH_4Cl

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

U_{H^+} ∝ $U_{Ca^{++}}$ levels.

HCO_3^- exhausted ← **ACIDEMIA** ⓝ U_{pH} = 6.5-7.0 (Blood pH - ⓝ)

PO_4^- required

Bone resorption

Rickets	Osteomalacia

⇓

Expected U_{pH} < 5.5 } (Highly acidic)
} ⇒ if kidneys are ⓝ

$U_{Ca^{++}}$ ↑↑

RTA

↳ Defect in acidification of urine
(U_{pH} > 5.5 , $U_{Ca^{++}}$ - Low in disease)

RTA

① H^+ secretion
H^+-K^+ ATPase

② HCO_3^- reabsorption
(Iso-nutrient reabsorption)

Ⓧ Type 2 RTA
(proximal RTA)

Type I
(Distal RTA)

③ HCO_3^- regeneration
(Action - carbonic anhydrase)

④ Minor role
Aldosterone
H^+/K^+ secretion.
in exchange of
$Na^+ + H_2O$.

Type 4 RTA
(Hyperacidosis)

Ⓧ Type 3 RTA
(Marble Brain Disease)

- < 100 cases (worldwide)
- Majority :- cerebral calcification.
  also - marble bone disease
  (osteopetrosis)

Not included in routine classification.

RTA	Type I	Type II	Type IV (260) M/C RTA
Epidemio-	<10yr, M>F (Most severe) M/C inherited RTA	20-30yr M=F (mild)	>50yr, M=F (Mildest) M/C RTA
Cause	Inherited	Inherited	Mildest (Acquired)
Association	30% autoimune M/c - Sicca syndrome SLE (M/c tissue) → Mixed connective tissue Disorder	FANCONI'S syndrome - glycosuria - aminoaciduria Syndactyly	Early CKI. ACEI/ARB K+ sparing diuretics Trimethoprim.
C/F	① short stature, Rickets ② Hypercalciuria → (stone) ↑ Renal calculi Nephrocalcinosis ③ Hypomagnesemia → M/s cramps	① mild acidemia Asymptomatic ② Vit D_3/PO_4 def. (2° to loss in urine) → Osteomalacia	① mildest acidemia Asymptomatic ② Rarely Hyper K+ complications
ABG analysis	← Metabolic Acidosis →		
Anion Gap	← (N) anion gap →		
U_{AG}	$(U_{Na^+} + U_{K^+}) - U_{Cl^-}$ [High/Positive]		
U_{pH}	always >5.5	maybe < 5.5	always (B) <5.5

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

S. K^+ Low (N) High

Rx ← Oral HCO_3^- supp. →

← Oral K^+ →

Citrate. supp. — ↓ Renal calculi (No Cure)

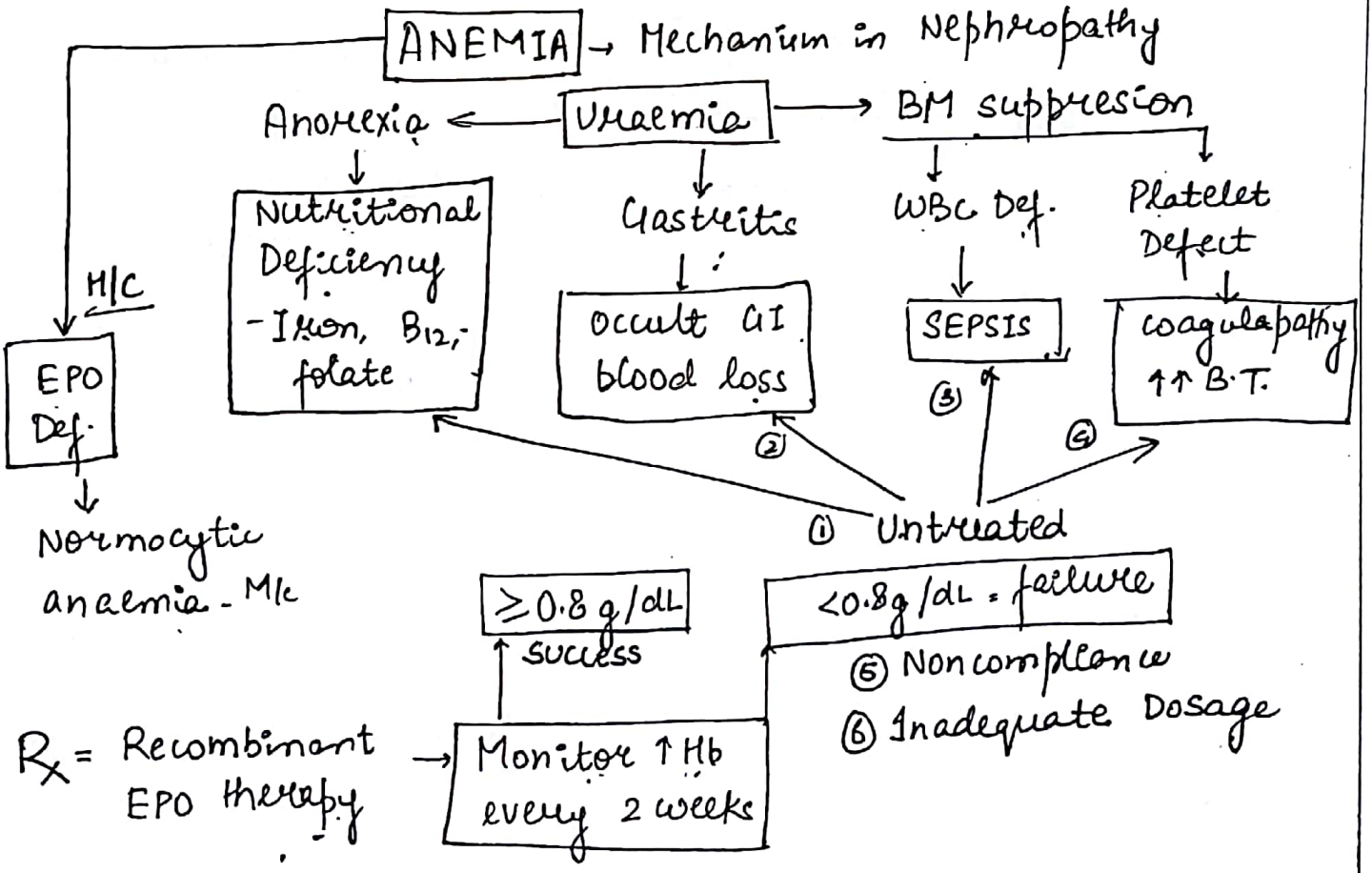
Vit D_3 / PO_4 supplements — ↓ Bone Disease

Stop offending drug & offers cure

Prog. WORST — Favourable — BEST.

ANEMIA

Defect in Erythropoietin Synthesis



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Vit D → final step of activation into [Vit D_3]
& its reabsorption occurs in [PCT]

↓ if Defective

BONE DISORDERS - in nephropathy
only C.K.I - Minimum (≥ 6 months) disease

RENAL OSTEODYSTROPHY

MIC
OSTEOMALACIA
- Vit D_3 def.
  - Oral vit D_3
- Chronic acidemia
  - Oral HCO_3^-

OSTEITIS CYSTICA FIBROSA
- 2° Hyper = PTH.
- Hypocalcemia
  - Most Imp. Hyper PO_4^-
    - SEVELEMER (Binding Resin)
  - Nutritional Def
    - Oral Ca^{2+}

ADYNAMIC BONE DISEASE
- Remodelling Defect of Bone
- Poor wt. Bearing
  - Encourage mobility

ASSESSMENT METHODS IN NEPHROLOGY

S. CREATININE LEVELS (Best) screening Test)

C. PRODUCED	EXCRETED
endogeneously @ constant Rate By Protein Breakdown.	Freely filtered at glomerulus Barely secreted/ reabsorbed @ tubules

S creatinine α GFR

↓ GFR ⟶ ↑ S. creatinine level

Renal Dysfunc^{n} — Early • sensitive marker

Limitations of Test

- nonspecific for Δ of nephropathy.
- may not co-relate immediate outcome of the disease (Limited Prognostic value)

FALSE +ve ↑ S. creatinine

↑ Produc^{n}

a) High Protein Diet
b) strenous exercise. (athletes)

c) Infection (sepsis)
d) Inflammation (A.I.D.)
e) Neoplasms (some)

Alternative Test To S. creat

S. CYSTATIN - C LEVELS

Produced endogeneously By all nucleated cells @ constant Rate

Freely filtered @ glomerulus
Excretion α GFR.

Adv - not related to Diet or Exercise

NOVEL MARKERS OF AKI. = Specific for Δ si of Nephropathy

NGAL (neutrophil gelatinase associated Lipocalcen)

KIM-1 (kidney Injury molecule)

IL-18

Tested in spot urine sample

Are secreted by tubules in response to injury.

Hence detectable only in Renal causes of AKI. (nephropathy)

TESTS - Detect :- SITE/ CAUSE/ SEVERITY

URINALYSIS — USG-KUB (structures) — GFR ESTIMATION. (functional status)

Proteinuria | Albuminuria | Hematuria | Pyuria | Cast/Sediment

PROTEINURIA

Defⁿ - >150 mg / 24 hours.

Detected using Dipstick Method (very sensitive)

- Non-specific for Δ si of Nephropathy
- Valuable in K/C/O - Nephropathy = identify SITE. (Based on quantity)

<2g/day (Tubular Range ↓ Tubulointerstial Disorders	≥2g/d/1.73m² (Glomerular Range Proteinuria)	
	<3.5g/d	≥3.5g/d.
	Nephritic range	Nephrotic Range

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

ALBUMINURIA

>30mg/24hrs (More specific marker)

QUANTITATIVE TESTS	Micro-alb	Gross-alb
24hr urinary alb. estimation (most reliable / gold std)	30-300 mg of Alb/24hrs	>300mg
(Most Preferred) Spot urinary ACR (alb/creat. ratio)	30-300 mg of Alb/gm of creat	>300 mg
USE:- PROGNOSTIC ↓ Staging of CKI	- Early marker - Reversible stages DOC = ACEI	Late/Irreversible stages

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Approach → HEMATURIA (RBC in urine)

Step 1 - Establish

"SIGNIFICANT" (any1)	"INSIGNIFICANT"
• >3-100 RBC/hpf ≥ 3 occassions • >100 RBC/hpf single occasion. • GROSS HEMATURIA	only observation. Repeat after 48 hrs

↓

Step2 – Urine microscopy : RBC morphology in Urine

EUMORPHIC

Source - Below the Renal Pelvis

Renal calculi
Cystitis
Carcinoma bladder

⇓

Radiological Testing

X-Ray, USG, CT → KUB

⇓

Inconclusive

⇓

Cystoscopy ± Biopsy

DYSMORPHIC (SOURCE → Renal; Disease → GN)

GROSS H.	Microscopic Hematuria	
IgA nephropathy	Post-infective causes Post-streptococcal GN (PSGN) Hep B- Polyarteritis Nodosa Hep C - Cryoglobulenemia SABE	Lupus Nephritis (SLE)
NORMAL	C_3 = initially Low Returns to (N) - 6-8wks	Persistently Low complement Levels

Approach - PYURIA. (Pus/WBC in urine)

Step1 :- "SIGNIFICANT" >5 WBC/hpf in centrifuged sample → Observe/Repeat if not significant

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Step 2 :- URINE CULTURE.

M/c cause of significant pyuria = UTI.

↓ ⊖

STERILE PYURIA

CAUSES

Infective

M/c - Partially Rx UTI.
(>72 hrs antibiotics)

FASTIDIOUS organisms
(special growth requirement)
- Chlamydia — Mcc of STD ♀
- Renal T.B.

Inflammatory

1) Renal Calculi
2) **Papillary Necrosis**
(severe tubular necrosis)
Vascular insufficiency - Mech.
↓
DM - analgesic abuse
Sickle - Kawasaki Disease
3) Post - Radiatherapy
4) Post - Transplant Rejection.

Approach :- CASTS / SEDIMENTS

Common CASTS But non-specific for Diagnosis

M/c cast in urine
HYALINE CAST
Most Benign cast
NO further Rx / test
↑
M/c found in AKI.

M/c cast in nephropathy
GRANULAR / CELLULAR
Present in Ⓑ
Tubulo-interstitia — GN

RARE CASTS (10-15% cases)	DIAGNOSTIC
RBC cast	GN * (Acute GN)
WBC cast	Pyelonephritis
Muddy Brown Cast	Acute Tubular Necrosis
Eosinophilic Cast	Acute Interstitial Nephritis
Broad / waxy Cast ↑ WORST CAST	C.K.I.* Indicates total break down of tubules.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

USG - KUB

(N)	Ab (N) & Its Interpretation
1> SITE :- Anatomical	ECTOPIC → NO relation to function
2> SIZE :- 7-11 cms < 7cm (Shrunken) CKI (exception) →	> 11 cms – Enlarged / Bulky AKI. → classical in acute Interstitial Nephritis Early DM nephropathy Adult PKD. (APKD) HIV associated Nephropathy Renal amyloidosis
3> SYMMETRY < 1.5cms	> 1.5cms - assymmetrical Kidneys. Pathology ⇒ always in smaller Kidneys
4> ECHOTEXTURE = (N)	Increased Echogenecity ↓ Active Disease in the Kidney
5> Cortico-Medullary Differentation (CMD)	Most Imp. parameter AKI (Vs) CKI Preserved | Loss
6> COLLECTING SYSTEM - (N)	Obstructive uropathy

GFR ESTIMATION (Functional Status)

Most preferred = Creat. clearance
(Indirect/ surrogate marker)
Easy, cheap, no radiation expo
Cockcroft Gault formulae (Estimated)

$$eGFR = \frac{[140 - Age] \times wt.(kg)}{72 \times S.creat} \quad (\sigma^{7})$$

$- [\ ] \times 0.85 \quad ♀$

Most Reliable/ Gold std :-
Radio-isotope scan.
(DTPA, MAG-3)
Direct method.
Accurate
Single Kidney GFR
Segmental GFR.
Total Kidney GFR.

Disad
1) Inaccurate (esp in AKI)
2) only - total Kidney GFR

Disad
Invasive
Expensive
Radiation exposure

Uses - MEDICAL
1) Staging of CKI
2) Follow-up - chronic medical Renal Disease
eg. DM, HTN, HIV associated Nephropathy
3) Dose adjustment of Nephrotoxic drug

Uses
- Pre-Transplant assesment of DONOR
- Pre-op assesment of uro Sx
- Medicolegal
- Decision making
  ↳ to operate on better kidney
  never done B/L → risk of infection ↑

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

INDEX : RENAL DISORDERS

AKI	Parameters	CKI
Preserved	USG = CMD	Lost
(N) or ↑	USG - size	(N) or ↓
Fluctuates - P_{osm}	Uosmolarity	Isothenuria
Hyaline Cast	CASTS	Broad waxy Cast
(−) uncommon	Anaemia	(+) common.
uncommon.	Renal Osteodystrophy	(+)

AKI

- pre-renal
- Renal
  - T.I.
    - ATN
    - Acute Interstitial Nephritis
    - GN
- Post-Renal

CKI

- Acq.
  - H/c - DM
- Inherited
  - Alports
  - APKD

R.R.T (Renal Replacement Therapy)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

AKI

Def^{n}:- Abrupt decline in GFR over short period of time

KDIGO Guidelines (Kidney disease improving Global outcome - part of National Kidney Found

Any 1

- ↓ U.O. ≤ 0.5mL/kg/hr ≥ 6hrs. [oliguria].
- ↑ S.Cr. ≥ 0.3 mg/dL from Baseline ≤ 48hrs
- ↑ S.Cr ≥ 1.5x Baseline (50% increase) ≤ 7 days.

Causes of AKI

MC

Pre-renal	Renal		Post-Renal
60-85% - HYPOPERFUSION	INTRINSIC		1-5% - OBSTRUCTIVE UROPATHY
1) Dehydration Diarrhoea Hypoalbuminemia Massive H'ge Burns (Insensitive loses through skin)	95% Tubulo Interstitial Disorders.	5% GN	
2) Hypotension Cardiogenic Septic shock.			
3) Drugs - disrupt autoregulation.			

http://mbbshelp.com WhatsApp: +1 (402) 235-1307

C/F	PR	Renal	Post-R
	Classical 3 stages	1) Non-oliguric AKI	Loin pain
	Oliguria <400mL/d	eg. SEPSIS	Dysuria
	anuria <100mL/d	(In Tubulo-Interstitial)	Urgency
	Diuretic phase (recovery)	2> Hematuria - GN	

Rarely - Serious UREMIC MANIFESTATIONS

(Cause - mortality in A.K.I.)

1> Encephalopathy / convulsion

2> Pericarditis / shock

3> Coagulopathy

Dx → KDIGO Guidelines.

Approach - AKI

USG - Collecting System

(X) → Post - Renal AKI

(N) → Exclude Post-Renal AKI.

PARAMETER	PRE-RENAL	RENAL
MECHANISMS	RAAS ⊕ ↓ Na^+/H_2O reabsorption ↑↑ urate reabsorption.	Loss of concentrating ability Na^+ lost in urine Dilute urine
BUN : Creat	>20:1	<12:1.
U_{Na}	<20mEq	>40mEq
F_{Na^+}	<1%	>2%

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

U_{osm}	> 500 mosm/L	< 350 mosm/L
CASTS	Hyaline casts	Granular/cellular
USG- Echotexture	(N)	↑ / Bright kidney
Single Best Novel markers of AKI	UNDETECTABLE	DETECTABLE

Rx PALLIATIVE

Indications of Dialysis

1> UREA > 100

2> CREAT > 7

3> SERIOUS UREMIC MANIFESTATIONS

4> Refractory Pulmonary oedema

5) Hyperkalemia > 6.5 mEq

6) Refractory pH < 7.20

Single most Imp. Indication for emergency Dialysis

7> Ingested Dialysable Toxin

(commonly used Accidental/suicidal)

a> Salicylates

b> Methanol

c> Lithium

d> Polyethylene glycol (solvent)

SPECIFIC

Depends on cause

Ⓐ Post-Renal AKI

Early Sx relief

Excellent recovery

Ⓑ Pre-Renal AKI

Fluid challenge (1st Line)

Inotrophs

Antibiotics

Stop offending drug

Excellent recovery

Delay in Rx → Progress to ATN

Ⓒ RENAL AKI.

↓

Further evaluation.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Approach - RENAL AKI.

95% 5%

Tubulo. Interstial	Parameters	GN
<2g/day	PROTEINURIA	>2g/day
(-)	HEMATURIA	common.
Granular	CASTs	RBc.

T.I. ⇒

ATN	Parameters	Acute Interstial Nephritis
>4%	$FeNa^+$	2-4%
(N)	USG - Size	enlarged / Bulky
Muddy Brown	CASTs	Eosinophiluria

ATN (Tubule - M/c site)

Anatomy
Prone to vascular Insufficiency

Physiology
Site of conc^n

Direct →
Luminal Contents

1) Untreated Pre-Renal
2) Sepsis
3) Contrast Induced Nephropathy
4) Drugs - aminoglycosides
5) Toxins - Heavy metal poison.
6) Cryoglobulinemia
7) Myoglobinuria
8) Hemoglobinuria

AIN

1) Allergic Response to Drug (M/c - 95% of case)
   - NSAIDs
   - Sulfonamides
   - Penicillin.
   - cephalosporin
   - Rifampicin
   - FQs
   - Dapsone
   - Nitrofurantoin
   - Contrast agents.
2) Viral Infe^n
3) autoimmune
4) Lympho - proliferative

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Supportive therapy - Underlying cause	Rx
4-6 wks	Avg. recovery
1-5%	Risk of ESKD
Favourable	Prognosis

Stop offending Drug. Supportive Rx
1-2 wks
<1%
Good

GLOMERULONEPHRITIS

Causes :-

Ⓐ PATHOLOGICAL :- Mesangial Involvement on Biopsy

⊕ Proliferative GN

- Mesangio-proliferative GN (IgA, PSGN)
- Crescentric GN (worst prog) (RPGN)
- Membrano-~~capy~~ proliferative GN
  MPGN - mesangio-capillary

⊖ Non-Proliferative GN

- Minimal Change Disease
- FSGN
- Membranous nephropathy

Ⓑ CLINICAL PRESENTATION of GN (More Preferred)

Asymptomatic proteinuria/ microscopic hematuria (MC)	Nephritic	Nephrotic	Reno-vascular HTN	C.K.I eg. Alport's Syndrome
	→ Hematuria → HTN → Rapid ↓ GFR. (Risk - RPGN) → Proteinuria <3.5g/day	→ Anasarca (serous cavity) → Hypercoagulable State → Preserved GFR >3.5g/day 1.73 m^2		

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Nephritic	Nephrotic
• PSGN • Lupus nephritis • RPGN	Children → MCD Adults → FSGS Elderly (>50 yrs) → membranous nephropathy

Proliferative GN	Non-Proliferative
More likely nephritic	More likely nephrotic

MESANGIO-PROLIFERATIVE

	IgA nephropathy	PSGN
M/c cause	Worldwide	India
Epidemio	20-30 yr, ♂=♀	5-15 yrs. ♂=♀
Etiopath	← Post-infective	M/c preceded by URTI →
Latent Period	< 1st week Syn-pharyngitic	1-3 weeks. ← SKIN 4-6 weeks ←
C/F	Recurrent Gross Hematuria 10-15% - Persistent microscopic	HEMATURIA Microscopic hematuria HTN, LUFR → Common [classical nephritic syndrome].
	Uncommon Benign nature of the disease	
Screening (Serology)	S. IgA-I level ↑↑↑	Anti DNAase (70% cases +) ASO, anti-hyaluronidase
Serum complement	Ⓝ	Initially Low Returns to Ⓝ in 6-8 wks

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Biopsy	← Mesangio-Proliferative changes →	
Immuno flowrescence	← Granular Pattern of Ig deposits →	
	Anti IgA staining	Anti IgG Staining
Rx	Reassurance Majority - self Limiting Risk of RPGN ≤ 1% Plamapheresis	→ Penicillin - no role in nephropathy To eradicate residual Infec. → Long Term prophylaxis. ⊗ Low relapse rates
Prognosis	BEST among GN	2nd Best (Risk of RPGN-1-5%

POOR PROGNOSTIC FACTORS

1) Elderly onset (> 40yrs)
2) Nephrotic
3) Progression to RPGN — any GN requires RRT ≤ 1 month of onset

LUPUS NEPHRITIS

Kidney involvement - most dreaded.

organ involvement in SLE → H/c c of acute mortality

Deposition of Anti-ds DNA on GBM. (100% specific)

Type	PATHOLOGY	C/F	Rx
I	Minimal Mesangial proliferation.	Asympt - Proteinuria microscopic Hematuria Preserved GFR	No active Rx
II	Diffuse mesangial proliferation.		

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

III	Focal nephritis	Classical nephritic syndrome	I.V. methyl prednisolone therapy
IV	Diffuse nephritis	High risk - RPGN (15-20%)	
V	MPGN/membranous	Nephrotic Synd.	oral steroids
VI	Glomerulo-Sclerosis	CKI	Consider RRT

RPGN ⟺ Crescenteric GN

(Clinical Dx) (Biopsy finding)

APPROACH – RPGN

Anti GBM Ab

GOODPASTURE's Syndrome (GPS)

Autoimmune

20-40yrs ♂ > ♀

α_3 subunit - Type 4 collagen

↓

Goodpasture's Ag

Alveolar BM | GBM

(Pulmonary + Renal Syndrome)

Alveolar H'ge | RPGN

⇓

MC among smokers.

I.F. :- Linear pattern of Ig deposits

ANCA

Vasculitis

mimics GPS

So, D/D. for Pulmonary-Renal Syndrome

- Wegener's
- Churge-strauss
- microscopic polyangeitis (MPA)

Sparse Ig deposits (pauci-immune)

Serum. Complement levels

Low C_3

↓

Anti dsDNA

Lupus (SLE)

↓⊖

Anti-DNA ase

PSGN

↓⊖

HbsAg

PAN

HCV-Ab

cryoglobinemia

↓

ECHO :- SABE

(N) C_3

IgA

Henoch-Schloenlein Purpura

Rx ⟵ PLASMAPHERESIS ⟶ Plasmapheresis

Prognosis ⟵ POOR > 70% acute mortality ⟶ Poor Prog.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

MPGN

279

Biopsy Based Δ sis

30-50yrs.

♂ > ♀

90% causes → 2° causes

70% cases → Low C_3 Level

Causes

1> Infections – Leprosy
Malaria
Syphilis
Hep. B
Hep. C

2> Autoimmune – Type V ~~MPGN~~ Lupus nephritis

3> Solid organ Tumours – [H/c Renal manifestation = MPGN]

4> Lymphoproliferative states

C/F

Majority → "NEPHROTIC SYNDROME"

Δsis

Renal Biopsy – Double BM /
Tram track appearance of GBM.

[Only INTRA-GBM MESANGIAL involvement]
↳ causes splitting of GBM.

10% Idiopathic → R_x - Immunosuppressants

FSGS (Mlc - adults)

- 1° (idio)
  - Mlc Biopsy finding = sclerosing type of FSGS
  - Most severe collapsing type of FSGS
- 2° Causes
  - end point of DM, HTN, Reflux induced
  - HIV associated nephropathy

C/F - HTN
Early & severe features

Rx underlying disease + strict HTN control

Risk of ESRD: common - slow 15-20 yrs

Acute mortality: No — Favourable Prognosis

MEMBRANOUS NEPHROPATHY (MC > 50 yrs)

85%

- 1° (idio)
  - EM finding (Gold std): Spike & Dome appearance of GBM
- 2° causes - Same as in MPGN

NEPHROTIC

WORST Hypercoagulable State

Hence, max. risk → RV Thrombosis

Anti-coagulation (all cases) + Immunosuppressants

Risk of ESRD: Common - 5-10 yrs

Acute mortality: Present (vascular) — WORST PROG.

C·K·I·

Gradual ↓ GFR ≥ 3 months duration.

Kidneys → Large functional Reserve.

Clinical Disease ≥ 70% Loss of nephrons ≈ 25-40 mL/min eGFR

C/F -

1) UREMIC symptoms (M/c) → M/c neurological feature (90%)

→ Encephalopathy / convulsions
→ Pericarditis / shock
→ Gastritis / Anorexia
→ Infertility / Loss of Libido
→ Proximal myopathy
→ Peripheral neuropathy
→ Restless Leg syndrome
→ Generalised pruritus

Peripheral neuropathy
- (axonal variant)
- Poor recovery inspite dialysis

2) FLUID OVERLOAD symptoms
peri-orbital oedema
peripheral "
CHF

3) Metabolic acidosis

4) ANAEMIA - CKI

5) Renal osteodystrophy

Asu - Done

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Rx STAGE of CKI	2 Parameters: Albuminuria	2 Parameters: eGFR	Rx
I, II	Microalbuminuria (Reversible stage)	90-120 mL/min	ACEI + strict control of Risk factors (DM, HTN)
		60-89 mL/min	
III	Gross (irreversible stage)	30-59 mL/min	Counsel + Prepare for RRT
IV		15-29 mL/min	
V ESRD	Gross	<15 mL/min (>90% nephron Loss)	RRT is mandatory

Specific Rx - Depends on Cause. → DM, alport, APKD

DIABETIC NEPHROPATHY

Microvascular complication of DM.

Pathophysio → Hyperglycemia (1)

- GLYCOSURIA = ↑ urine osm ← (2) ↑ Glycated end products
- RAAS activation ⊕ (absence of dehydration) ← HYPOPERFUSION ← oxidative injury vascular endothelial
- (3) Efferent arteriolar vasoconstrict"
- ↑ Glomerular capillary Pressure (already (N))
  - (1) ↑GFR → supra-(N)
  - Capillary HTN → GLOMERULOSCLEROSIS (F.S.G.S.)
- Microglobu
- Micro albuminuria

Gradual nephron Loss
(2) Returns to (N)
(5) ESKD (>90% Loss)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Stage	Duration of DM	Alb.	eGFR.	Rx
(I) Hyper functioning	1-5yrs	(-)	supra-(N) > 120mL/min. ⇓	Strict DM control (1)
(II) Silent stage	5-8yrs	(-)	Returns to (N)	Adequate Hydration. + (2)
(III) Incipient (subclinical)	8-12 yrs	Micro albuminuria +ve	CKI stage I/II	ACEI / ARB (3)
Early - EM → Thickening of GBM non-specific to Dis				
(IV) OVERT (symptomatic)	12-18 yrs	Gross	CKI Stage 3/4	Consider RRT
(V) ESRD	18-25 yrs	Gross	Stage (5)	RRT is mandatory

LATE/ Advanced/EM → Nodular glomerulosclerosis
irreversible (K-W - Kimmelstiel - Wilson nodules)

ALPORT'S SYNDROME

M/c- X L -® defect
20-40 yrs.
♂ > ♀

α_5 subunit - Type IV collagen = ABSENT

M/C ↓ GBM	↓ Cochlear B.M.	Lens		↓ Skin
		M/C ≈ 75%	Most specific	
G.N ↓ Recurrent Hematuria	SNHL	Dot & fleck retinopathy (Not specific)	Ant. Lenticonus (≈ 25% cases)	Asymptomatic

Dx - Renal Biopsy ⇒ "BASKET-WEAVE" appearance of GBM.

only Rx - Renal Transplant
↳ Never recurs in graft
Excellent survival

Post-Transplant Complication - Mimic Recurrence (Hematuria)
↓ ↓
RARE → [already on Immunosuppression] Anti-GBM disease (Ab against α_5 subunit).

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

POLYCYSTIC KIDNEY DISEASE

Group of inherited Disorders characterised by

A) multiple cyst in multiple organs
- Kidney
- Liver
- Pancreas
- Spleen

B) Berry Aneurysm
↑ risk of SAH

C) Colonic Diverticuloses
↓
Recurrent Colitis
↓
↑ oxalate reabsorp" from gut
↓
Hyperoxaluria
↓
Oxalate Renal calculi

Mode of Inheritance

AD-PKD (H/C)
⇓
Survive till adulthood
Called - adult - Polycystic KD

AR-PKD (Rare)
⇓
Never survive >10yrs of age

APKD-1	APKD-2	PKHD (Hepatic)
POLYCYSTIN-1	POLYCYSTIN-2	Fibrocystin
Chr. 16	Chr. 4	Chr 6
moderate form	mildest form	most severe
20-30yrs.	30-50yr of age	I.U. Life / Infancy

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

C/F	AD	AR
	M/C Recurrent Loin Pain + Hematuria / fever (Infection in Renal cyst) M/C - Extra-renal (Hepatic cysts) - mechanical compression - Bil. radicles - cholestasis / cholangitis	- oligohydramnios (30% fetal Loss) - Uremic symptoms in infancy - ESKD ≃ 10 yrs of age - Cirrhosis ≤ 10 yrs of age (CAROLI's Disease = Defect of Intra-Hepatic Biliary Radicals Present ≃ 3% cases
Dx is USG <30 yrs ⊕ ≥ 2 renal cysts each kidney ≥ 1	30-59 yrs ≥ 4 renal cyst ≥ 2 in each	
Rx - Renal Transplant No recurrence Good Prognosis		No cure Grave Prognosis

RENAL REPLACEMENT THERAPY

BEST FORM → TRANSPLANT

- Potential cure
- Better survival
- Better quality of life

DIALYSIS

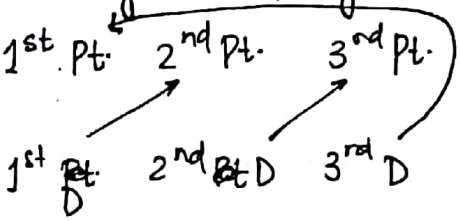
only filteration.
Palliative Rx only

⇓

Limited Donor Availability

DOMINO Tx

Kidney swapping



HLA Registry

All Sx must be done on same calender

(Limits - chain size)

HAPLO-Identical

(MHC/HLA matching) — 6 Ag matching

Class I	A	B	C
Class II	DP	DQ	DR.

> 3 = good match.

≤ 3 = Poor match.
(Less than half match)

- Most imp. HLA match is HLA-DR
  ↓
  Best success

DIALYSIS

HEMODIALYSIS (H.D.)

- vascular access
  (Cannula, AV fistula)
  High complications Rates
  (Bleeding, sepsis, Thrombosis)
- H.D. centers
  (Limited availability)
- Biocompatible - methyl cellulose polymer (filter)
  (High cost)

PERITONEAL (P.D.)

- Intraperitoneal catheter placement → done ↓ LA
  Low complication rates
  (≤ 1% risk → Peritonitis)
- no problem
  only C/I → Para H/o recurrent GI Sx

Lower cost - omentum acts as filter

http://mobshelp.com WhatsApp: +1 (402) 235-1397

• Risk → Infection transmission (HIV, Hep B, Hep C, CMV)	• No Risk → Installing sterile peritoneal Dialysate fluid
• Huge Hemodynamic/osmotic shift → poorly tolerated (M/C) acute comp^{n} → HYPOTENSION – Muscle cramps / Fatigue • Sudden cardiac death In cardiomyopathy EF < 15% ↳ C/I	• LOW SHIFTS → Better Tolerated Safe in cardiomyopathy & Post cardiac Sx
• Risk → HYPOGLYCEMIA Preferred Form. Excellent filteration Rate 800 - 1200 mL/min	Risk → HYPERGLYCEMIA/ Wt. Gain Poor Filteration 15-25 mL/min. only Back-up

DIALYSIS ASSOCIATED AMYLOIDOSIS

- Accumulation of β_2 microglobulin (β_2-MG)
- In the musculoskeletal system
- M/C → entrapment neuropathy
- On dialysis ≈ 3-7yrs
- Neither form (HD/PD) can filter β_2-MG.
- X-Ray Hand - Deposits in metacarpals.
- only R_x = Renal Transplant

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

PRE-TRANSPLANT - Indications

1) APKD
2) Horse-shoe kid
3) Obstructive uropathy

} ↑ Risk of infections in the native kidneys

⇓

Post Transplant Immunosuppresion

↙

Septicaemia → stop Immunosuppresants

⇓

Rejection of Graft

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

CNS

achin_mehra@yahoo.com

Priyachin mehra

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

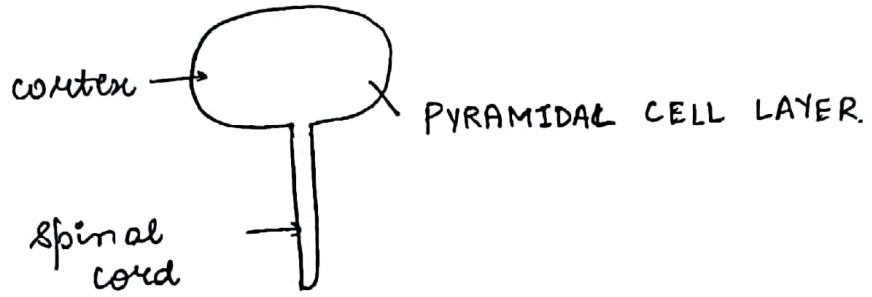
SEIZURE DISORDER & EPILEPSY

SACCIRE

= to take possesion of

SEIZURE

Paroxysmal event due to hypersynchronous CNS discharges



EPILEPSY

≥2 unprovoked seizure

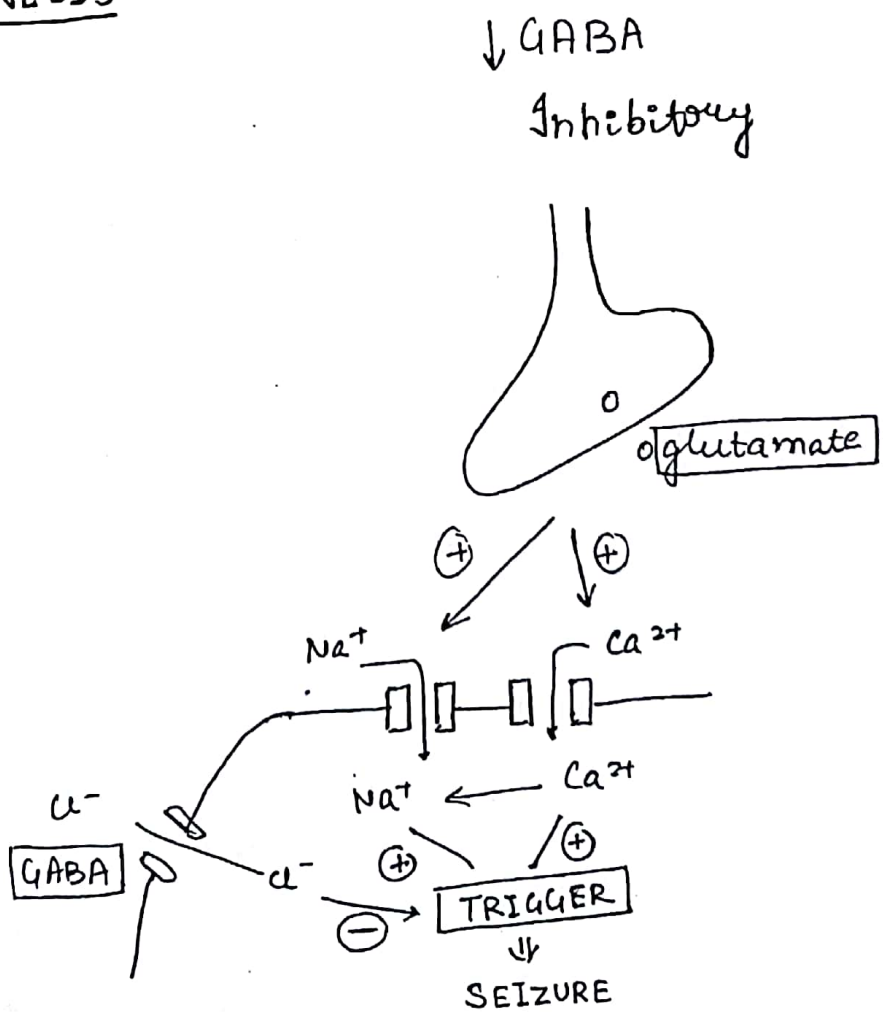
EPILEPTOGENESIS

↑ GLUTAMATE

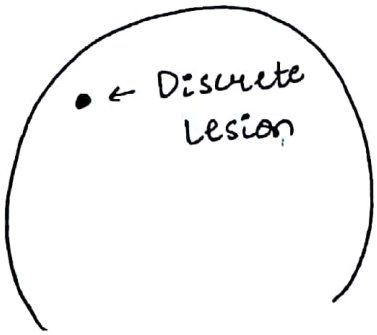
excitatory

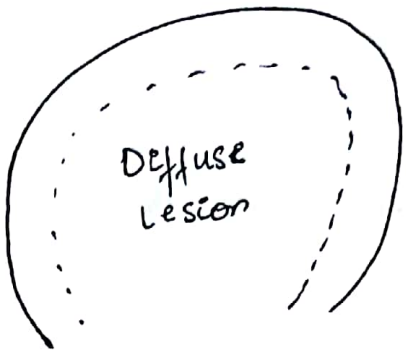
↓ GABA

Inhibitory



CLASSIFICATION OF SEIZURES





FOCAL

PARTIAL

Structural Ab(N)

GENERALISED

DRUGS

Antibiotics - Quinolone

Antivirals - Acyclovir

Antimalarials → mefloquine
→ chloroquine

Analgesics - Tramadol

TOXINS

ABUSE
Cocaine
Amphetamine

WITHDRAWAL
Alcohol

METABOLIC

1) ↓Na^+ (M/c Biochemical Ab(N) ppt. seizure)
↓
due to cerebral oedema
<100

2) ↑K^+, ↓K^+ ⇒ doesn't cause seizure.

http://mbbshelp.com WhatsApp:+1 (402) 235-1397

FOCAL SEIZURES

↓

LOSS OF CONSCIOUSNESS

‖

Contact

‖

Cognition

→ ⊕ = Dys cognitive (complex) ← PARTIAL

→ ⊖ = Non Dys cognitive (simple) ←

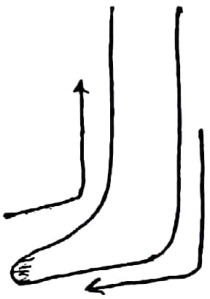
TODD'S PALSY

→ Post Ictal Paralysis

→ Self recoverable

↳ starts in **1st 24 hours** of onset

FOCAL SEZZURE



Distal → Proximal

JACKSONIAN MARCH

→ focal seizure arising ~~from~~ in a Limb.

GENERALISED

ABSCENCE SEIZURE / PETIT MAL EPILEPSY / PYKNOLEPSY

→ Loss of contact ⊂ environment

→ Tone of Body (N)

→ ABrupt onset

→ ≤30 sec

→ Subtle Motor Signs ⊕ (minor)

→ AURA ⊖

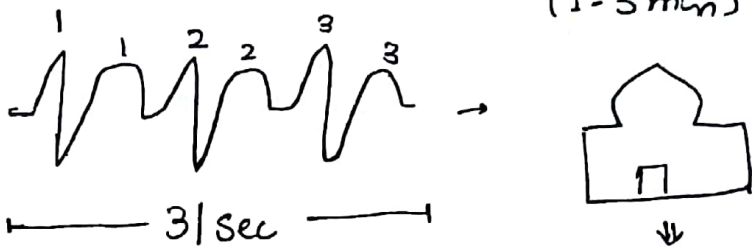
→ NO post Ictal confusion

Starts - 4–8 yrs of age

Spontaneous Remission
in 60–70% by 18 years of Age

EEG :- B/L 2–4 Hz spike & wave

Precipitated by Hyperventilation.
(1–3 min)



3 spikes & 3 waves

SPIKE & DOME pattern
or
Spike & wave "

ATYPICAL ABSCENCE SEIZURE

→ Loss of consciousness – Less abrupt
↑ Duration.

→ mental Retardation

→ Structural Ab (N)

– EEG – ≤ 2.5 Hz spike & wave
(slow)

→ Resistant to Anti epileptic Drug

MYOCLONIC SEIZURE

↓
Jerky movement

CAUSE – 1> Hypoxia
2> Degenerative

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

H/o Hanging → compressed Carotid
↓
Cause hypoxia.

JUVENILE MYOCLONIC EPILEPSY

- Early Adolescence
- Family H/o
- Chromosome No. 6
- unknown cause. ⇒ ✗ hypoxia
  ✗ Degeneration.

- B/L Myoclonic jerks
  - on awakening
  - ppt by → Fatigue, Alcohol

- IQ (N)
- Loss of consciousness (−)
- subtle motor signs (−) [AUTOMATISM] → Eye Blinking, Lip smaking

MAJORITY may turn into GTCS. pt

GENERALISED TONIC CLONIC SEIZURE

GRAND MALL EPILEPSY

PREMONITARY SYMPTOMS-
Nausea
vomiting
Abdominal Pain

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

AURA → ⊕ Focal / ⊖ Generalised

↓

Hallucinations

- Olfactory, gustatory ← MEDIAL TEMPORAL
- Auditory ← LATERAL TEMPORAL
- Visual ← OCCIPITAL

[NOTE: Aura seen in Focal Lesions.]

↑ Tone
- flexors of UL, Extensors of LL → DECORTICATE POSTURING
- NECK → VERSIVE HEAD TURNING
- Intercoastal, Adductor (Larynx) → ICTAL CRY, Cyanosis +

↓

Clonic (Jerky)

↓

Post Ictal Confusion (Urinary Incontinence)

JUVENILE MYOCLONIC EPILEPSY

- Myoclonus
- Majority → GTCS
- 1/3rd → Absence Seizure

M/C presentation of JME is MYOCLONUS (AIIMS)

MESIAL TEMPORAL LOBE EPILEPSY

- Focal seizure ± Loss of consciousness [DYSGOGNITIVE]
- DEJA VU
- Febrile seizure.
- Enlarged Temporal Horn
  Small Temporal Lobe
  Hippocampal Scleroses
  → Rx → Temporal Lobectomy
  Rx OC = Sx
  antero-medial part removed
  → Amygdalo Hippocampectomy
- Resistant to anti-epileptics

S. PROLACTIN
↑ 30 mins after True seizure

ANTI-EPILEPTIC DRUG

A.E.D. X 2 years —TAPER→ 3rd year
↓
Stop.

Sudden withdrawal of DRUG ⇒ ppt. seizure.

Seizure ppt. while withdrawal in 1st 3 months. more commonly.

1st episode of seizure

✗ DRUG	✓ DRUG
Provoked	Unprovoked
→ Febrile seizure	→ Status epilepticus
→ Alcohol withdrawal	→ Family H/o ⊕
⇓	→ Ab⊕ neurological exam"
BZD → Injectable	

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Chlordiazepoxide
Oral
for gen. alcohol withdrawal
not for seizures

Ab(N) - EEG
↘ CT/MRI.

IOC
⇓
seizure ⇒ EEG

DOC =

↑ EFFECT

↓ SIDE EFFECT

FOCAL

L - Lamotrigine → STEVENS JOHNSON SYNDROME (1%)

O - Oxcarbamazepine → ↓ Na^+ (SIADH)

C - carbamazepine → ↓ Na^+ (SIADH)
Aplastic anaemia

P - Phenytoin → hypersensitivity
hyperglycemia
hyperplasia of gums
hydantoin syndrome
nystagmus
hepatitis
+
megaloblastic anaemia
[↑ excretion of folate]
+
osteomalacia

L - Levetiracetam
irritability
mood disorder

[6H]

FETAL HYDANTOIN ⇒ Valproate
Phenytoin
carbamazepine

Microcephaly
Hypoxia of Limbs
Cleft < Lip
Palate

GTCS

Valproate
Lamotrigine
Topiramate

ABSCENCE

ETHOSUXIMIDE - DOC
Valproate
Lamotrigine

ATYPICAL ABSENCE SEIZURE

SAFEST A.E.D

Lamotrigine > Carbamazepine > Pheno barbitone
↓ teratogenic
↑ sedative even for fetus

DOC → as per seizure type
monotherapy
Lowest effective Dose

GTCS → Valproate → Neural Tube Defect → Preg. 1-2%
↘ c A.E.D. = 10-20%

A.E.D is not 100% Teratogenic
Do not change Rx During ♀ becoz changing Rx can ppt. seizure [Break Through].

Seizure frequency during ♀
50% - Unchanged
20% - ↓
30% - ↑ → emesis,

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Y ↑ in 30%

1) Emesis → ↓ absorptn of drug

2) Hormones

Progesterone	Estrogen [Epileptogenic]
↑ Seizure threshold	↓ seizure threshold

A.E.D. Excreted In Breast Milk

MAXIMUM	MINIMUM
Levetiracetam	valproate

Breast feeding is recommended

AED is also continued

JME

A.E.D. x Lifelong

DOC = Valproate
Levetiracetam

⇒ **DRUGS NOT USED IN JME**

→ Carbamazepine
→ Phenytoin
→ Lamotrigine
→ ↑ myoclonus

⇒ **PRE ♀** on valproate
↓ change to
Levetiracetam

STATUS EPILEPTICUS

Seizure — Inter Ictal LOC — S_2

Convulsions ≥ 5 mins

≥ 30 min

EPILEPSIA PARTIALIS CONTINUA

⇒ Continuous partial seizure

⇒ Status epilepticus in focal seizure

1st Drug LORAZEPAM (0.1 mg/kg) DOC or MIDAZOLAM (0.2 mg/kg)

↓

I.V. A.E.D.

PHENYTOIN 20 mg/kg @ 50 mg/min
- 0 order kinetics
- cardiotoxic

× Dextrosex ⇒ Phenytoin ppts
Normal Saline

FOS PHENYTOIN @ 150 mg/min
↓ Hypersensitive
mixed ≅ Dextrose
I/M

OR

VALPROATE (25 mg/kg)

OR

LEVETRIACETAM (20-30 mg/kg)

[POST - TRAUMATIC EPILEPSY → LEVETRIACETAM.]

+ seizure ↓

I.V. MIDAZOLAM 0.2 mg/kg → 0.2 - 0.6 mg/kg/hr

OR

I.V. PROPOFOL

+ Seizure

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

↓

THIOPENTONE

CARBAZEPINE → not recommended in status as found in oral form

MOVEMENT DISORDERS

ATHETOSIS / CRAWLING

→ Slow
→ Sinuous
→ writhing
→ Seen in Lesions of GLOBUS PALLIDUS → G A P

CHOREA / DANCE like movement

Semi purposeful movement

Lesion - CAUDATE NUCLEUS

↑

CORPUS STRIATUM

CAUSES -

C - Chorea Gravidarum
H - Huntington's Chorea
O - OCP
R - Rheumatic / Sydenham's Chorea
E - Endocrine / Thyrotoxicosis
A - Atherosclerotic / Senile

M/C/C ⇒ SLE

HEMIBALLISMUS ⇒ Exclusively on ONE SIDE

- ✓ Large Amplitude
- ✓ Flinging
- ✓ Proximal
- ✓ Limb
- ✓ Lesion ⇒ SUBTHALAMIC NUCLEUS (STN)

⇓

C/L

PARKINSONISM

Degeneration / Atrophy ⇒ SUBSTANTIA NIGRA PARS COMPACTA (SNPC)

⇑

LEWY BODY

- → Intra-neuronal
- → Intra-cytoplasmic
- → Eosinophilic inclusion Body
- → Contains α synuclein

↓ DA

Level (N) 100% → 70%

↓ 30%

RIGIDITY

↑ ACh

TREMORS

ETIOLOGY :-

1) DRUGS ⇒ DA ⊖ (Hlc/c of 2° Parkinsonism)

- TYPICAL ANTIPSYCHOTICS
  - Haloperidol
  - CPZ
  - METOCLOPRAMIDE

DA Depletors ⇒ Methyldopa, Reserpine

2> TOXINS → CO
→ Mangnese
→ MPTP - Heroin Addicts.

3> TRAUMA
Boxers

4> FAMILIAL / GENETIC
↓
MUTATIONS
↓
GENES → α synuclein gene — Chr. 4
PARKIN gene — Chr. 6
LRRK-2 gene — Chr. 12
<40 yrs
>40 yrs
Age OF onset
⇓
EARLY ONSET

5> IDIOPATHIC -
85-90% pts.
⇓
PARKINSON DISEASE. (M/c type)
=
PARALYSIS AGITANS

C/F :-
- TREMORS → 1st M/c symptom
  - Resting → Pill rolling movement
  - 4-6 Hz.
  - UL > LL
  - Spares neck
- RIGIDITY
- AKINESIA
- POSTURAL INSTABILITY → Last symptom or advanced.
  - asymmetrical

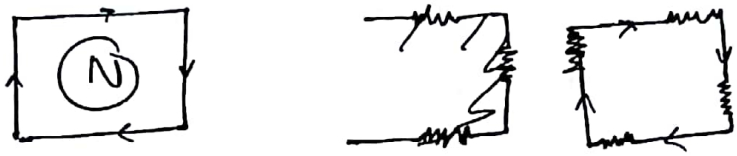
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

TITUBATION → ⊖ Pancuronium
↓ ⊕
cerebellum

TREMOR

RESTING TREMOR ⇒ PARKINSONISM

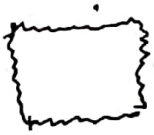
INTESIONAL TREMOR ⇒ CEREBELLAR LESIONS



FLAPPING TREMOR = HEPATIC ENCEPHALOPATHY
"ASTERIXIS" UREMIC "
CO_2 narcosis

FINE TREMORS = THYROTOXICOSIS

BENIGN ESSENTIAL TREMORS



→ 5 - 11 Hz
→ AD inheritance
→ VL > LL
→ ORIGIN = cerebellum
→ ↑ anxiety
↓ on alcohol consumption
= R_x → Propranolol

RIGIDITY – BEST Jt to show Rigidity = WRIST
Resistance to passive movement

LEAD PIPE → EXTRA PYRAMIDAL SYNDROME

COG WHEEL → PARKINSONISM → UL = COG WHEEL
LL = LED PIPE

Superimposed tremors on leg lead pipe

CLASP KNIFE – UMNL

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

RIGIDITY

Tone ↑ Flexors = Extensors
Bidirectional

SPASTICITY

Flexors > Extensors
unidirectional
velocity Dependent

GAIT

FESTINATING GAIT → Parkinsonism
(ready to run)
Kinesia Paradox
↳ ↑ acceleration on running

+ spasticity
Wk. Distal > Proximal

CIRCUMDUCTION GAIT – Hemiparesis → corticospinal tract

WADDLING GAIT → Myopathy (Proximal)

Lurching GAIT → Polio Lesion → Ant. Horn cells.

BROAD BASED → Cerebellum → Drunken Gait

HIGH STEPPAGE → Foot Drop] neuropathy Deep Peroneal N/V

STAMPING → TABES DORCALIS
↳ Lesion – post column
↓
Loss of Vibration

POSTURAL INSTABILITY

Loss of Postural Reflexes → FALL

MICROGRAPHIA
Small handwriting
(N) I am a doctor
(PD) I am a doct-

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

MONOTONOUS SPEECH

Hypophonia

MASK LIKE $ FACE

Depression

Dementia

SYMMETRICAL
↳ unresponsive to Levodopa

PARKINSONISM + ATYPICAL PK

1> Progressive Supranuclear Palsy / STEEL RICHARDSON SYNDROME

→ Extended Posture
→ Defective Downward Gaze
→ H/o fall ⟷ early in this type
→ Dementia
⊖ Tremors

2> LEWY BODY DEMENTIA. (LBD)

Parkinsonism + Visual Hallucination

3> MULTIPLE SYSTEM ATROPHY (MSA)

Parkinsonism + cerebellum + Autonomic symptom Instability

4> CORTICO BASILAR DEGENERATION (CBD)

Parkinsonism + myoclonus + Dystonia
sustained Poisturing

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

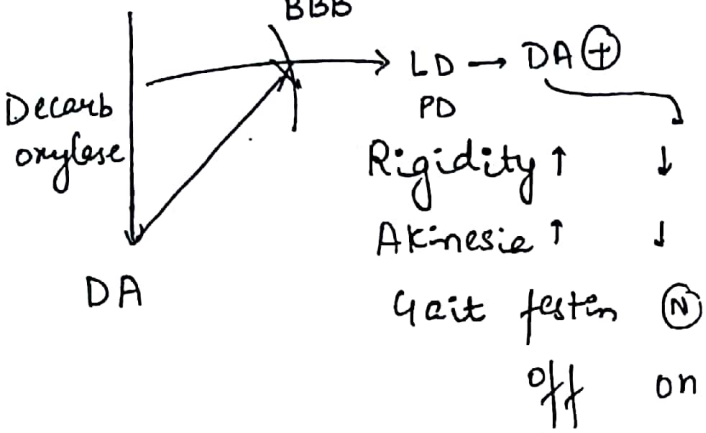
Rx

PD

↓ DA (rigidity)

↑ ACh (Tremor)

1> LEVODOPA → DOC



2> PERIPHERAL DECARBOXYLASE INHIBITORS

- → CARBIDOPA
- → BENSERAZIDE

3> MAO B ⊖

- → SELEGELINE
- → RESAGILINE (neuroprotective)

3> COMT ⊖

- → ENTACAPONE
- → TOLCAPONE

5) AMANTADINE

↑ DA Level

6) DA + D_2

- → PRAMIPRAZOLE
- → Ropinirole
- → Rotigotin

8> ANTICHOLINERGICS

TRIHEXYPHENYDYL

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

J) APO MORPHINE

↓ sedative — DA ⊕ (Injectable) — off ↓ on — RESCUE THERAPY

CEREBRVOVASCULAR ACCIDENT (CVA)

STROKE

→ Focal neurological Deficit due to vascular cause > 24 hrs

→ TIA (Transient Ischaemic Attack) –

< 24hrs

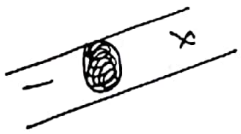
most → for 1 hour

20 mL/100gm brain tissue/min = Ischaemia + Infarction ⊖

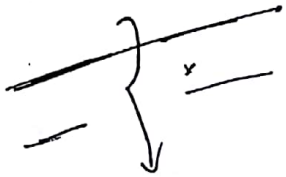
16 mL/min × 1 hour = Infarction ⊕

0 mL/min × 4-10 min = DEATH

CLASSIFICATION



ISCHEMIC (85%)



HAEMORRHAGIC (15%)

EMBOLIC (75%)

M/c/c AF.

↳ non-rheumatic AF

THROMBOTIC (25%)

Most epileptogenic stroke

Embolic > H'ge > Thrombotic

↓

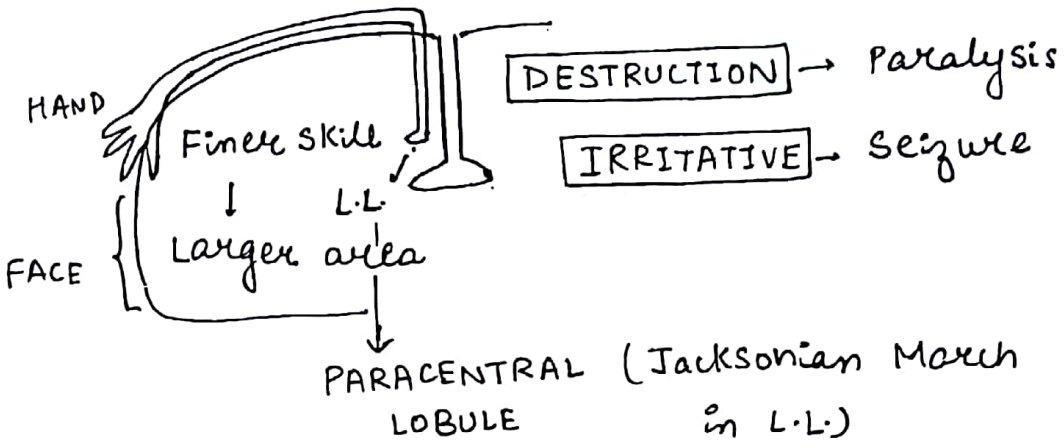
cerebral oedema

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Lacunar Infarcts - subcortical
So no seizures

FRONTAL LOBE

1> 1° MOTOR AREA



2> MICTURITION AREA → LESION

⊖ → ? where
Social Inhibition

LESION → Incontinence
[Infant Bladder]

3> SUPPLEMENTARY MOTOR AREA → LESION

⊖ Primitive Reflexes
- sucking ⊕
- grasping ⊕

LESION ⇓ [Resurgence of Primitive Reflexes]

4> BROCA'S AREA
- → Word area
- → Located in Inf. Temporal Gyrus

5> PRE FRONTAL AREA → LESION → [ANTI SOCIAL BEHAVIOUR]

↑ CONTROL

↑ EMOTIONS

↓ FORMED → Limbic system

CIVIC LOBE = FRONTAL LOBE

PARIETAL LOBE

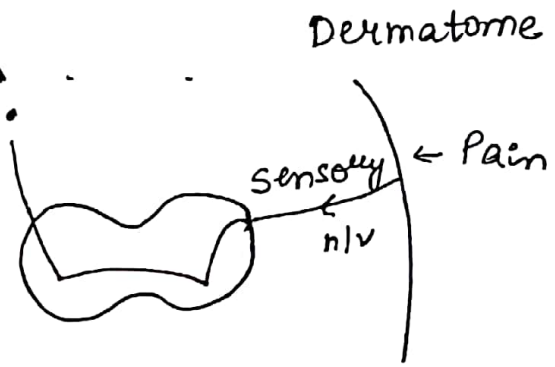
1> 1° SENSORY AREA

Localisation of stimulus

LESION → ANAESTHESIA

Perception ← Thalamus →

Spino thalamic Tract



2> STEREOGNOSIS

Ability to identify on touch.

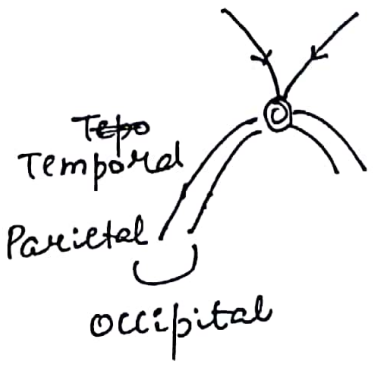
3> TASTE

LESION → DYSGUSIA

4> OPTIC RADIATION

↓

SCOTOMA



5) ANGULAR GYRUS

Stores images a/c
→ Reading
→ Calculation
→ Naming Fingers

LESION

DEVELOPMENTAL

a> (R) to (L) confusion
b> DYSGRAPHIA (Reading)
c> DYSLEXIA (Learning)
d> ACALCULIA
e> Finger AGNOSIA
Cannot Identify

GERSTMAN SYNDROME

↓

Lesion = (L) Hemisphere

(N) BOMBAY

BOMBAY

(R) to (L) confusion

TEMPORAL LOBE

1> 1° AUDITARY AREA

Hearing ↓

LESION → CORTICAL DEAFNESS

2> WERNICKE's AREA

Sup. Temporal Gyrus

Comprehension

3> OLFACTION → ANOSMIA

4> OPTIC RADIATION → SCOTOMA

5> DEEP/MEDIAL TEMPORAL LOBE

Memory

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

MEMORY

Immediate → Short term → MEDIAL TEMOPARAL

Short term → converted to Long Term → Stored – Neocortex – Hippocampus

AMNESIA

NEO CORTEX → Retrograde ← Anterograde ← TEMPORAL

Retrograde → + WR, BR+ → LEFT / DOMINANT / CATEGORICAL ← AUDITORY ← Anterograde AMNESIA

WR - Wernicke
BR - Broca's

Anterograde AMNESIA → RIGHT / NON-DOMINANT / REPRESENTATIVE ← VISUAL

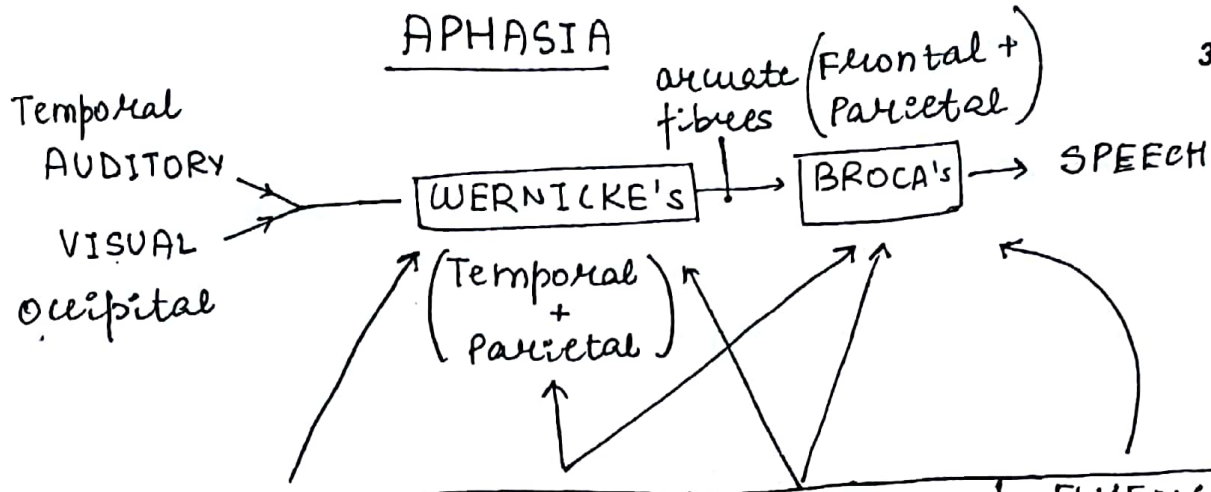
– WR, BR –

Inability to Recognise Faces (Prosopagnosia)

Handedness → Right → 90%
Handedness → Left → 60%
Left hemisphere → Dominant

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

APHASIA



APHASIA	COMPR.	NAMING	REPETITION	FLUENCY
WR.	⊖	⊖ · Neologism	⊖	Ⓝ/↑ EXPLOSIVE JARGON speech
BROCA	Ⓝ	⊖ Telegraphic speech Melodic Circumlution speech	⊖	↓ Insight ⊕ Depression
CONDUCTION ↓ arcuate fibres damaged	Ⓝ	⊖	⊖	Ⓝ
TRANS CORTICAL Sensory (Post)	⊖	⊖	Ⓝ	Ⓝ/↑
Trans Cortical ~~Sensory~~ Motor (Anterior)	Ⓝ	⊖	Ⓝ	↓

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Mixed Trans cortical (Isolation Aphasia)	(-)	(-)	(N) Echolalia	(-)
Pure Word Deafness Auditory Damage	(-)	(N)	(-)	(N)
Pure Word Blindness (Alexia)	↓ Reading	(N)	(N)	(N)
Anomic Aphasia	(N)	(-)	(N)	(N)

- M/c type
- angular gyrus

seen in ↓

- Alzeihmer
- Head Trauma
- Metabolic Encephalopathy

SCANNING Speech — I AM A DOCTOR

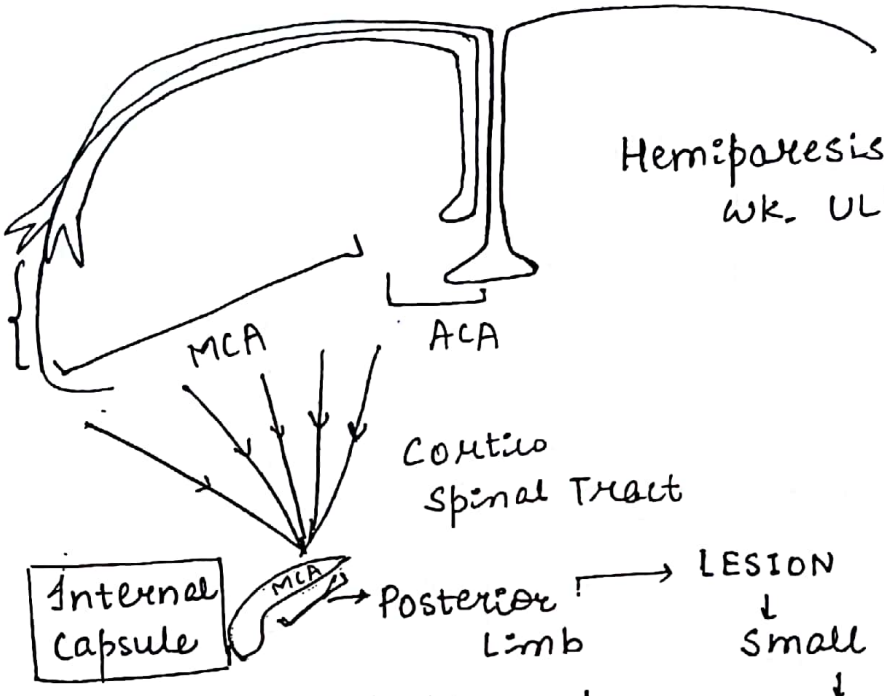
↳ CEREBELLAR Lesion.

⇒ Broca's Lesion ⇒ Couldn't write a Dictation

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Ant Cerebral Artery

- FRONTAL
  - Paracentral Lobule → L.L. weakness, Incontinence
  - Supplementary motor → Primitive Reflexes (+)
  - Prefrontal → Antisocial Behaviour



Hemiparesis
wk. UL > LL ⇒ MCA involved

LESION → Small Lesion → Large Deficit → Dense hemi paresis → [Pure motor]

APHASIA → MCA (L) → Broca's, Wernicke's

AMNESIA → Post. cerebral artery → medial Temporal → Hippocampus

GAIT APRAXIA → Ant. cerebral artery → ⊖ movement

Rx [ISCHEMIC]

1> THROMBOLYSIS

Recombinant tissue Plasminogen activator (rtPA)

(I.V.) = 0.9 mg/kg → 10% → Loading Dose
→ 90% → Infusion × 1 hour.

MAX DOSE = 90 mg

WINDOW PERIOD = 4.5 hours from onset

2> ANTIPLATELETS

ASPIRIN

NO clopidogrel

3> ANTI COAGULANTS → AF
→ Prosthetic valve

HEPARIN

↓

WARFARIN

POWER

GRADING (MRC scale)

0 → no movement

1 → flickering

2 → with gravity eliminated

3 → against gravity

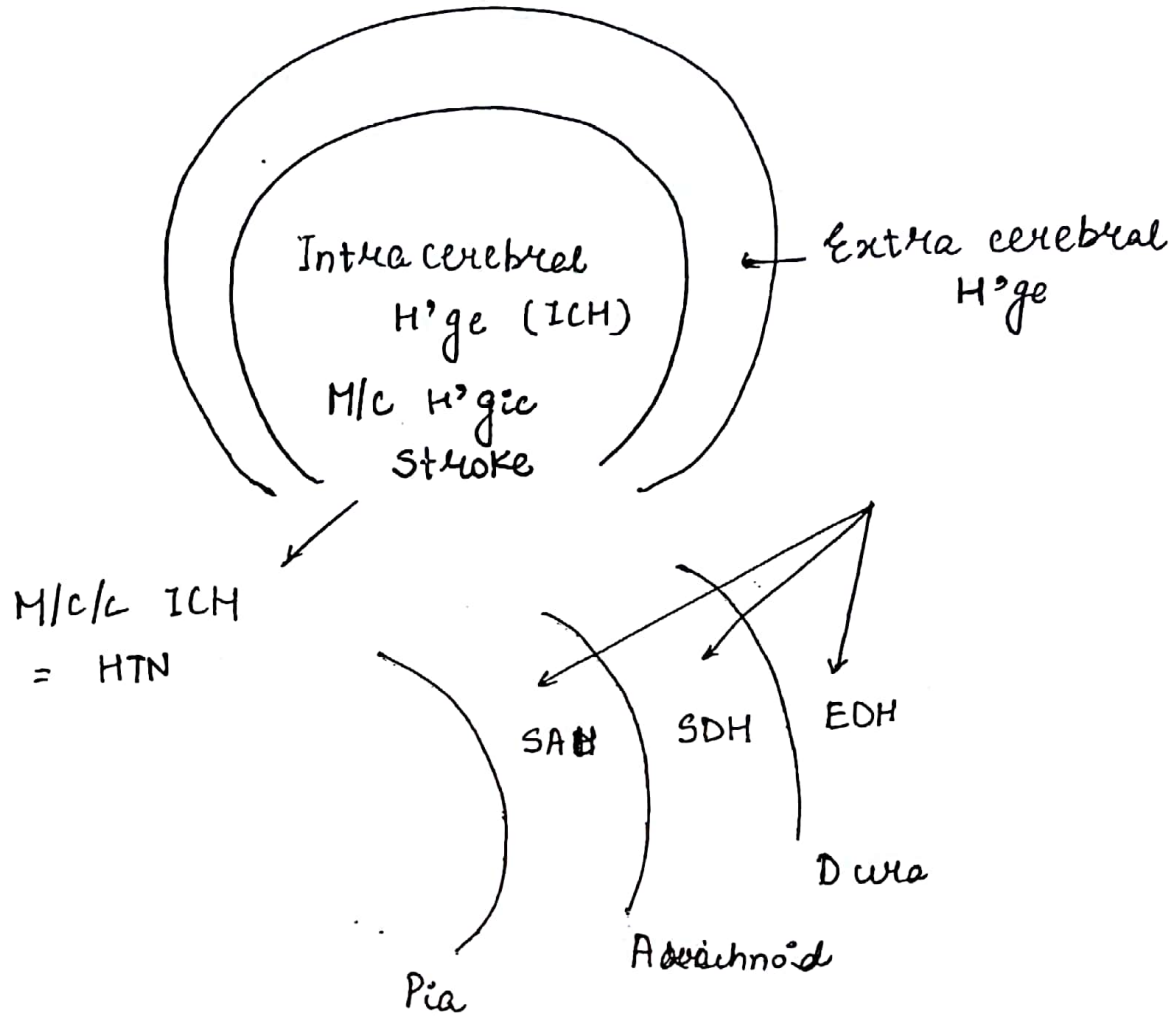
4 → against Resistance

5 → NORMAL

Power
↑ (1/5 → 4/5) ⇒ EMBOLIC
↓ (4/5 → 1/5) ⇒ THROMBOTIC

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

HAEMORRHAGIC STROKE



HTN ICH

SITES

1) Basal Ganglia (Putamen)] HEMI PARESIS — M/c site

2) Thalamus ← HEMI ANAESTHESIA

3) Cerebellum ← ATAXIA, ↖ VERTIGO] Rx Decompression diameter >3cm

Worst Prog 4) Pontine ↑ HR, RR, Temp, Sweating

B/L extensor plantar

PIN POINT → OP Poisoning

PUPIL → morphine

* also seen in-

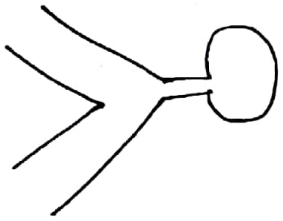
000 SAH H'ge

S.A. Space

↳ CSF → Formed → CHOROID PLEXUS

Absorbed → ARACHNOID VILLI.

CIRCLE OF WILLIS



SACCULAR / BERRY ANEURYSM

ETIOLOGY

1> Trauma (M/c/c) (non-traumatic)

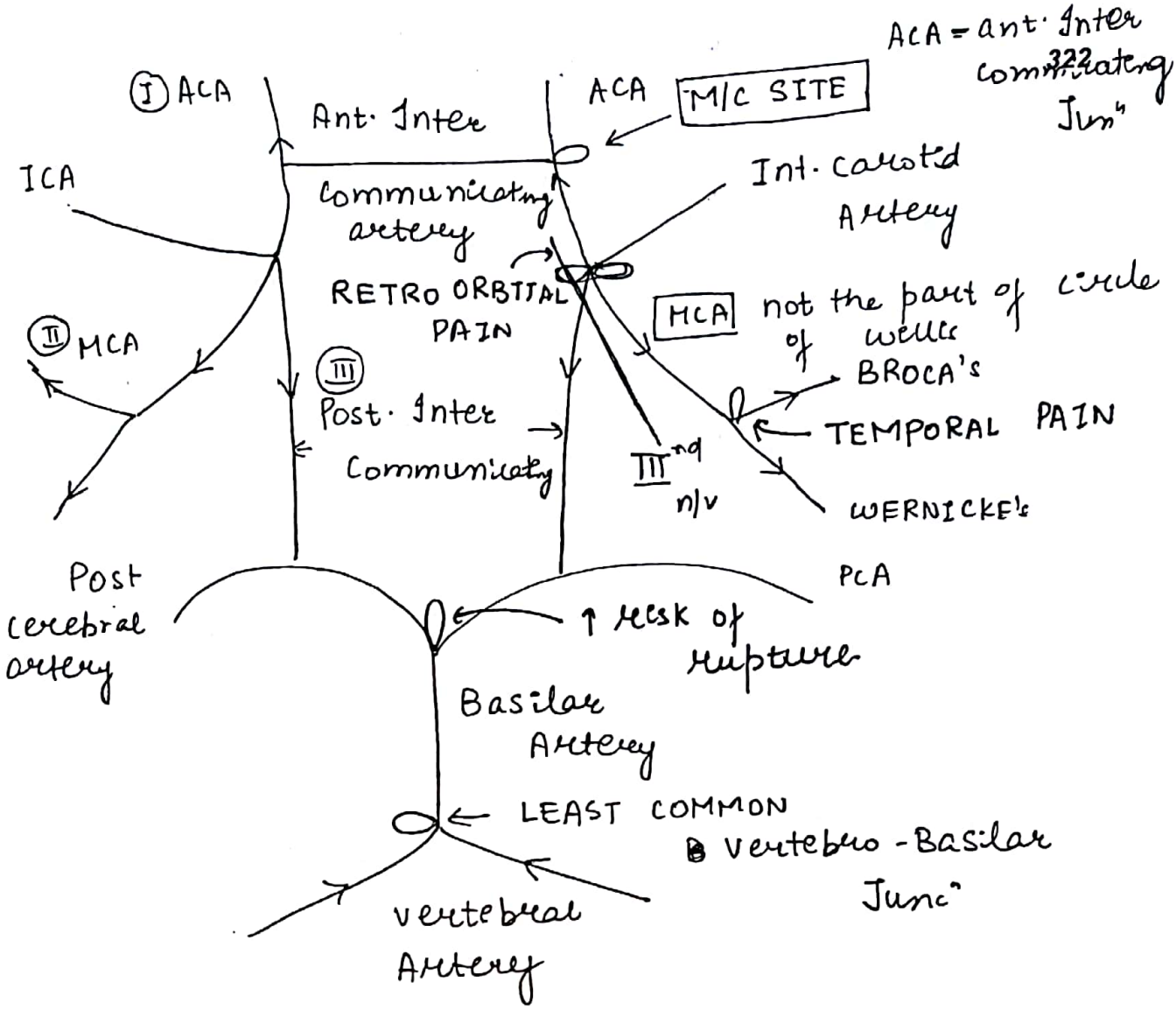
2> Rupture of Berry Aneurysm (M/cc spontaneous SAH)

3> A-V malformations

4> Extension from ICH

5> Idiopathic

- ↳ LOCATION = Perimesencephalic cistern
- ↳ Angiography ⇒ (N)
- ↳ Source = venous



85% of aneurysm ⇒ ANT. CIRCULATION

15% " ⇒ POST. CIRCULATION

↓

Less common

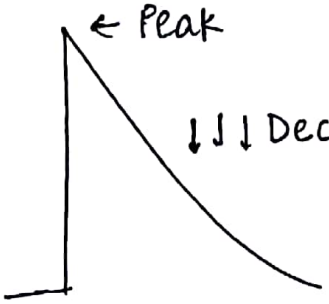
↑ risk of Rupture

M/c Cranial n/v

- Berry Aneurysm ⇒ III rd
- ↑ ICT ⇒ VI th — Paralysed = VII th
- GBS ⇒ VII th
- DM ⇒ III rd th
- HIV ⇒ VII th
- Sarcoidosis ⇒ VII th

C/F-

Onset / Immediate



[THUNDER CLAP HEADACHE]

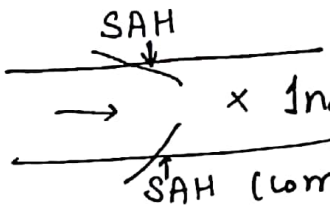
Neck Rigidity

Loss of consciousness (transient)

No focal neurological Deficit

DELAYED

1> Vasospasm



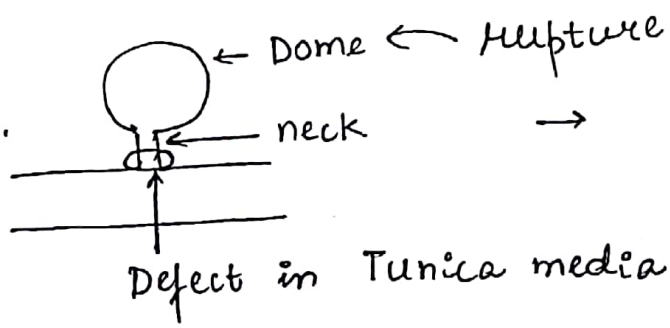
4-14 days after SAH

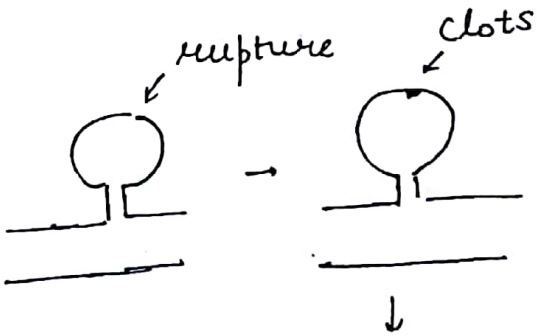
↓

Peaks in 1st 7 days of onset

M.C.C → mortality
→ morbidity

2> Re ruptured





↓

may rebleed if undetected

30% Re-rupture in 1st month

Peaks in 1st 7 days.

3> Hydrocephalus

SAH → BLOOD

↓

Blocks → ↓ CSF Absorption

Arachnoid villi

↓

↑ ICT

4> ↓ Na^+ Hypovolemia

↑ ICT → BNP

CEREBRAL SALT WASTING DISEASE

H_2O ↓

↓

Na^+

INVESTIGATIONS

NEUROIMAGING

CT

Acute H'ge (clot)

Calcified

MRI

Inflammation

Infarction

Ischaemic

CVA

↓

IOC → CVA → NCCT (Brain)

[To exclude acute H'ge]

↓ (N)

Infarct. → MRI (Brain)

[To exclude acute infarct]

IOC

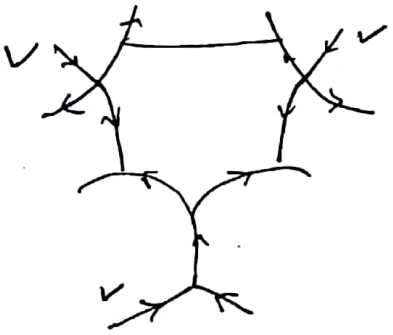
Acute SAH = NCCT (Brain)

Aneurysm = ANGIOGRAPHY

↳ DYE
- ⊖ → MR angio
- ⊕ → 4 vessel angio
  - ↳ 2 ICA
  - ↳ 2 VA

↓

Injected
- ↳ 2 ICA + 1 VA
- ↓
- via femoral vein



Digital Substraction Angiography (DSA)

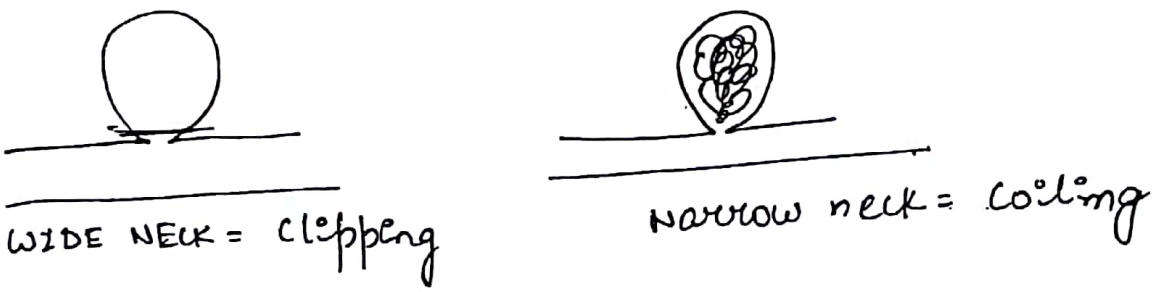
Subtract Bone

Rx

SURGICAL

TITANIUM ↑ clipping

PLATINUM ↑ coiling (BETTER)



WIDE NECK = Clipping

Narrow neck = coiling

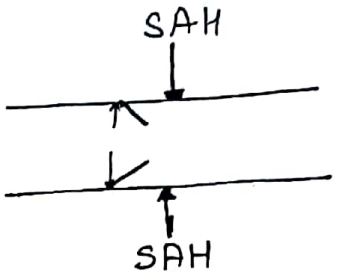
MEDICAL

⇒ NIMODIPINE ⊖ Vasospasm

↓

Intracerebral

⇒ 3H → HTN [160/90]
→ Hypervolemia
→ Hemodilution (I.V. fluid)



SDH

occurs due to rupture of cortical Bridging veins

EDH

Rupture of middle meningeal artery (MMA)

HEAD INJURY (closed)

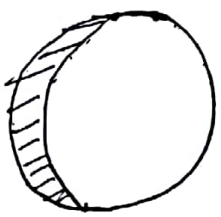
↓

Headache + neurological Deficit

↓

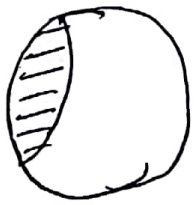
Progresses

Days - weeks - months
slowly



SEMILUNAR

Hours - minutes
Rapidly



LENTICULAR

SDH — CT > MRI

- Acute = HYPER-DENSE
- Subacute = ISODENSE
- Chronic = HYPO DENSE

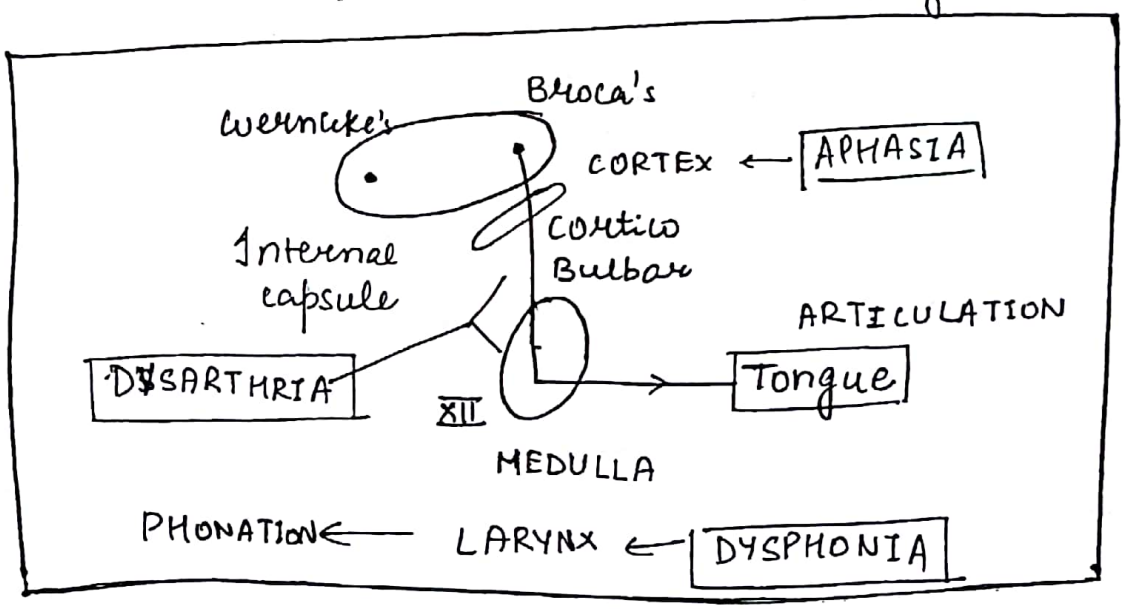
MRI > CT

LUCID INTERVAL = EDH

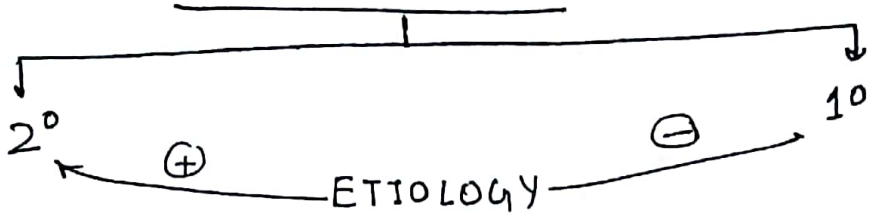
H'gic CVA

- ICH >
  - HTN
    - Putamen
    - Thalamus → SUB CORTICAL
    - Cerebellum → SUB CORTICAL
    - Pons → SUB CORTICAL
  - A-V malformation → CORTICAL / LOBAR H'ge
- ECH
  - SAH ← H/C
  - SDH ← BOXERS
  - EDH

Post-Traumatic



HEADACHE



TEMPORAL ARTERITIS

Elderly

♀ > ♂

Headache ⇒ Throbbing
Stabbing

Scalp Tenderness → touching inflammed artery

Jaw claudication [SPECIFIC]
↳ Difficulty in chewing food

Blindness ← irreversible
↳ due to involvement of post cerebral artery

Inv-
↑ ESR
, Biopsy → Temporal Artery Biopsy
↓
Giant cells

Rx- DOC = STEROIDS

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

PSEUDO TUMOUR CEREBRI / BENIGN IDIOPATHIC INTRACRANIAL HTN

M/c- young obese, ♀

Headache

Projectile vomiting (nausea ⊖)

Papilloedema

ventricle size (N)

No focal neurological Deficit

↓ CSF Absorption

ETIOLOGY

1) Hypervitaminosis A
2) Expired Tetracycline
3) OCP
4) Steroid withdrawal (Abrupt)

M/C/C ⇓ Idiopathic

℞ = ACETAZOLAMIDE
↓ CSF formation.

TENSION HEADACHE

♀ > ♂

M/c 1° Headache = Tension Headache

Associated ⊽ DEPRESSION

Tension is not an etiology

Dull Aching Pain
Band like

℞ < EPISODIC → <15 day/mnth = ANALGESICS
CHRONIC → >15 day/mnth = T.C.A. (℞ of ↙) ↳ Amytryptiline

MIGRAINE

♀ > ♂

4-72 hours

≥ 2
- P → Pulsatile
- U → U/L
- M → Moderate to severe in Intensity
- A → aggravation

+ any 1 < nausea (M.C.), Vomiting

or any 1 < Photophobia, Phonophobia

AURA = visual > sensory

(+) CLASSICAL (20%)

(−) COMMON (80%)

ACCEPTED THEORY

(I) Cortical Spreading Dissociation

Main Trigger → vaso constrict" ⇒ [SCOTOMA]

↑

Intracranial (occipital)

↓

vasodilatation ⇒ FLASHES OF LIGHT ← FORTIFICATION SPECTRA

vasodilation

Headache ↓ ⊕

Meningeal irritation → Pain → Brain

Calcitonin gene related Peptide

CGRP

(II) SEROTONINERGIC

[5HT ⊖] ⇒ Throbbing

R_x = 5HT ⊖

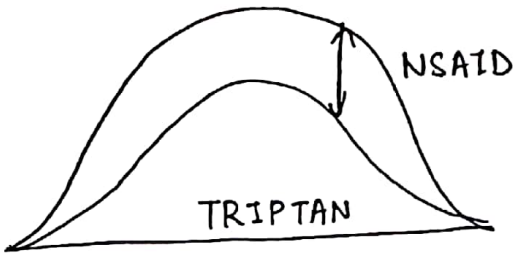
NON SELECTIVE → ergotamine

SELECTIVE → 1B/1D

[Triptans]

DOC for acute attack

RIZA triptan > SUMA triptan



(III) DOPAMINERGIC → DA ⊖

DA ⊕ - nausea

Metoclopramide

PROPHYLAXIS × 5 - 6 months

① β ⊖ ⇒ Propranolol (widely used)

② TCA ⇒ Amitryptaline

③ CCB → Flunarizine

④ A.E.D. → Valproate
Topiramate
Gabapentine
Ethosuximide
↓
Not Recommended.

CLUSTER HEADACHE

♂ > ♀

Peri / Retro orbital Pain
- U/L
- 30 min - 2 hours
- ppt. by consumption of alcohol
- awakens from sleep.

Autonomic (+) hyperactivity → Lacrimation
→ Rhinorrhoea

Rx = O_2 inhalation (Roc)
@ 10 - 12 L/min × 10 - 15 min

Prophylaxis = Verapamil (DOC)
(lifelong)

PAIN

SENSITIVE

- Circle of willis
- Meningeal arteries
- Dural sinuses/veins

INSENSITIVE

- Duramater
- Arachnoid Mater
- Choroid Plexus
- Ventricular Ependyma

D/D of MIGRAINE

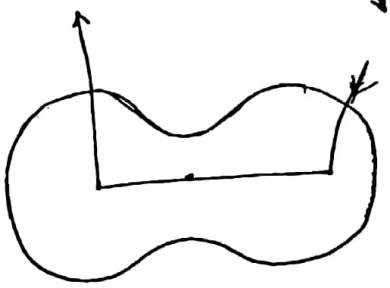
1) Glaucoma

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(S) ↑ SPINAL CORD ↓ (M)

ASCENDING / SENSORY

SPINOTHALAMIC → Pain, Temp, Crude Touch



POST. / DORSAL COLUMN ← vibration
← ~~Jt~~ proprioception (Jt. position)
← Fine touch.

Medulla

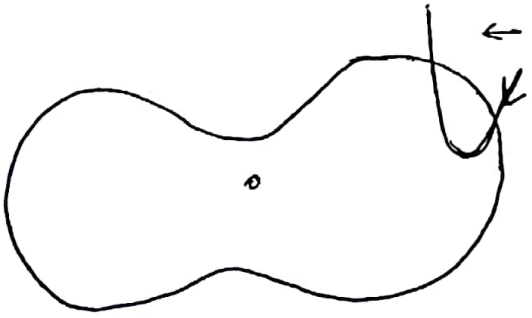
LESION

↳ Stamping Gait
ROMBERG's TEST (+) → sways ⊂ eyes closed

SPINOCEREBELLAR TRACT

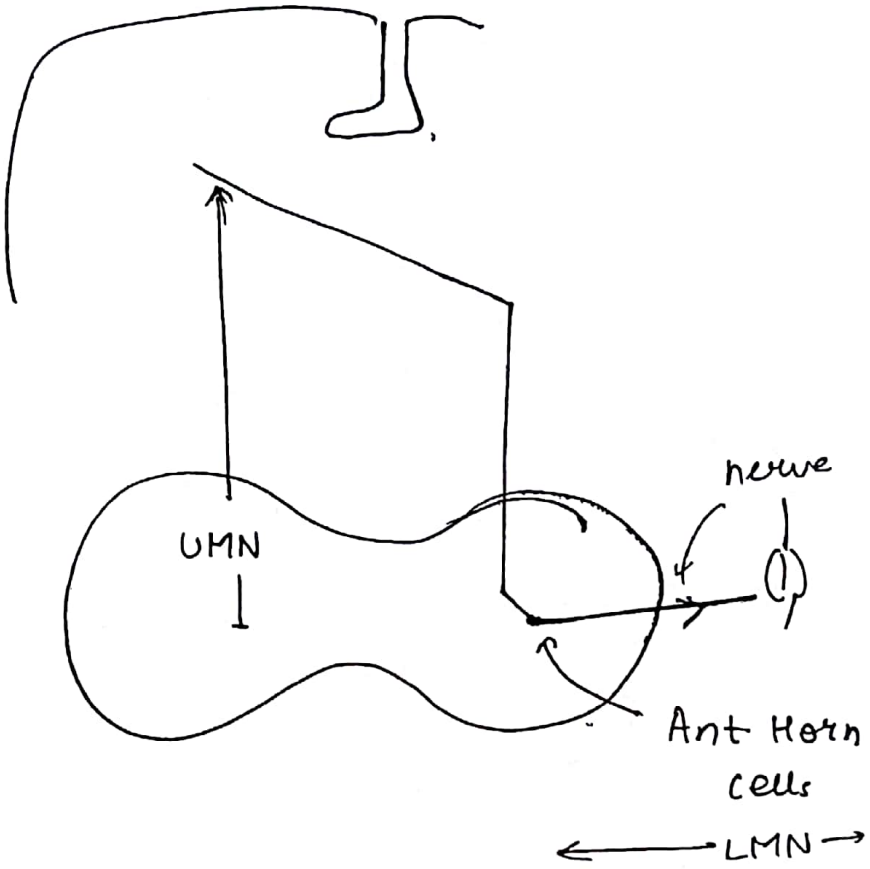
↳ subconscious proprioception

← cerebellum



DESCENDING TRACT

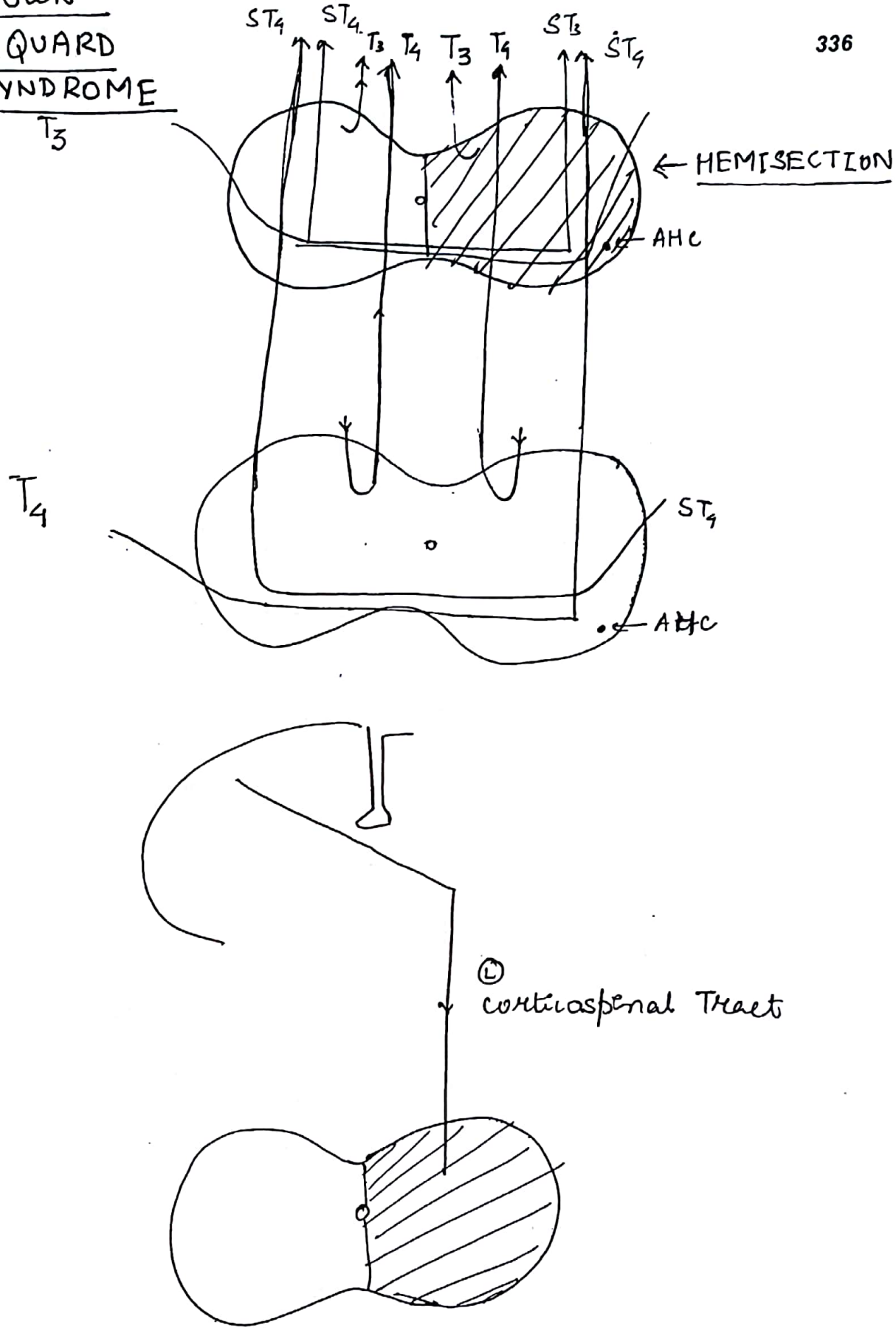
CORTICOSPINAL TRACT



PARALYSIS

UMN	LMN
Tone ↑ (spasticity)	↓ (flaccidity)
DTR Brisk	Dull / absent
Plantar Extensor [Babinski +]	Wasting / atrophy ⊕
	Fasciculation → Twitch → visible / Palpable
	LESION ↳ Ant. Horn cell.

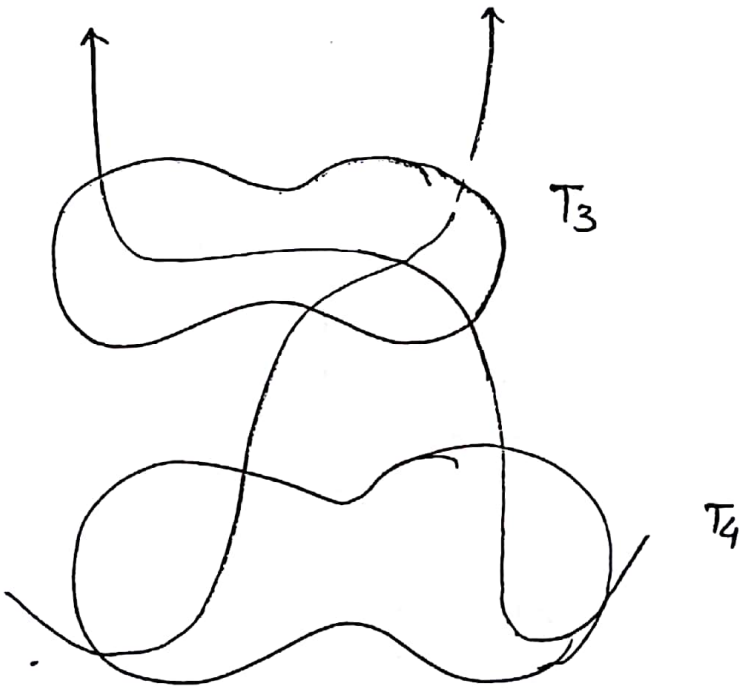
BROWN SEQUARD SYNDROME



HEMISECTION of T_3

At T_4 → ~~C/L~~ Loss of spinothalamic → C/L
Post. column → I/L
weakness → UMN I/L.

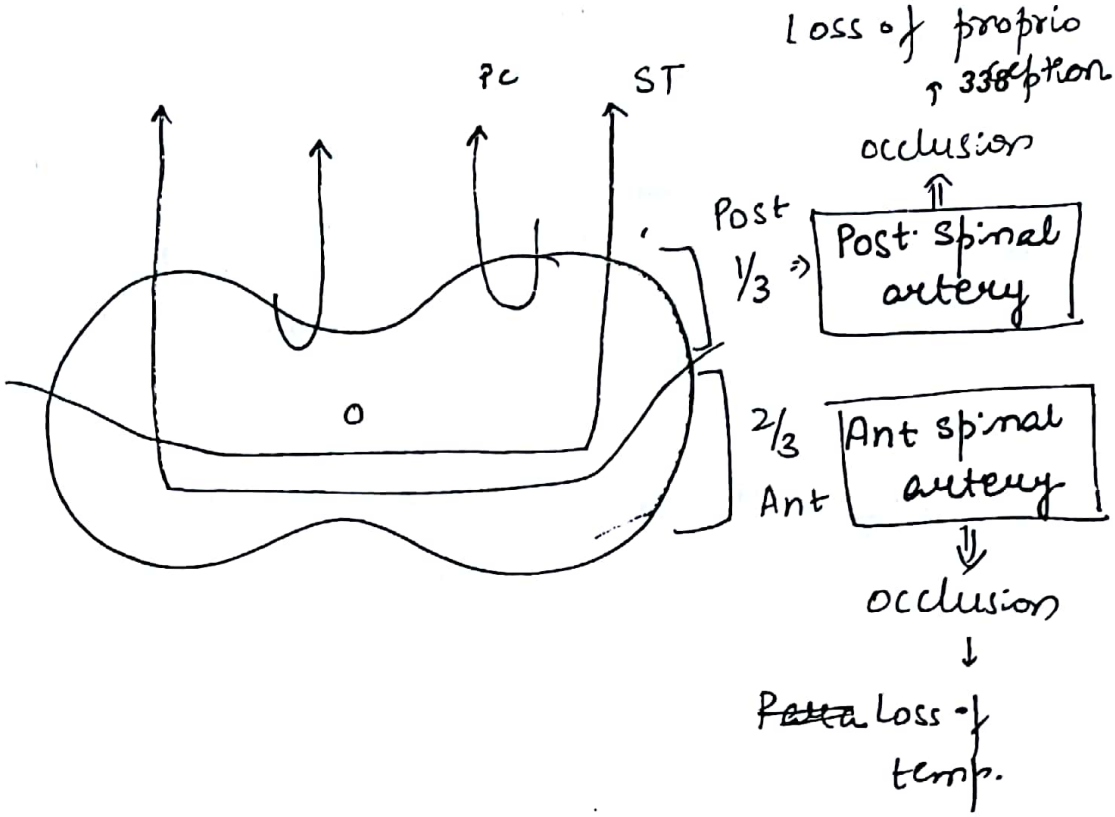
At $T_{\cancel{4}3}$ = ~~P~~ Loss of Post column - I/L
weakness - LMN, I/L
** **Spinothalamic - I/L**

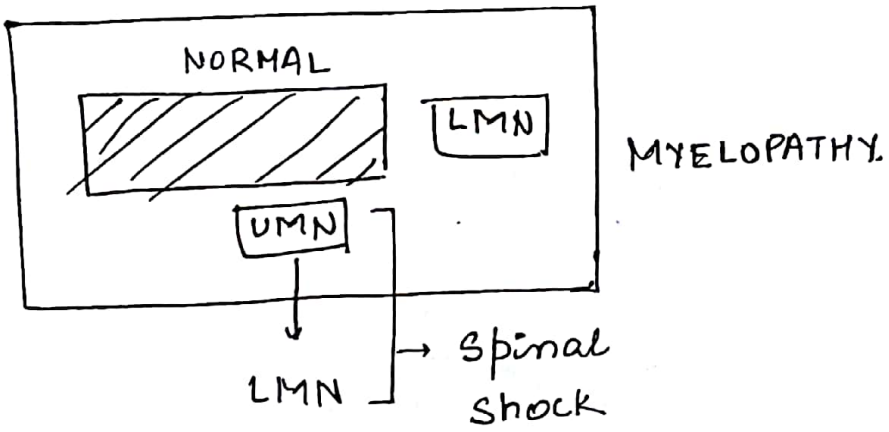


AT THE LEVEL ⇒ Spinothalamic, Post. column, LMN → SAME SIDE

~~AB~~ BELOW The LEVEL ⇒
Spinothalamic ↓ opposite side.
P.C. UMN → same side

http://mbbshelp.com WhatsApp: +1 (402) 235-1397





QQ SPINAL SHOCK

"Transient" LMN weakness below the level of lesion

↓

most occurs @ 48-72 hrs

→ Flaccidity

→ Areflexia

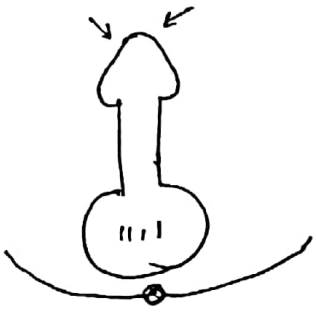
→ Urinary retention.

→ Sensory Loss

→ Wasting ⊖ ⟹ → Transient process
internal nutrition is intact

Spinal Shock = LMN - Wasting

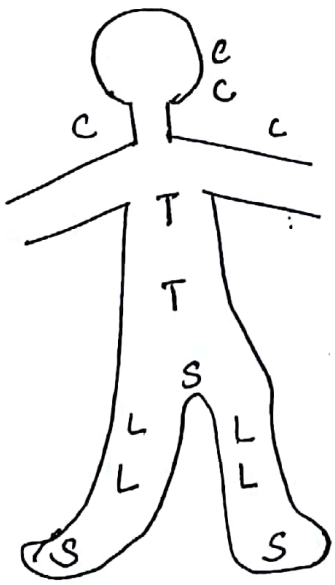
1st Reflex Recover-
BULBOCAVERNOUS. ⇒ EXTERNAL ANAL SPHINCTER.

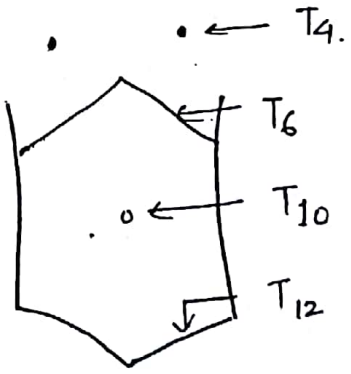


CREMASTERIC

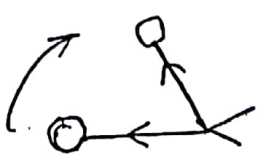
↓

FLEXOR WITHDRAWAL.





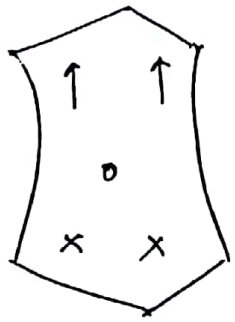
BEEVOR SIGN



BEVOR SIGN

Supine ⟶ Sitting positon

↓ umbilicus moves upward ⇒ Lesion @ / below T_{10}

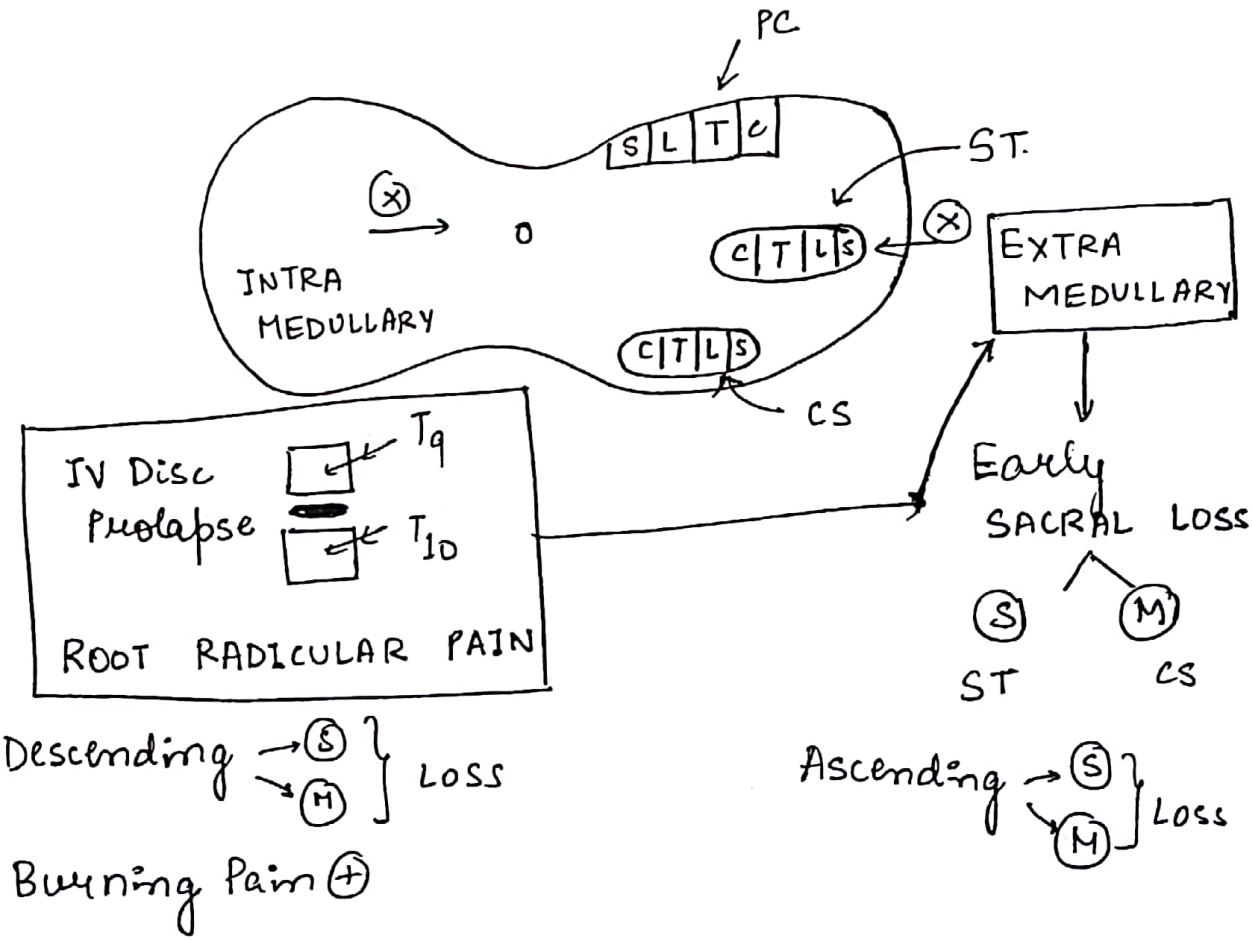


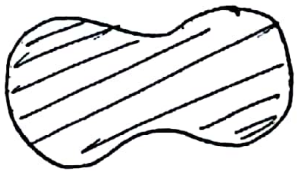
PRONATOR DRIFT SIGN

Weak Side

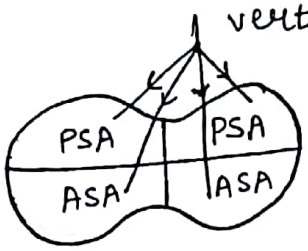
PRONATION + ↓ DRIFT

} Injury CS Tract
CVA in Evolution.



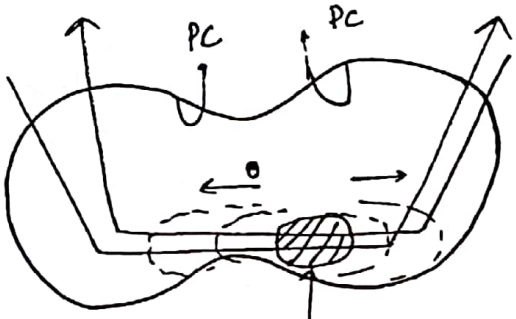


⇒ TRANSVERSE MYELITIS → extra medullary
leads to
transverse
myelitis.



Occulcion of 1 side ASA + PSA
↑ ⇒ BROWN SEQUARD
due to vasculitis

QQ SYRINGOMYELIA



Selective Loss of
- Pain
- Temp

DISSOCIATED ANAESTHESIA

SYRINX = cavity

Assymetrical

M/C site = Lower cervical
upper Thoracic

CAUSE :-

1) congenital

2) 3T
- Trauma
- Tumour
- TB

AT THE LEVEL ⇒ LMN weakness

BELOW THE LEVEL ⇒ UMN weakness

[CAPE LIKE DISTRIBUTION OF SENSORY LOSS]

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

q/c

CHIARI MALFORMATION > 50%
(Type 1)

⇓

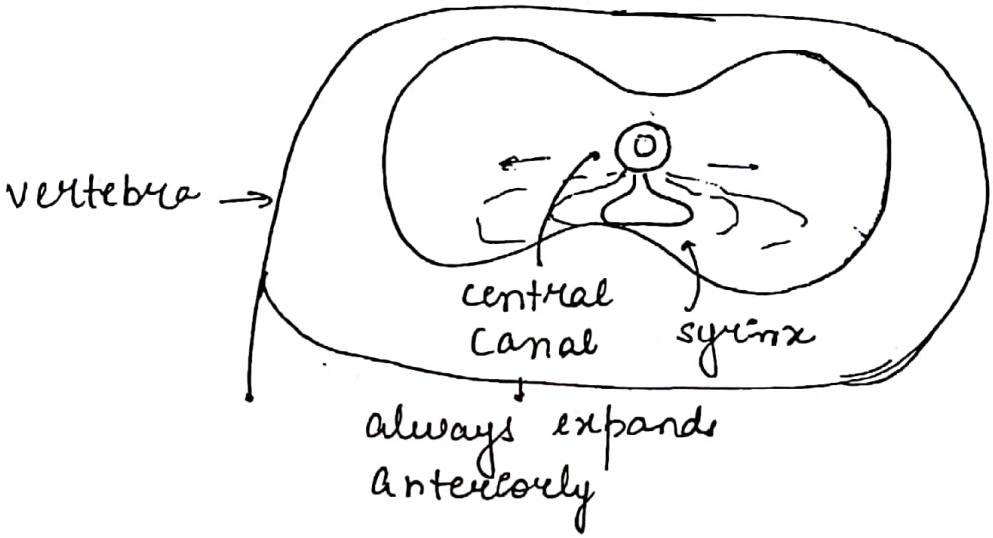
Cerebellar tonsillar herniation into foramen Magnum

↓

compresses central canal containing CSF

↓

it starts enlarging due to compression



Rx = DECOMPRESSION LAMINECTOMY

| to relieve pressure on ~~for~~ expanding spinal cord from vertebra

DISAD

↳ doesn't relieve symptoms.

NOTES (C/F of syringomyelia)

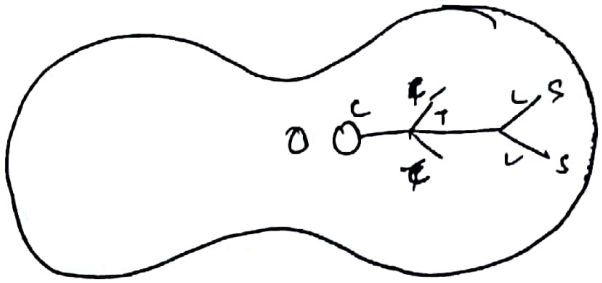
→ Painless burning of hands occur easily

↓

Trophic ulcers

→ absent biceps Jerk (C5, C6)

→ extensor plantars [L5, S1]



URINARY BLADDER

FRONTAL (Paracentral Lobule) where ⇒ ACA

↓

PONS CENTRE

⊕ ← contraction, micturition] PARA [$S_2\ S_3\ S_4$]

⊖ ← Relaxation, storage] SYMPATHETIC [$T_{11} - L_2$]

Sensory S_2, S_3, S_4 ↑

[A] $S_2\ S_3\ S_4$ ⊖ [AUTONOMOUS BLADDER]

$S_2\ S_3\ S_4$

⊖ → sensory
↘ Para

$T_{11} - L_2$

++ L Sympathetic

HYPOTONIC
FLACCID
LARGE CAPACITY
OVERFLOW
INCONTINENCE

[B] $T_{11} - L_2$ ⊖ [AUTOMATIC BLADDER]

$T_{11} - L_2$ — ⊖ Symp

S_2, S_3, S_4 — ++ < sensory, parasymp

- HYPER TONIC
- SPASTIC
- LOW CAPACITY
- URGE INCONTINENCE

CONUS MEDULLARIS

S.C. ends opp. to $L_1 L_2$.

$S_1 - S_5$ segments

KNEE JERK

$L_3 - L_4$ ++ [N]

ANKLE-JERK

$S_1 - S_2$ ⊖

BLADDER

AUTONOMOUS (early) → Intra /

CAUDA EQUINA

nerve Roots

$L_1 - L_5$

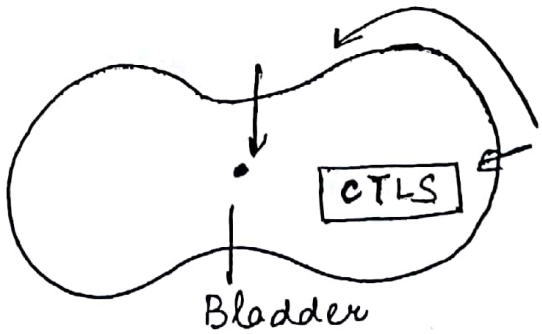
$S_1 - S_5$

⊖

⊖

MIXED (NEUROGENIC)

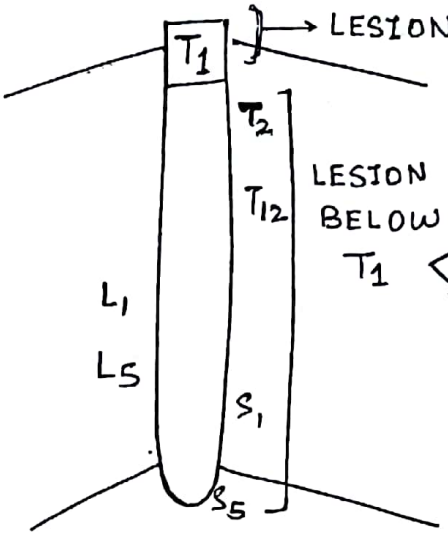
(Late) ↑ Extra



Asymmetrical

Areflexic

LMN Paralysis



LESION ABOVE T_1 → UL = LMN, LL = UMN → QUADRI PARESIS

LESION BELOW T_1 → UL = (N), LL = weakness → PARA PARESIS

PHRENIC N/V ← C_3, C_4, C_5

HIGH → LESION (⊖) → APNOEA

INTERCOSTAL N/V ← C_6, C_7, C_8

LOW → LESION (⊖)

DIAPHRAGMATIC BREATHING

As C_3, C_4, C_5 intact

T_1, T_6] UPPER] Lesion Above T_6

T_7, T_{12}] LOWER

↓ H.R. ← para

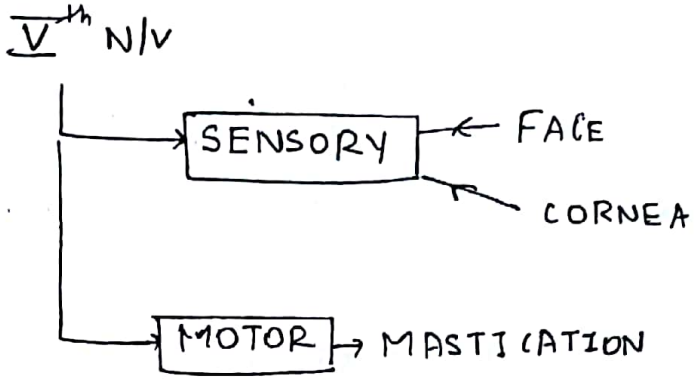
↑ B.P. ← symp

] AUTONOMIC DYS REFLEXIA

Pain (⊕)

R_x = NIFEDINE
CLONIDINE

TRIGEMINAL N/V



NUCLEUS

SUPRANUCLEAR → UMN

PONS

NUCLEAR → LMN

INFRANUCLEAR

C_1 x
C_2 x
C_3 x
C_4 x

SPINAL ‖ SENSORY

MYELOPATHY

Jaw Jerk ← V th / V th

BRISK → UMN

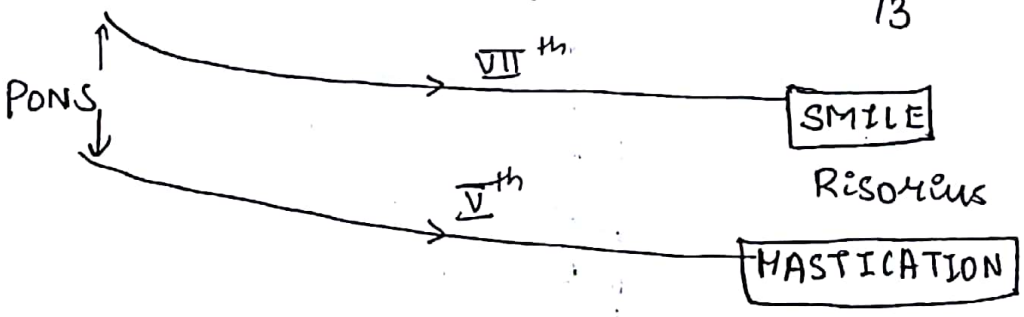
Loss of sensations over Face

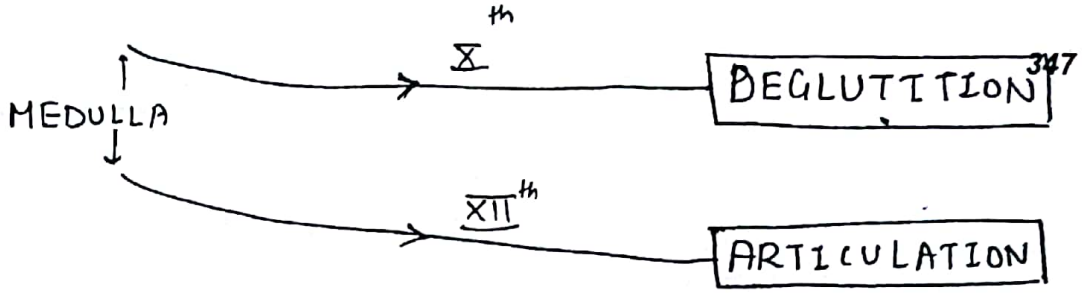
Supranuclear

[Lesion above PONS]

VII th Taste — Tongue

Chorda Tympani — Ant 2/3rd





~~FACIAL N/v~~

TRIGEMINAL NEURALGIA

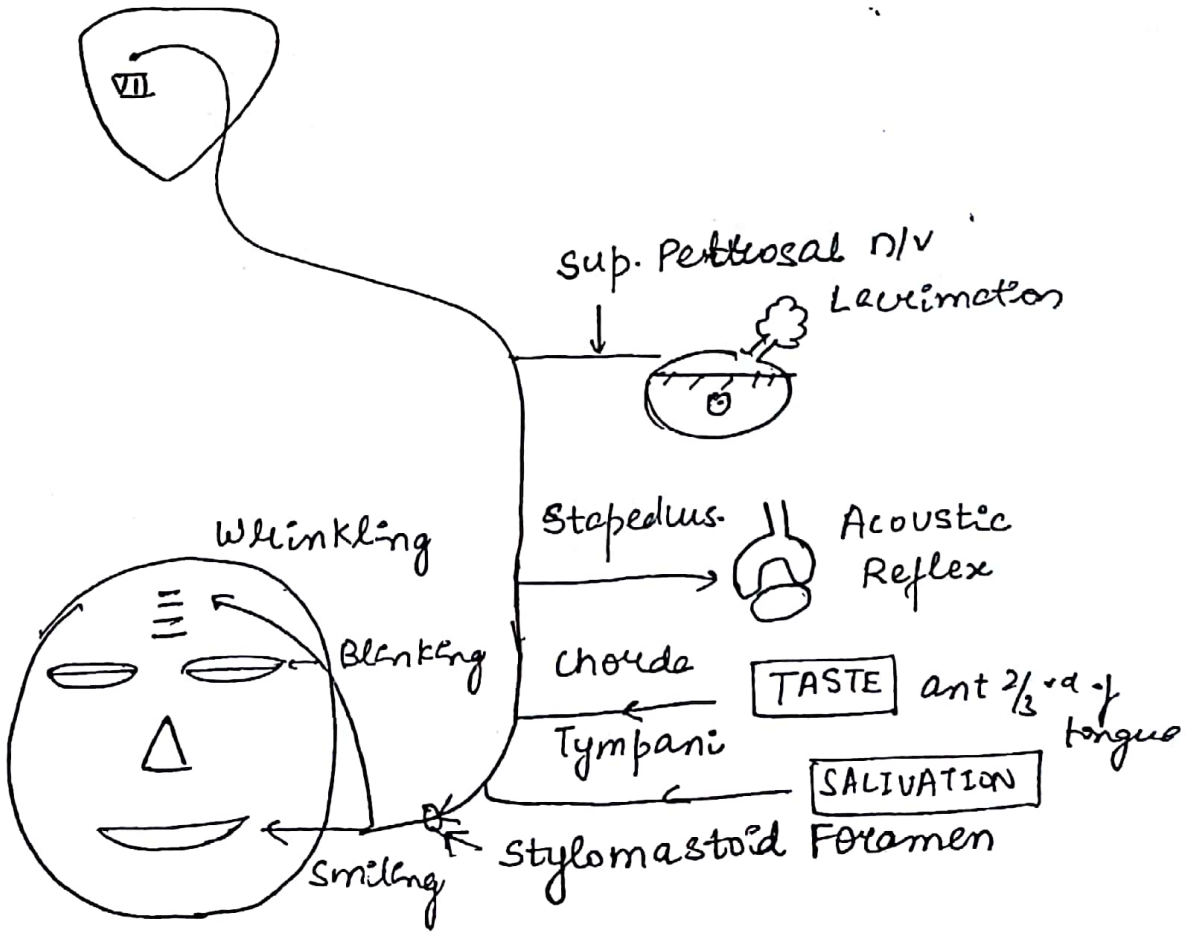
Electric shock on Face / TIc DOLOREAUX

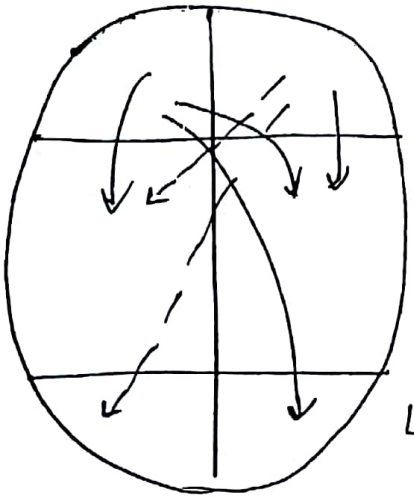
Rx → Injec" of C_2H_5OH / glycerol in gasserion ganglion

RHIZOTOMY - Radio Frequency Ablation

FACIAL N/V (VII th)

PONS



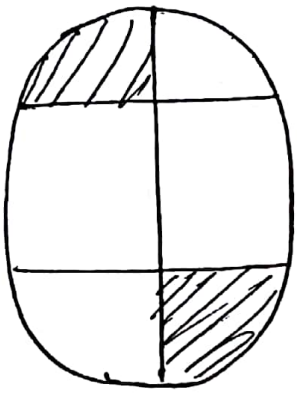


D

Upper $2/3^{rd}$ Face is having B/L cortical innervation

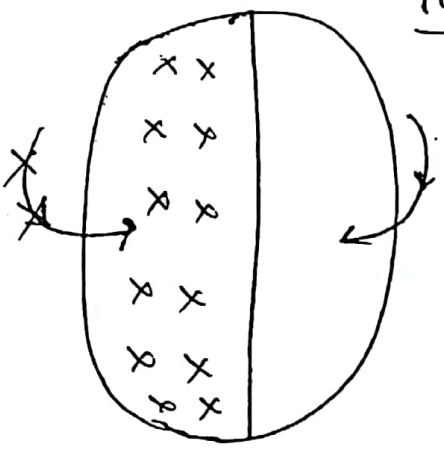
Lower $1/3^{rd}$ of Face supplied by opposite cortex

A)



<u>Cortical lesion</u> ⇒ UMN PARALYSIS
(Supranuclear)

B)



<u>PONS LESION</u> ⇒ LMN PARALYSIS

U/L → CAUSE

1) Trauma
2) Herpes zoster virus [RAMSAY HUNT SYNDROME]
3) Idiopathic [BELLS PALSY]

B/L CAUSE

1) GBS
2) HIV
3) Sarcoidosis

RECOVERY

Aberrant Reinnervation

1> CROCODILE TEAR SYNDROME

2> SYNKINESIA (smiling Blinking together)

H/O ⇒ S/O CERVICAL CORD INJURY

1) Fall from height
2) Road Traffic accident
3) Hanging

LHERMITTE SYMPTOM

↓

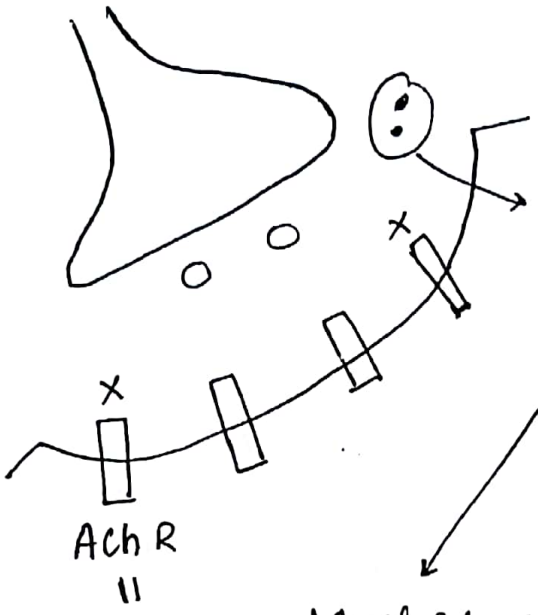
MULTIPLE on flexion of neck
SCLEROSIS. ↓
Pain / electric shock
across spine

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

MYASTHENIA GRAVIS

ACh (R) ANTIBODIES

Destroy > BLOCK



ACh E → ↓ACh Levels

THYMIC AB(N)

↳ 75% Myasthenia Gravis

↳ 65% Hyperplasia

↳ 10% Thymoma

↳ LOCAL → Compressive

↳ PARANEOPLASTIC

Myeloid cells
↓
antigenically mimic ACh(R)

So, Antibodies cross react

MRI (chest)

- Pure red cell Aplasia
- Pernicious Anaemia
- Hypo γ globinemia
- Dermatomyositis

♀ : ♂ = 3:2

3-7% MG
↓
suffer from Hypothyroidism } So, Inv = TSH. 351

C/F :-

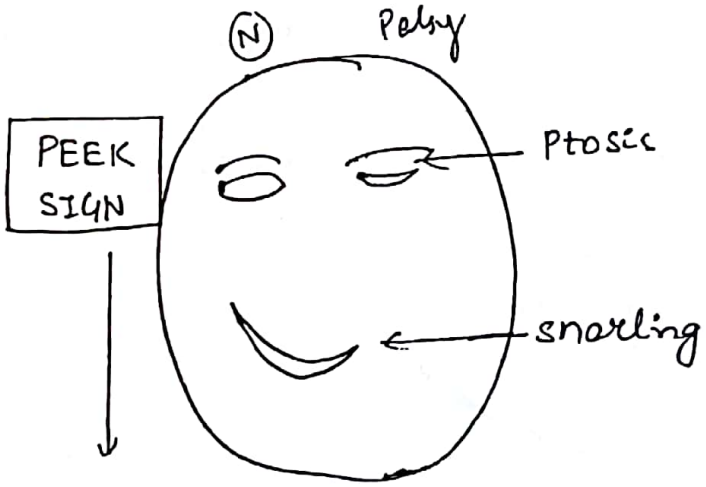
1> Easy fatiguability
- Proximal
- Asymmetrical

a> OCULAR [1st m/s to involve
M/C m/s to involve]

- Ptosis
- opthalmoplegia

2) FACIAL

Snarling
↓
can't maintain smile for long



close eyes for some time then opens as if seeing through small aperture

3> SKELETAL

N → DTR
- Sensory intact
- Bladder
- Cognition

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

INV:-

1> EDROPHONIUM / TENSILON TEST

↓

shorter acting
Peripheral action
[BEST SCREENING TEST]

2> ACh (R) Antibodies

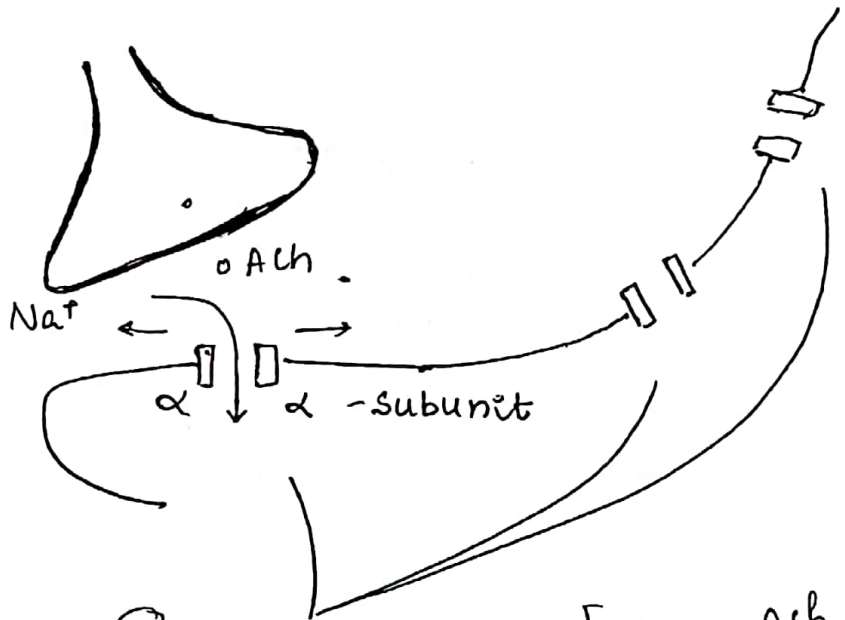
MOST SPECIFIC TEST

+ in [85% of pts. ε gen. MG.
↳ 50% **Ocular MG.** → [Eye symptoms x 3yrs]

-ve doesn't rule out MG.

3> MUSCLE SPECIFIC TYROSINE KINASE (MUSK)

MUSK Antibodies



Ab ⊖ → CLUSTERING ⊕ ↑

Lipoprotein Related Protein

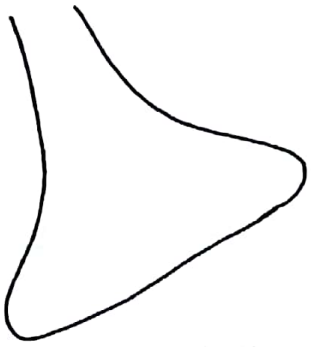
[ADV:- Ach can act on all (R) at same time

⊕ ↑ MUSK

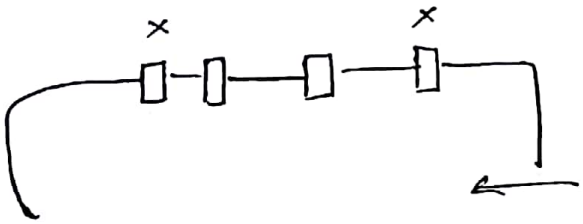
⊖ ↑ Ab against musk → +ve in 40% AchR Ab ⊖

→ +ve in BULBAR MG

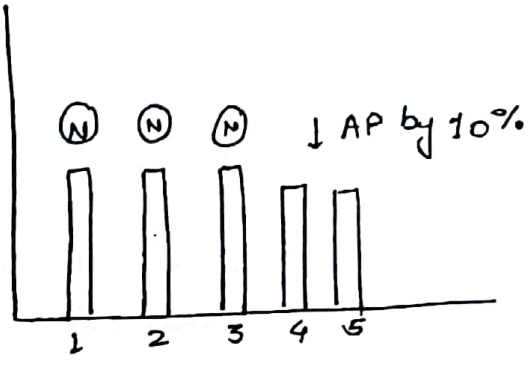
47 RAPID/REPEATED NERVE STIMULATION (RNS) 353



• ACh



Action Potential (A.P.)



DECREMENTAL RESPONSE

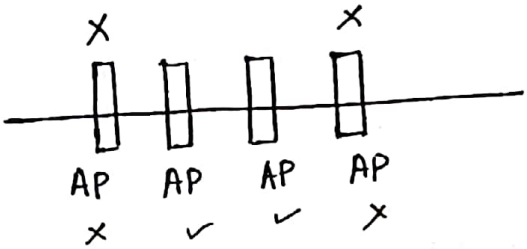
⇓

S/o MG.

5> SINGLE FIBRE EMG (SFEMG)

↑

MOST SENSITIVE TEST
CONFIRMATORY
GOLD STD. TEST.



Difference in AP. ⇒ JITTER ↑↑.

EMG → shows myopathic pattern

doesn't record Jitter well.

BEST

SFEMG > EDROPHONIUM > RNS

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Rx

1> AChE ⊖

DOC → PYRIDOSTIGMINE
AchT
Oral

NEOSTIGMINE
AchTTT
Cholinergic crisis
Injectable

2> IMMUNOSUPPRESANTS
MYCOPHENOLATE MOFETIL (MMF) — Best

3> IvIg
4> Plasmapheresis
→ Refractory MG
Myasthenic crisis
↳ resp m/s weakness
↑ ?
Infection.

5> THYMECTOMY
35% MG → Drug Free
85% MG → Symptom Remission
It is Recommended Inspite of medical control. [15-55yrs] [MUSK Ab ⊖]
MOST USEFUL → In Thymoma pts.
↳ local effect
↳ Paraneoplastic synd.

NOT USEFUL IN
<15 yrs ⇓ Immuno Def.
>55yrs ⇓ Vestigial

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

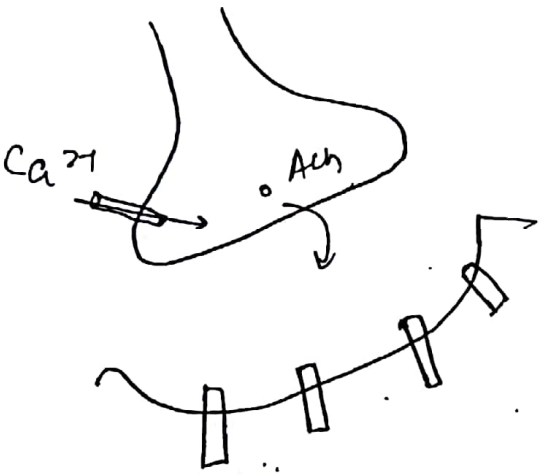
→ Ocular MG

• Risk surgery >> Disease

– MUSK Ab ⊕ [↓ Benefit]

LAMBERTEN EATON MYASTHENIC SYNDROME

[LEMS] [PARANEOPLASTIC SYNDROME]



P/Q Ca^{2+} CHANNELS

Voltage Gated

// antigen similarity

Ab

Small cell Ca Lung (SCC)

↓ Ach Release

[PRE SYNAPTIC DEFECT]

C/F:-

Weakness skeletal > Facial > ocular [NOTE - MG opp. seq.].

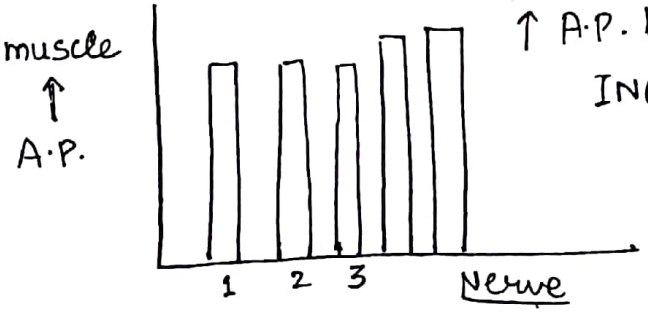
DTR ↓ / ⊖ [MG, DTR ⓝ]

Bladder Involved [MG, Bladder ⓝ]

INV:-

1) Edrophonium +ve. (weakly +ve compared to MG)

2) Rapid N/V Stimulation Test



↑ A.P. by 10%

INCREMENTAL RESPONSE

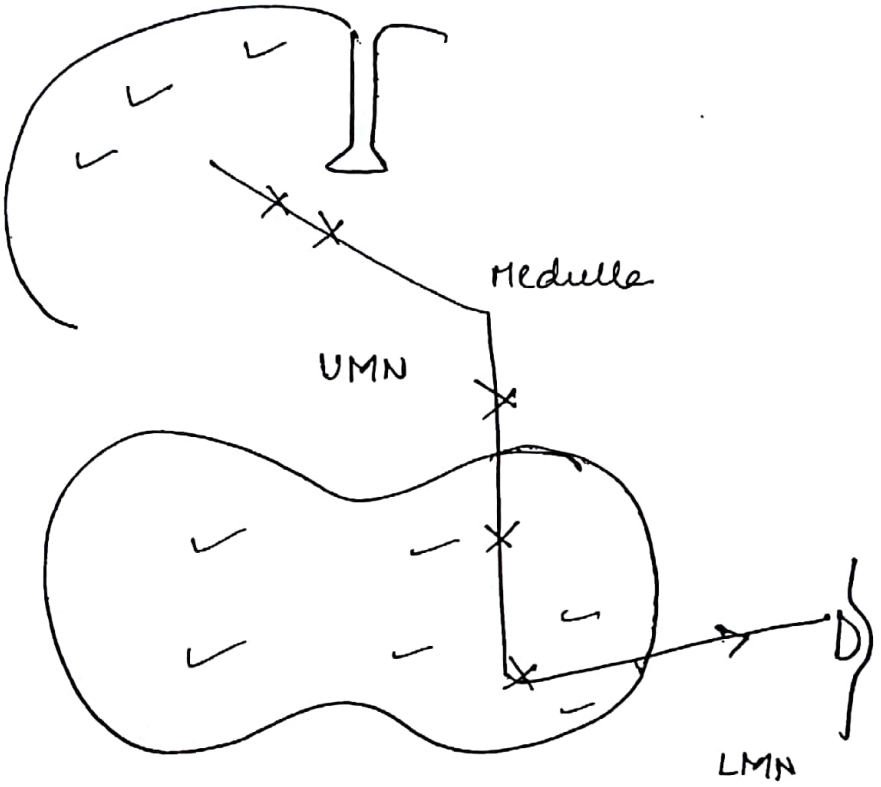
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

℞ -

↳ 3, Diaminopyridine ← DOC

3DAP [TAch Release]

MOTOR NEURON DISEASE



① AMYOTROPHIC LATERAL SCLEROSIS (M/C)

Cortico spinal Tract ← UMN ± LMN ← due to AHC

Weakness is starts distally.

Amyotrophic ⇒ no trophic factors

Weakness occurs.

(II) 1° LATERAL SCLEROSIS (PLS)

Degeneration of CS Tract ⇒ UMN

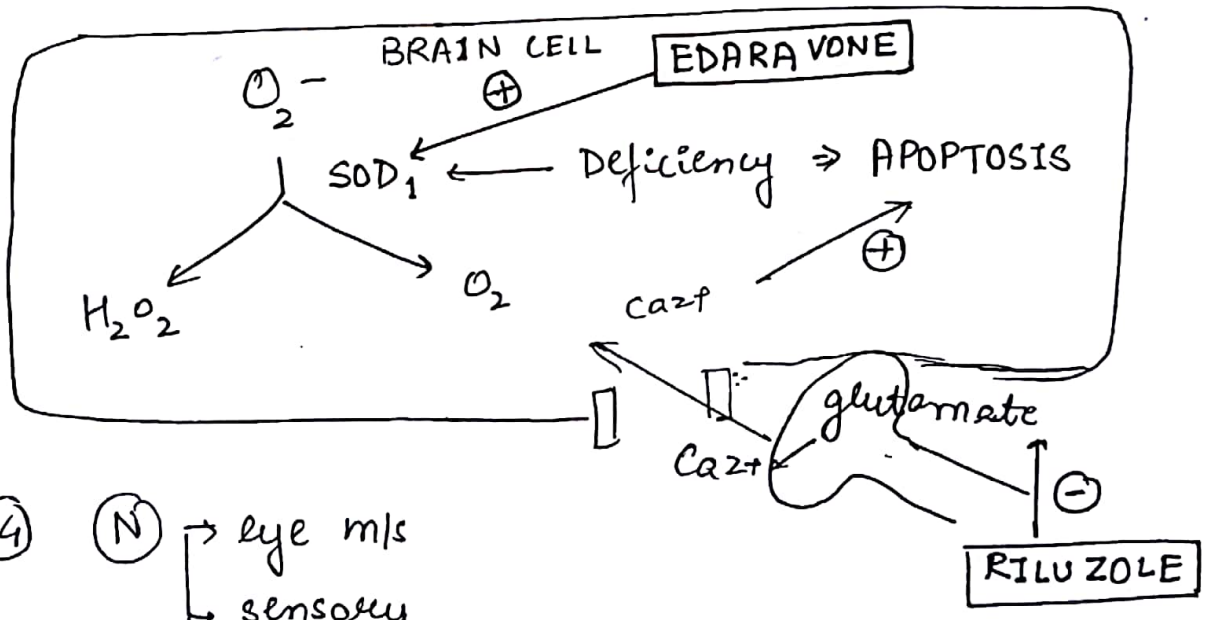
(III) SPINAL MUSCULAR ATROPHY

only LMN

ALS

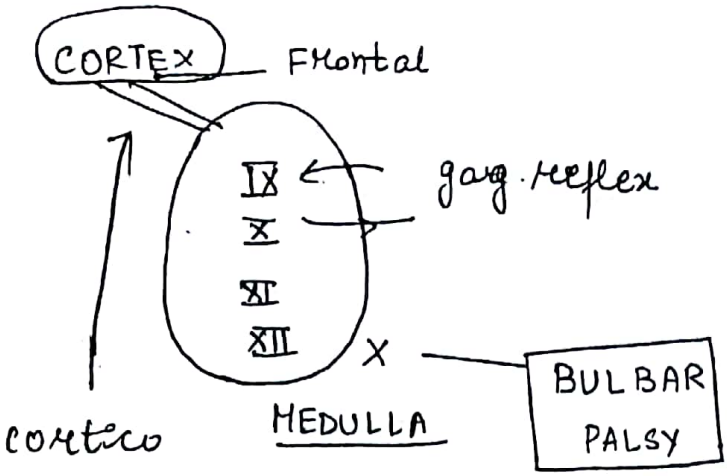
C/F -

1) Elderly
2) Fasciculations ← [PATHOGNOMIC]
3) SUPEDXIDE DISMUTASE (SOD1) Deficiency



(4) (N) → Eye m/s
- sensory
- Bladder
- Cognition.

(5)



PSEUDO BULBAR PALSY		BULBAR PALSY	
Dysarthria	+	++	→ ALS → Polio → M.G. [Bulbar MG]
Dysphagia	+	++	
Labile Effect	+	⊖	
Gag Reflex	+++	⊖	

ATAXIA

DRG = Dorsal Root ganglia

	FREIDRICH ATAXIA	TABES DORSALIS	SUBACUTE COMBINED DEGERATION
TRACTS	POST. Pyr./C.S. Spino cerebellar	POST.	POST. Pyr./C.S. Peripheral n/vs
VIBRATION	⊖	⊖	⊖
PROPIOCEPTION			
PAIN, TEMP	⊕	⊕	⊕
DTR.	⊖ Early DRG involved	⊕	⊕ → ⊖ neuropathy
Babinski	+ve	⊖	+ve
ASSOCIATE D T	cardiomyopathy Optic Atrophy DM.	Syphilis ARP ⊕ Bladder disturbance	↓ vit B_{12} Megaloblastic anaemia

FREIDRICH's

Trinucleotide Repeat sequence = GAA

AR

Chr. 9

TABES DORSALIS

Syphilis.

Argyll Robertson Pupil.

Bladder Disturbance

SACD

↓ vit B_{12}.

↓

Megaloblastic Anaemia

CEREBELLAR LESIONS

Dysmetria – Past Pointing

Titubation → persistent head knodding

Intentional Tremor

Dysdiadokinesia

Pendular knee Jerk

Romberg's Test ⊕ → Lesion in Post. column

Broad Based Gait

Tendency to fall towards Lesion.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

ALZHEIMER DISEASE

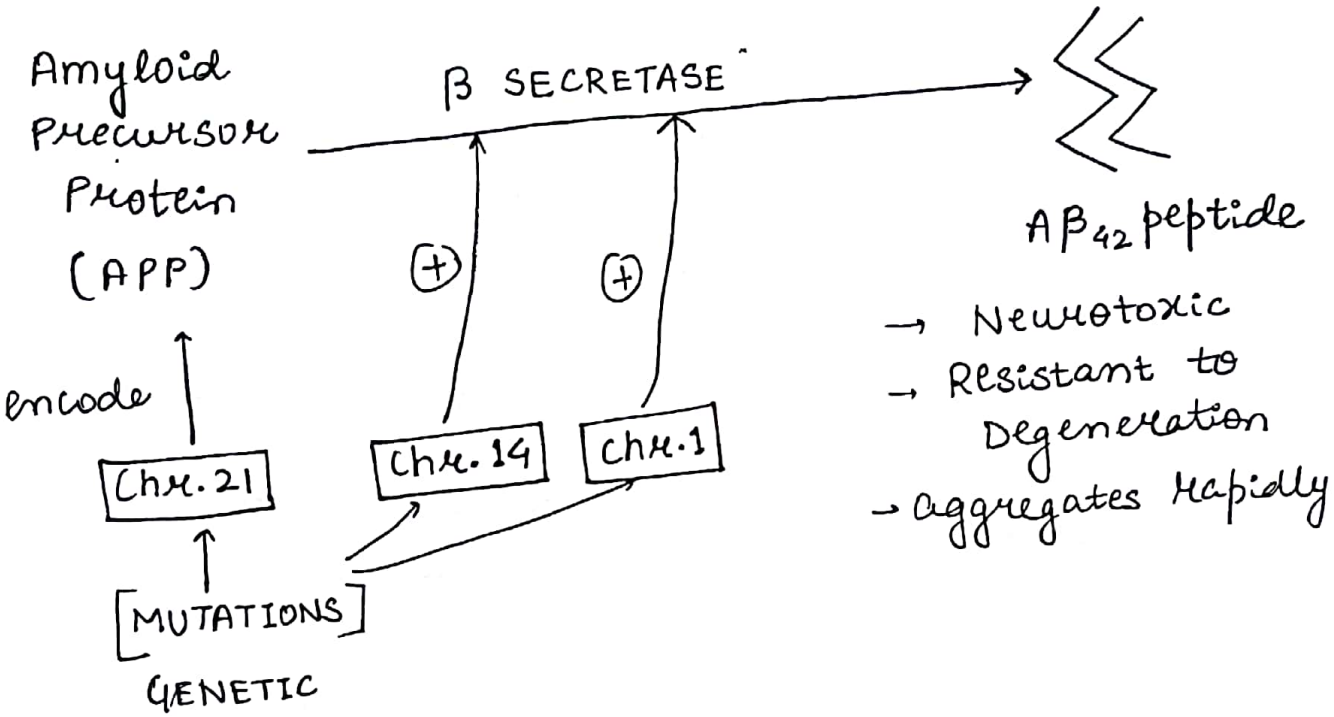
AMYLOIDOSIS

↓

ATROPHY

↓

AMNESIA



RISK

↑

Elderly

♀

Chr. 19 - Apo E_4 gene

Aluminium

Mercury

Family H/O

Low Education (poor maths)

↓

Post Menopausal Estrogen

NSAID Use

Apo E_2 gene.

Smoking

↓ Risk → Parkinsonism

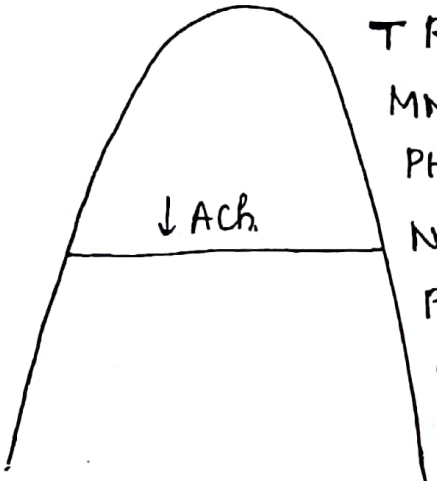
↓ Risk → Ulcerative colitis

ATROPHY

Temporal
Parietal
+
Hippocampus

→ Earliest

C/F



TROPHY
MNNESIA (anterograde)
PHASIA (Anomie)
NOSOGNOSIA (unaware)
PRAXIA
GNOSIA (can't identify)
NOSMIA
SPIRATION PNEUMONIA (cause of death)

→ ACALCULIA is not seen. [DSM CRITERIA]

→ AGNOSIA not seen in early onset Alzeihmer's (age < 65yrs) [ICD CRITERIA]

→ DELUSION (false belief) = OF DOUBLES → Doctor replaced by Enemy | CAPGRAS syndrome (in 10% pts)

BIOPSY

APP ⟶ ξξ → [ξξ] NFT

1> NEUROFIBRILLARY TRIANGLES

Intracellular
Correlate ¯c severity

[TAU] - Hyper PO_4^- microtubular proteins
s/o neurodegeneration

Also seen in TAUPathies

1> Fronto Temporal Dementia

- Behavioural Ab(N) due to frontal lobe involvement → early, → severe
- memory loss → Late → mild
- Age of onset <65yrs
- Insight ⊖

2> Progressive Supranuclear Palsy (PSP)

- extended posture
- downward gaze ⊖ - fall
- dementia

3> Corticobasilar Degeneration [PD + myoclonus + Dystonia]

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

2) SENILE NEURITIC PLAQUES (SNP)

→ extracellular

→ Correlate ↑ Age

CEREBRAL AMYLOID ANGIOPATHY (CAA)

- Large Vessel → cortical → Alzeihmer's Disease
- Small vessel → Subcortical → Progressive Supranuclear Palsy

→ DEMENTIA

3) GRANULOVASCULAR DEGENERATION

Best seen in HIPPOCAMPUS

HUNTINGTON's CHOREA

→ Huntington gene [Chr 4 - short arm] — Trinucleotide Repeat sequence defect

CAG > 40 repeats.

→ AD inheritance

→ 2 successive generations are affected

→ 1 Parent affected

[Chance 50%) 1:2

→ If Both parents affected.

[chance 75%] (3:4)

ANTICIPATION

(11-50yr)
- ♂ (Father) = early onset 2nd Decade
- Mother = Late Onset 4th Decade.

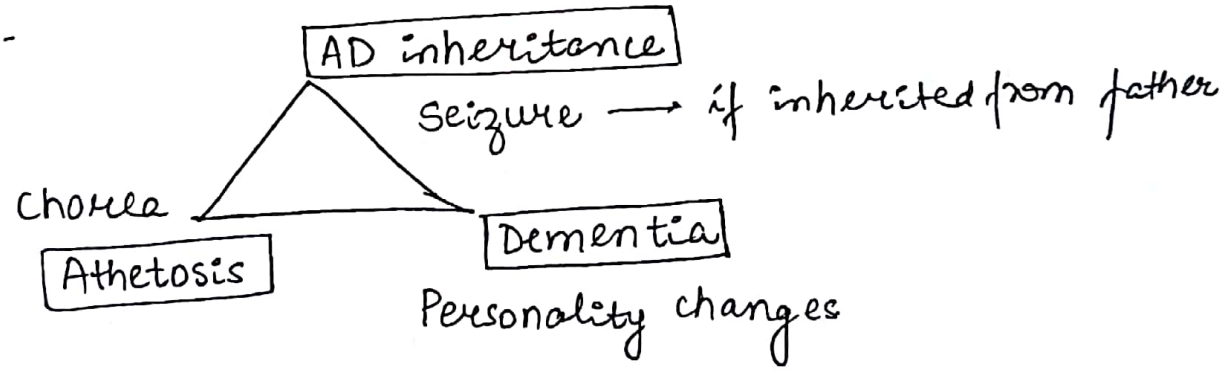
LENGTHENING

Larger Defect
- → ↑ severe
- → Early onset (from father)

Father Repeats	Mother Repeats
400	400
↓	↓
40,000	400

anticipation
↳ occurs due to lengthening.

C/F -



ATROPHY – in CAUDATE NUCLEUS.

↓ACh ↓GABA Intra striatal
↑ DA

Rx → DA ⊖ → Haloperidol
DA Depletor → Tetrabenzine ← DOC

NORMAL PRESSURE HYDROCEPHALUS (NPH)

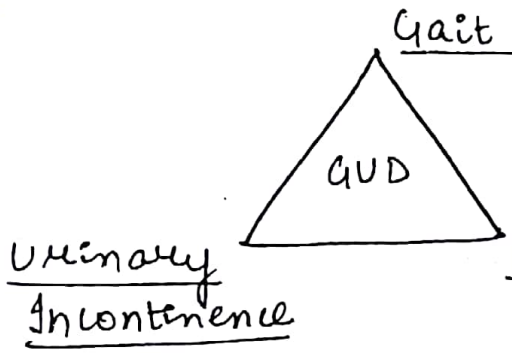
CSF PRESSURE → (N) = 50 - 150

↳ NPH = 150-180

↓ CSF Absorption. ← SAH

↑ ↳ Meningitis

C/F



MAGNETIC GAIT

→ external hip rotation

→ shorter strides

→ Low gradend clearance..

SCISSORING GAIT → spastic CP

CHARLIE CHAPLIN GAIT → Tibial Torsion

Rx V-P shunt

↓

1st / Most responsive symptom to improve on VP shunt

ATAXIA

QQ WERNICKE'S ENCEPHALOPATHY

EA PREDISPOSED –

1) Hyperemesis
2) Alcohol Intake

→ B_1 Deficiency

↓

CO-FACTOR for.

α-keto glutarate dehydrogenate
Pyruvate Dehydrogenase

↓

GLUCOSE ACCUMULATION

↓

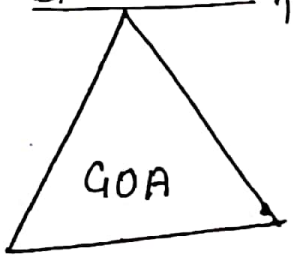
Mitochondrial Damage

↓

NEUROTOXIC

C/F

GLOBAL confusion.



Ophthalmoplegia

Ataxia

Rx THIAMINE REPLACEMENT x 14 Days.
(100 mg/day)

1st Improve = ophthalmoplegia

[Glucose Infusion can Precipitate it]

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

KORSAKOFF'S PSYCHOSIS / ALCOHOL DEMENTIA

DEMENTIA ⟶ CONFABULATION
False story to hide memory loss

SITES

Periaqueductal Grey Matter
Mamillary Bodies
Thalamus → [AMNESTIC DEFECT]

CONFUSIONAL STATE

1) seizure
2) T.I.A.
3) Metabolic – ↓ glucose
   ↳ alcohol

TRASIENT GLOBAL AMNESIA

Both anterograde + Retrograde amnesia

CNS INFECTIONS

BACTERIAL / PYOGENIC MENINGITIES

M/C/C

Adolescent / Adult = N. MENINGITIDIS (Epidemic)

Elderly = STEPTO. PNEUMONIA (Community acquired)

CSF

	~~Appearance~~ (N)	PYOGENIC
Appearance	Transparent	Turbid
cell count	≤5	Pleocytosis (N>7L)
Protein	15-45 mg/dL	↑↑
Glucose	40-70 mg/dL	↓↓↓
Cl⁻	116-126 meq/L	↓/(N)

Hypoglycorrhizia = ↓ CSF Glucose

Rx

N-MENINGITIDES → ceftriaxone × 7 Days

S. PNEUMONIAE → ceftriaxone + vancomycin] × 14 Days

>60 yrs pt → LISTERIA → Ampicillin

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

C/F

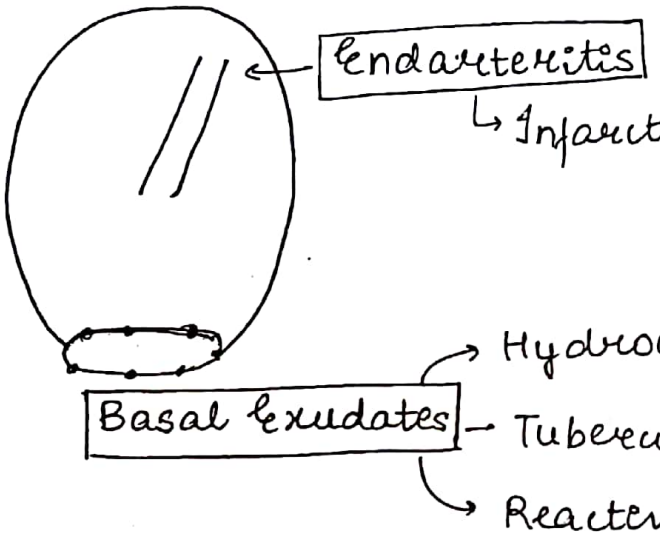
± HEADACHE.

Dexamethasone
10 mg IV Stat
↓
1st Dose of antibiotic

TBM

M/c Meningitis in India

TBM ATT × 1 month
↓ sensorium
① ATT induced hepatitis
↳ hepatic encephalopathy
② ↑ ICT → cerebral salt wasting
③ Infarct
④ Tuberculoma
⑤ Hydrocephalus



CSF

→ COB-WEB
→ Pleocytosis [L >> N]
→ Protein ↑↑↑
→ Glucose ↓ Cl^- ↓↓↓

GOLD STD TEST = Culture of CSF

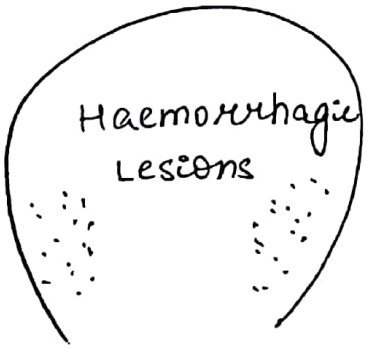
℞
ATT × 12-18 months (↓ Reactivation)
Steroids × 2 mnths [⊖ Endarteritis]

VIRAL ENCEPHALITIES

M/C C → ENTEROVIRUS

- epidemic = ARBOVIRUS
- sporadic = HSV type 1

HSV ENCEPHALITIS



CSF

→ xanthochromia

- SAH — CT Scan. → (N) CSF xanthochromia
- Traumatic LP

→ Pleocytosis
→ ↑ Protein
→ (N) Glucose
→ Cl^- ↓

MOST SENSITIVE TEST = PCR for HSV in CSF

MRI — Bitemporal Hyperintensities.

	T_1	T_2
Brain	↑	↓
CSF	↓	↑

↑ = itis

℞ Acyclovir - 10 mg/kg IV 8 hrly × 14 days

↓

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

↓
CSF
PCR for HSV
↙
Prognosis ↳ ⊕ = continue same Rx for 7 days.
↳ ⊖ = Stop Rx.

PROGRESSIVE MULTIFOCAL LEUCOENCEPHALOPATHY (PML)

Jc virus → oligodendrocyte
Inclusion bodies

A/C -
Immunocompromised host
↳ HIV + (80%, M/C host)
Transplant Recipient

C/F - Visual field Defects. (M/C)

Inv
MRI → Hyperintensities
↘ Demyelination
↓
CSF (PCR for Jc virus)
↓
Brain Biopsy

Rx
not available

Prognosis Death 3-6 months of onset

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

PRION DISEASE

CREUTZFELD JACKOB DISEASE (CJD)

DNA/RNA ⊖

Transmittable → Dural Grafts
→ corneal Grafts

C/F-
Dementia + myoclonus (M/C)

Inv
EEG- Biphasic waves
Brain Biopsy - spongeform degeneration

Rx- not available

NCC [Neurocysticercosis]

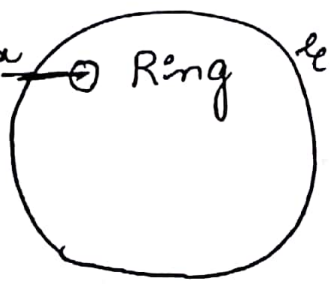
Agent = Taenia Solium

HOST = DEFINITIVE = Human — accidental intermediate Host
INTERMEDIATE = PIG

Via → consumption of undercooked Pork
→ consumption of undercooked raw vegetables

C/F- seizure (M/C)

Inv-
CE → CT
→ MRI



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

STAGES

		Oedema
(Viable)	VESICULAR	+
(Dying)	COLLOIDAL	+++
(Dead)	CALCIFIED	−

℞

ANTI-PARASITIC

DOC → ALBENDAZOLE PRAZIQUENTAL

↓

15 mg/kg/Day × 8-28 days

+ Steroids + A.E.D. × 6 months

↓

CT Scan

↓

calcified

Taper 2-3 months

↓

STOP.

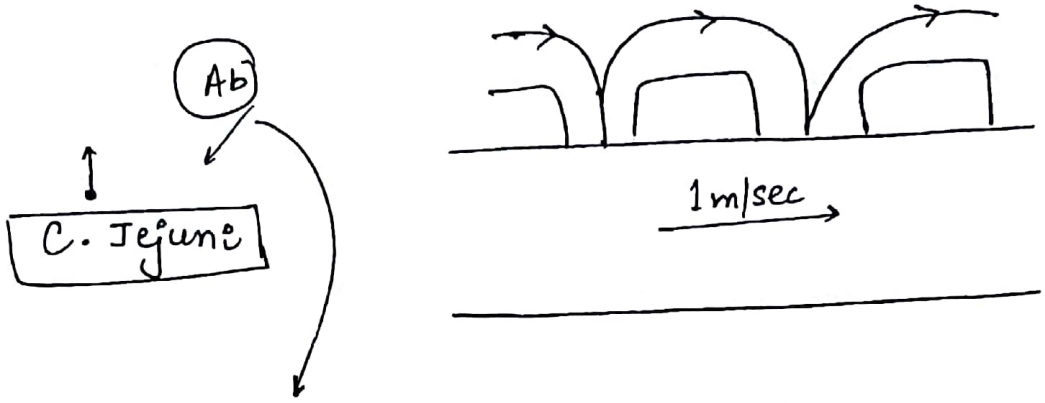
OTHER TYPES OF GBS

AIDP (<4wk)	AMAN	AMSAN
Motor Sensory	motor only	M=S
>90% children mostly	children young adult	Mostly adult
GM_1 Ab +ve	GD_{1a} Ab	Worst Prog.

CIDP >9wk.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

GUILLAN BARRE SYNDROME



Schwann cells → ↓ schwann cell
↓ myelin
↓ conduction

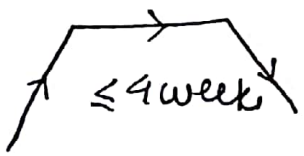
→ Post Infectious
→ Demyelinating
→ Poly neuropathy

VACCINES causing GBS :-
RABIES (neural)
Influenzal

C/F

ASHBURY CRITERIA

→ Ascending Paralysis → Symmetrical
≤ 4 weeks
Distal → Proximal



Areflexia
Minor sensory
Bladder - spared

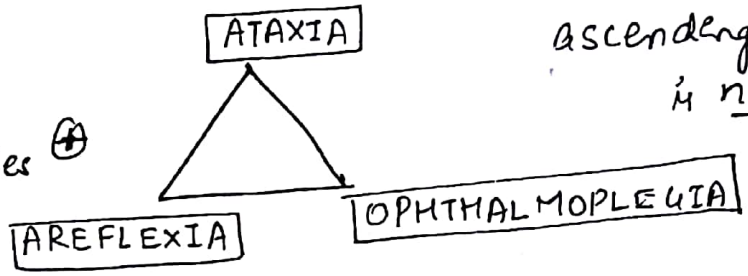
M/c cranial N/v Involved = VII th (B/L, LMN)

ACUTE INFLAMMATORY DEMYELINATING POLYNEUROPATHY (AIDP)

VARIANT OF GBS

MILLER FISCHER VARIANT / SYNDROME

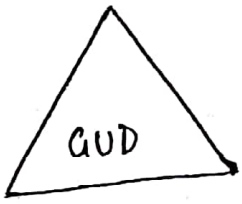
GQ1b Antibodies (+)



ascending paralysis is not seen.

MILLER FISCHER TEST (DNB)

Done In Normal Pressure Hydrocephalus



CSF Drained (30 ml)
↓
Cognition
↓
Improved
↓
then go for V-P-Shunting

Inv For GBS

1) Nerve Conduction Study
↓ N/v conduction velocity
↓ A.P.

2) CSF

↑ Albumin
No pleomorphism
] Albumino cytological Dissociation.

℞

1) IVIg ~~2mg~~ 2gm/kg over 5 Days.] Both are equally effective
2) Plasmapheresis

Best in 1st 14 Days

Steroids is not recommended

PROGNOSIS

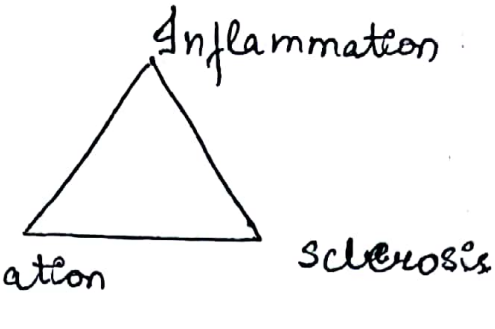
Recovery occurs in 85% [IVIg & Plasmapheresis will not alter the sequlae]
Sequlae → 10%
Death → 5%

INFLAMMATORY MYOPATHY

	DERMATO MYOSITIS	POLY MYOSITIS	INCLUSION BODY MYOSITIES
AGE	Any	>20yrs	>50yrs
MUSCLE INVOL.	Proximal	Proximal	Distal
SKIN Changes	+	−	−
Ass ū malignancy	+ (15%)	−	−
EYE	(N)	(N)	(N)
	Creat. Kinase ↑↑	↑↑	↑↑

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

MULTIPLE SCLEROSIS



DISSEMINATED
- Time
- Space.

C/F

1> SENSORY

1st M/C symptom

↑ Exposure to HEAT ⇒ UTHOFF SIGN

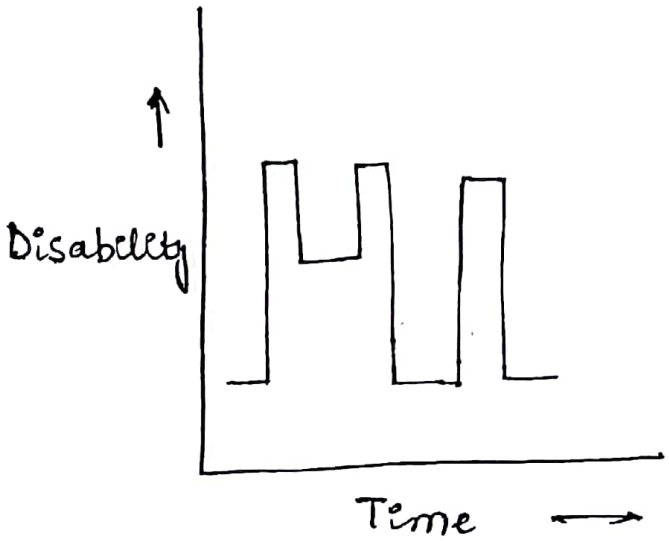
ICE PACK TEST

Cold ⊖ ACHE ⇒ ↑ in MG pts.
Weakness ↓

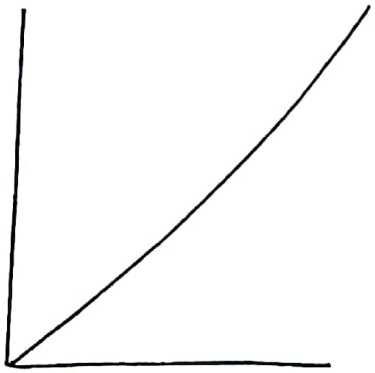
② OPTIC NEURITIS

③ SPASTICITY

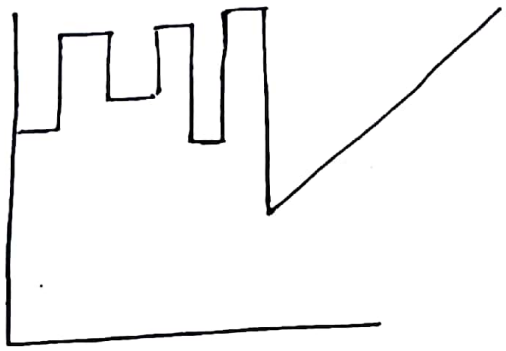
TYPES



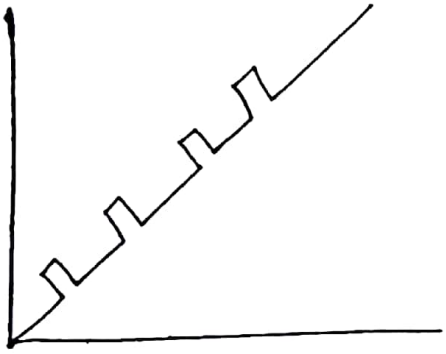
RELAPSING REMITTING [RRMS] (85%)



1° PROGRESSIVE 15%
M/S (PPMS)



2° PROGRESSIVE
MS (SPMS)



PROGRESSIVE RELAPSING
M/S (PRMS)

STAGING

MS = EXTEDED DISABILITY SCORING SCALE (EDSS)

SAH = HUNT & HESS SCALE

MG = OSSERMAN GRADING

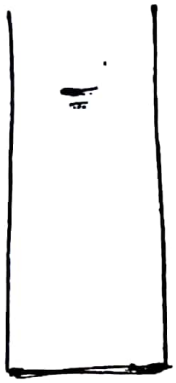
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

INV

MAC DONALD CRITERIA

MRI → Demyelination → Plaque → Periventricular

CSF



Oligo Clonal Bands ⇒ IgG

Liquid Chromatograph

Rx

ACUTE ATTACK

METHYL PREDNISOLONE (DOC)

DISEASE MODIFYING AGENTS

1) IFN β → β1a, β1b ← DOC

2) Glatiramer

3) Fingolimod [ORAL]

4) Natalizumab [BEST] ⟶ S/E = PML

WhatsApp: +1 (402) 235-1397

D/D of DESCENDING PARALYSIS

Botulism

Polio, Porphyria

Diphtheria

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

ENDOCRINE

– Dr. Achin

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

PROLACTIN

Secreted in Ant Pituitary

Prolactin making cells LACTOTROPH

FUNC":-

1> Induce, maintain the process of lactation

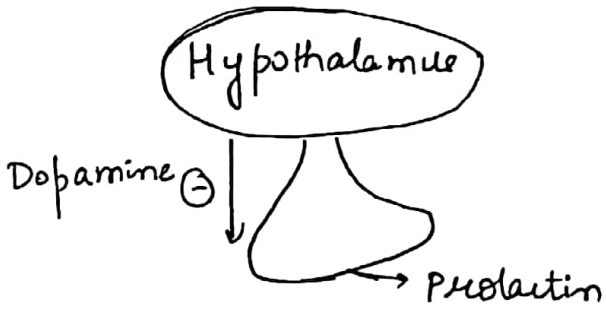
2> prolactin hormone ⊖→ GnRH → LH ↓
↳ ↓ ovulation

↓

sexual drive ← ↓ Testosterone ↳ ⊖ menstruation

↓

Spermato genesis



HYPEPROLACTINEMIA

ETIOLOGY-

A) PHYSIOLOGICAL

1> Lactation

2> ♀

↑ estrogen → ↑ PL

3> Sleep [NREM sleep]

4> Chest wall stimulation

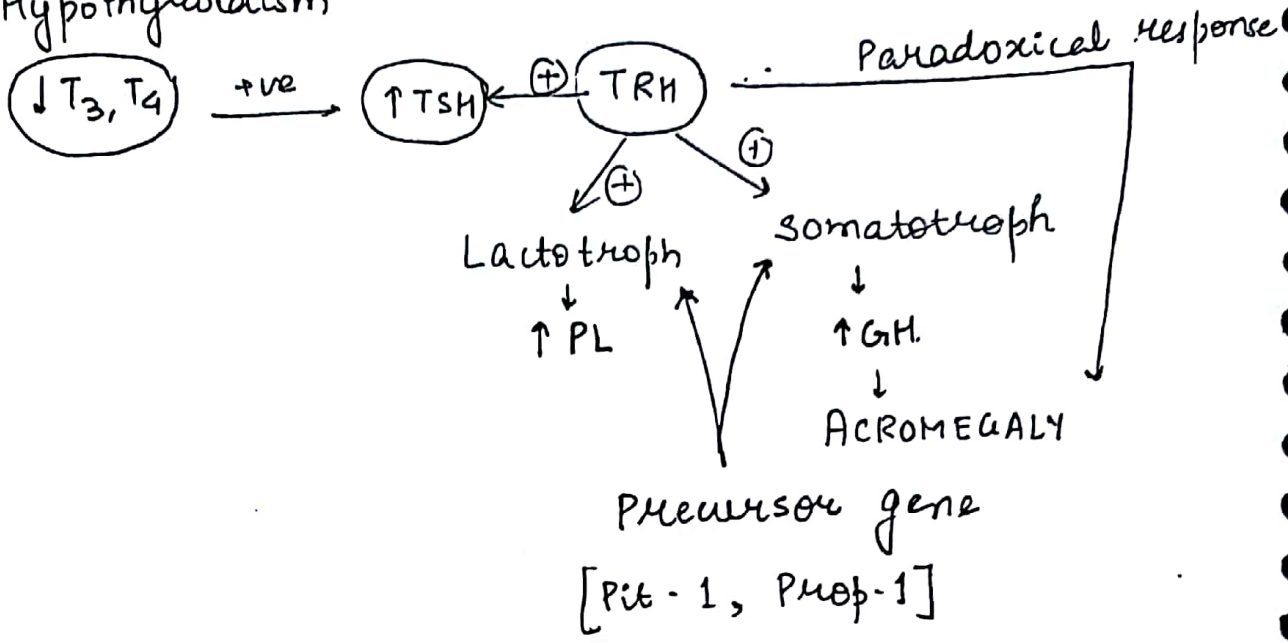
→ nipple stimulation

→ chest trauma or surgery

→ herpetic lesions

5B) SYSTEMIC DISORDERS

1) Hypothyroidism



2) CKD

→ ↓ excretion of prolactin

3) SEIZURE

Post Ictal (30 mins)

C) DRUGS (Iatrogenic)

Dopamine ⊖

→ Typical Antipsychotics
  - Haloperidol
  - CPZ

→ Atypical Antipsychotics
  - Risperidone

→ Metoclopramide

Dopamine Depletors

CH_3 Dopa
Reserpine
CCB - verapamil

H_2 ANTAGONIST

Ranitidine
Cimetidine

⇒ These drugs cause hyperprolactinemia due to blockage of Infundibular Pathway

D> PITUITARY ADENOMA

PROLACTINOMA → M/c type

<10mm
MICRO (90%)
F:M = 20:1

>10mm
MACRO (10%)
F:M = 1:1.

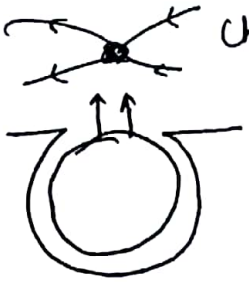
C/F → ♀ → Galactorrhoea - 80%
↳ B/L.

Infertility (M/c presentation)

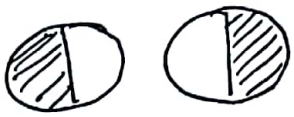
Amenorrhoea
↑ PL → ↓ LH
↓ ovulation

↓ estrogen
↓
osteoporosis

♂ → ↓ Libido
Azoospermia
Infertility



⇒



Compressive
MACRO > MICRO

S. PROLACTIN

(N) = 5 - 25 µgm/L

- PHYSIOLOGICAL → 25 - 40
- IATROGENIC → 25 - 100
- PRACTINOMA → >200
- MACRO PROLACTINOMA - >250

Stop offending drug
Reasses PL after 72 hours

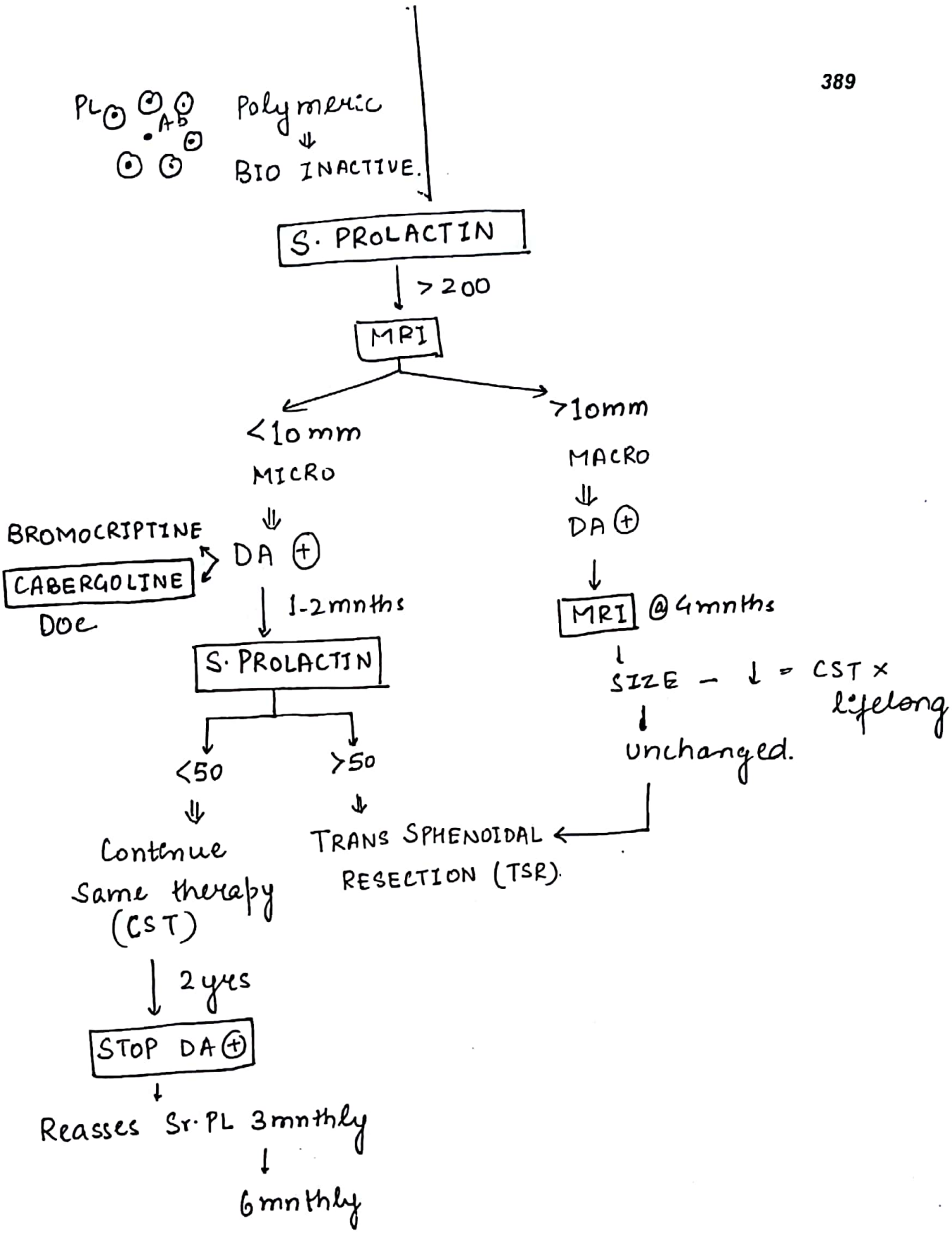
MACROPROLACTIN

Symptoms ⊖
Prolactinoma ⊖
S. Prolactin ↑↑↑
[FALSE HIGH]

PROLACTIN = Peptide hormone (198 A.A)
↳ 85% monomeric

HOOK EFFECT

Symptoms ⊕
Prolactinoma ⊕
S. Prolactin (N)
[FALSE (N)]



Always 1st Line = Medical Rx

PROLACTINOMA ON DA ⊕ WANTS TO CONCEIVE

↓

allow 3 Ⓝ cycles

↓

Stop DA ⊕ → Teratogenic precious ♀.

↓

♀ → Assesment

Rare < [Headache, ↓ Vision] DA ⊕ [BROMOCRIPTINE]

↓ no response

SURGERY (TSR)

Prolactinoma is ♀ are asymptomatic

DOC for Prolactinoma = CABERGOLINE

Long acting

Convenient Intake

↓ nausea

Better effect

↓

In ♀

↓

BROMOCRIPTINE

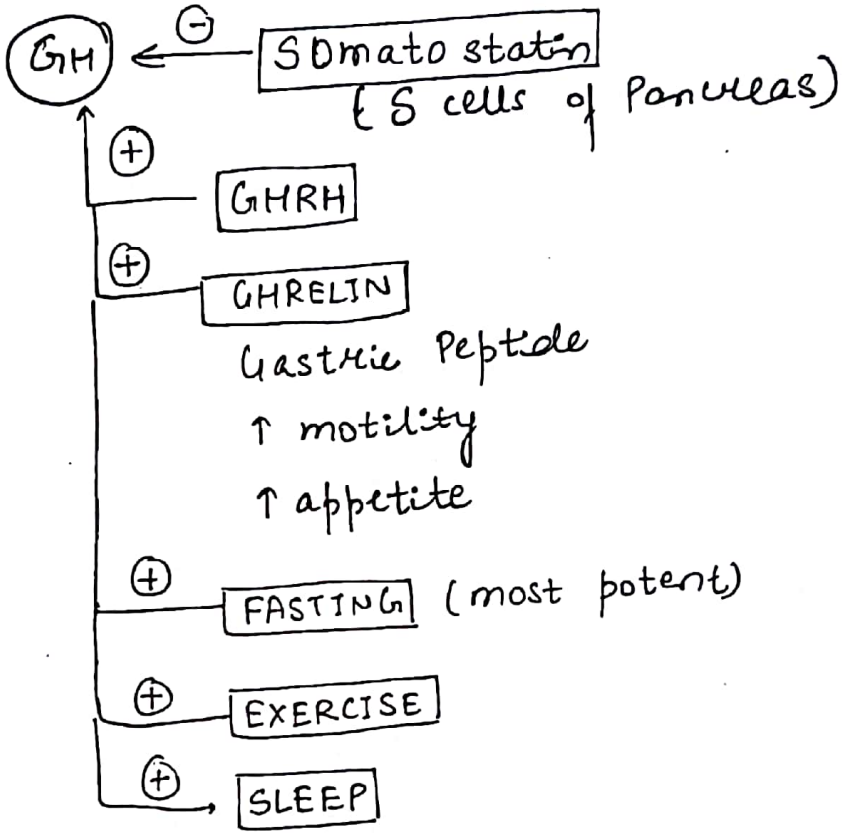
FERTILE ♀ → BROMOCRIPTINE

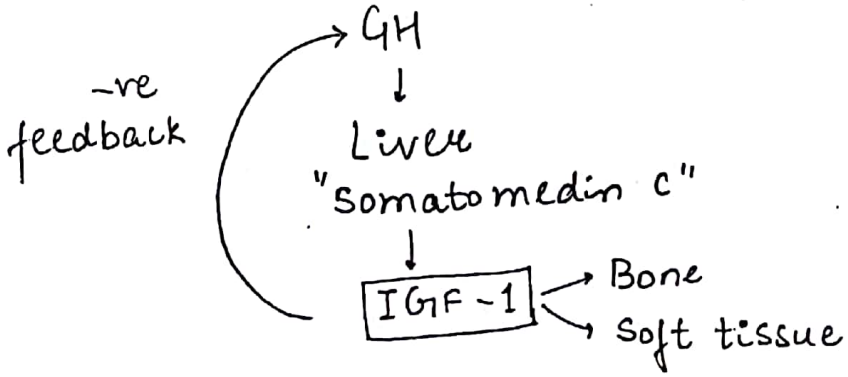
GROWTH HORMONE

→ Released from Ant. Pituitary

→ By SOMATOTROPHS (Most abundant cells) 50%)

> Lactrotrophs > Gonadotrophs
(20 - 30%) (10 - 20%)





http://mbbshelp.com WhatsApp: +1 (402) 235-1397

	GH	IGF-1
CARBOHYDRATE	Diabetogenic	Anti diabetic
PROTEIN	ANABOLIC	ANABOLIC
FAT	LIPOLYTIC	ANTILIPOLYTIC

GH $\xrightarrow{(+)}$ Lipase → ↑FFA → Insulin Resistance → Diabetogenic

↑GH
↳ epiphyseal fusion.
↳ BEFORE = GIGANTISM
↳ AFTER = ACROMEGALY

ACROMEGALY

ETIOLOGY

↑GH

PITUITARY
↳ Somatotrophic Adenoma (M/cc)
↓
Loss of feedback
↳ MAMMO SOMATOTROPHIC ADENOMA → ↑PL ↑GH

↑GHRH

HYPOTHALAMUS
HAMARTOMA

ECTOPIC
BRONCHIAL CARCINOMA

ECTOPIC

ISLET CELL CA of PANCREAS

C/F

CVS → LVH
Diastolic Dysfunc"
HTN
CAD

H/CC of DEATH
ACUTE M.I.

Resp → Nasal turbinate Hypertrophy
obstructive sleep apnea (OSA)

GIT → ↑ Liver & spleen (Hepatosplenomegaly)

Q Colonic Polyps >> Cancer
↓
Benign

ENDOCRINE → DM (Insulene resistance)
Goitre

SKELETAL → Tall Stature
Large Digits
Prognathism
Jaw malocclusion
[↑ space bet" lower Incisors]
Fleshy nose.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

INVESTIGATION

1> GH ASSAY → not useful test

2> IGF-1 ASSAY
Best screening Test

3> GH SUPRESSION TEST → confirmatory Test

[GH $\propto$ $\frac{1}{\text{glucose}}$]

75 gm glucose (oral)

GH → (N) → ↓

ACRO → unchanged

Rx

TSR – [RxOC] F/B → ADJUVENT THERAPY

[Initial therapy]

Somatostatin
octreotide
Lanreotide

GH ⊖
Pegvisomant

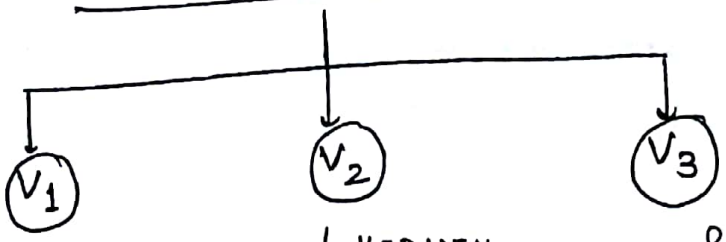
INSULIN STIMULATION TEST

GH $\propto$ $\frac{1}{\text{glucose}}$ → on giving Insulin.

glucose ↓ → GH ↑ (N)

Dwarfism → GH unchanged

ADH / VASOPRESSIN

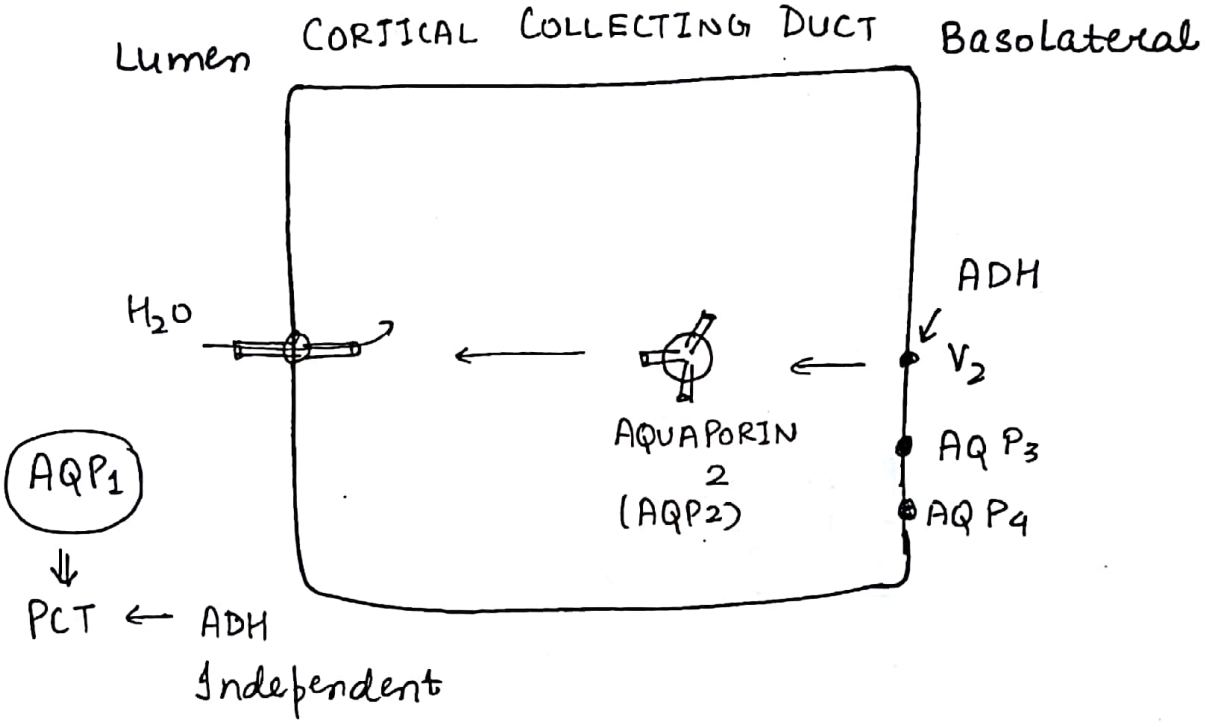


BLOOD VESSELS
Vaso constriction

SMOOTH M/S
(contraction)

↳ KIDNEY
↳ vascular ~~smooth~~ endothelium
(VWF)

Pituitary
ACTH (+)



(N) values

S. Osmolality = 275 - 295 mosm/L

Urine osmolarity = 300 - 1000 mosm/L

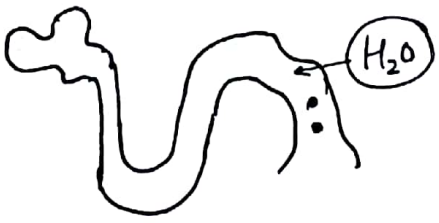
Sr. Na^+ 135 - 145 meq/L

Sr. K^+ 3.5 - 5 meq/L

POLYURIA

> 50 ml/kg/day

> 3L/day



↑ Solute = ↓ H_2O

Isosmolar

SOLUTE/OSMOTIC DIURESIS

⇓

Glucose

Mannitol

Ca^{2+}

Urine osmolality

> 300 (N)

DILUTE

H_2O > Solute

Ur. osm < 300

→ DI

→ Psychogenic Polydypsea (PP)

H_2O Deprivation Test

Ur. osm. ⟶ (↑) = P.P.

↳ unchanged = D.I.

ADH stimulation Test

Ur. osm → (↑) = ADH Def.ⁿ

↳ unchanged = ADH resistance

nephrogenic DI

Phys

Psychogenic Polydipsia

Lumen

$H_2O \rightarrow H_2O$

$\uparrow$ S. osm $\xrightarrow{+}$ Thirst $\rightarrow$ No dehydration

$\uparrow$ Sr. Na^+

Polyuria

↓

Ur. osm $\rightarrow$ (N)

↓

DI

PP

solute diuresis

26

CEREBRAL SALT WASTING DISEASE

$\uparrow$ICT $\rightarrow$ BNP

↓

$\downarrow Na^+, \downarrow H_2O$

Hyponatremia — Hypovolemia

natriuresis

$H_2O \xleftarrow{+}$ Na^+

$\uparrow$ICT $\rightarrow$ $\uparrow\uparrow$ ADH · SIADPH

↓

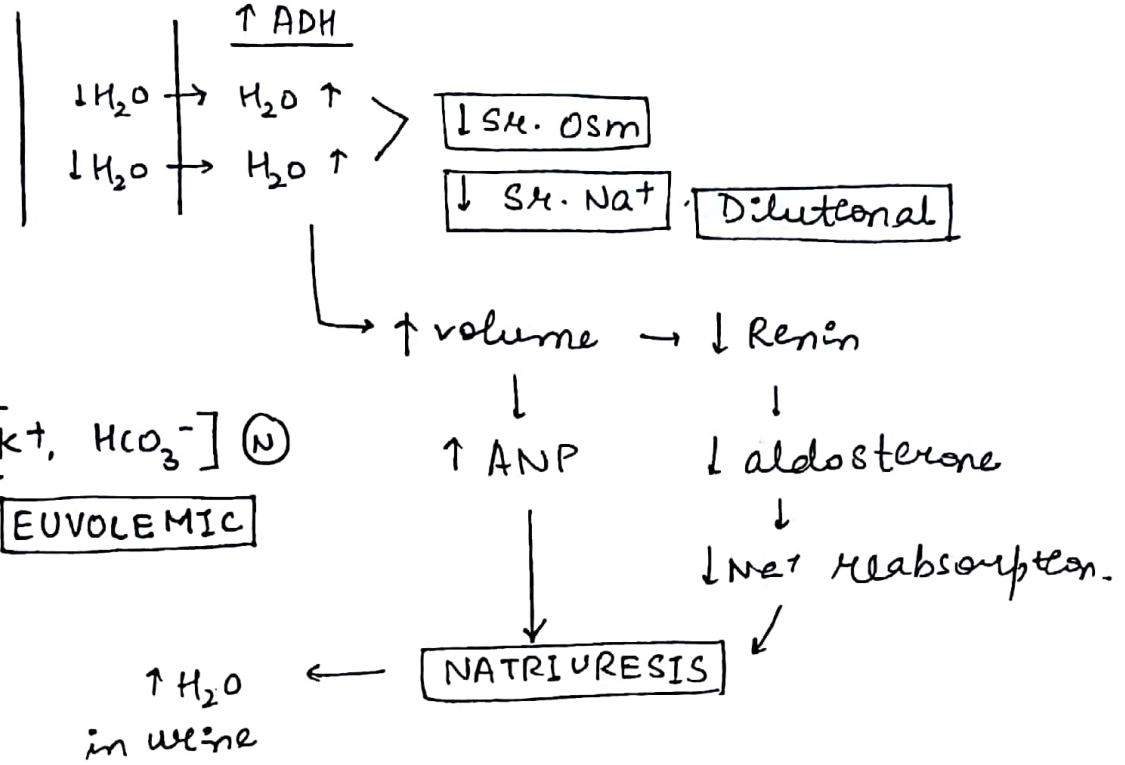
$\downarrow$ ADH (DI)

Mannitol $\xleftarrow{+}$ H_2O $\rightarrow$ $\uparrow$Sr. osm

$\rightarrow$ $\uparrow$Sr. NaT

High output due to diuretics

SIADH [Syndrome of Inappropriate ADH]



HYPONATREMIA

HYPOVOLEMIC	EUVOLEMIC	HYPERVOLEMIC
Cerebral Salt Wasting Disease	SIADH ⇓ H_2O Loading Test	CCF CKD Chr Liver Disease

Pt. produce less urine than N pt.

R_x = H_2O restriction R_x oc

ADH ⊖ ⇒ DEMECLOCYCLINE

↳ VAPTAN (DOC)

Na^+

[(N) = 135 - 145 meq/L]

>120 = Asymptomatic

110 - 120 = GI symptoms
↳ nausea

100 - 110 = mild CNS symptoms
giddiness
Ataxia

Seizures → <100 = cerebral oedema

PARATHYROID HORMONE

↓ Ca^{2+} → ↑ PTH
↳ Bone = Resorption
↳ Intestine = Absorption
↳ Kidney = Reabsorption

↑ PTH

- 2° → CKD
  Vit D deficiency
  Malabsorption.

- 1° → Parathyroid → Hyperplasia
  Adenoma [M/C/C]
  ↓
  M/C type = solitary
  M/C site = Inf. Pth lobule.

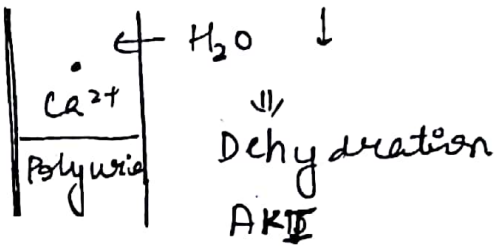
3° = PTH hyperplasia → ADENOMA (3°)

2° ↙ ↘ 1°

HYPERCALCEMIA

C/F -

- → nausea, vomiting
- → Constipation
- → Bony pains ⊕
- → Renal calculi
- → Abdominal Pain
- → depression
- → Psychosis



℞.

1) Hydration.

2) Diuretics
   Caliuric → Loop Diuretics

3) Bisphosphonates
   ⊖ osteoclastic activity
   DRONATES.
   [Delayed onset of Action]

4> GALLIUM ┐
5> PLICAMYCIN ┘ → Osteoclast ⊖

6> CALCITONIN

7> DIALYSIS

WhatsApp: +1 (402) 235-1397

PSEUDO HYPO PTH

↓ Sr. Ca^{2+}

Sr. PTH ↑

PTH resistance

ALBRIGHT HEREDITARY OSTEODYSTROPHY (AHO)

Short Stature

Round Face

Short 4th / 5th metacarpal. (Brachydactyl)

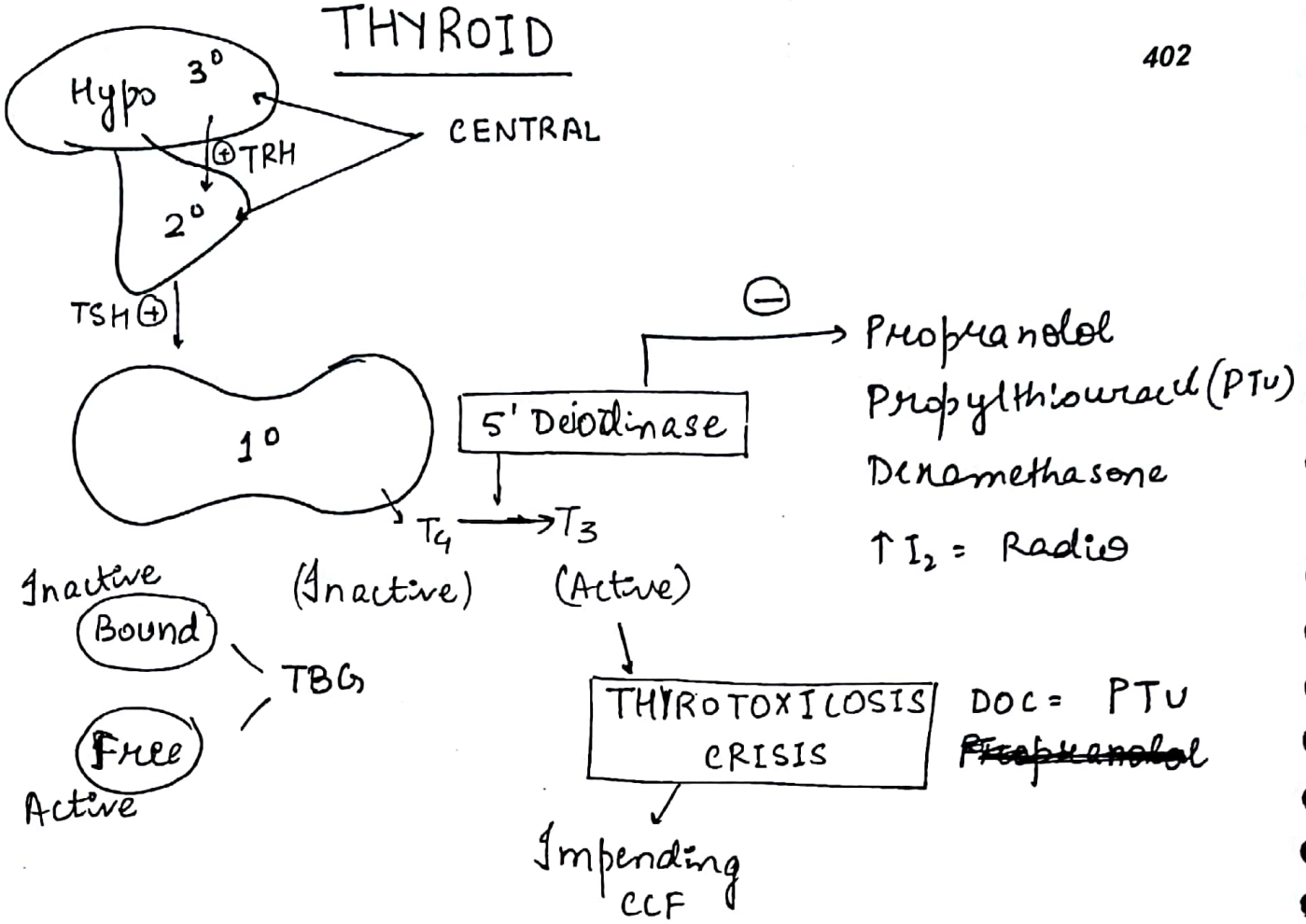
PSEUDO PSEUDO HYPO PTH

Sr. Ca^{2+} = (N)

Sr. PTH = (N)

AHO Phenotype (+)

THYROID



	TSH	FT_3	FT_4
HYPOTHYR (1°)	↑	↓	↓
HYPERTHYR	↓	↑	↑
2° HYPOTHYR	↓	↓	↓
SUBCLINICAL HYPOTHYR	↑	Low (N)	Low (N)

HYPOTHYROID	HYPERTHYROID
Weight Gain	Weight Loss
Fatigue	Anxcety
Cold Intolerance	Heat Intolerance
Constipation	Diarrhoea
Menorrhagia	Amenorrhoea
M/C Amenorrhoea	
↓ H.R.	↑ H.R.
mild Diastolic HTN	↑ S.B.P. / ↑ D.B.P.
Delayed Relaxation of Jerk [HUNG UP REFLEX]	Fine Tremors
	Exophthalmos

Rx HYPOTHYROIDISM

L-Thyroxine [1.6 µg / Kg / Day]

↓ DOSE = elderly, IHD

↓

TSH after [6 weeks]

[(N) = 0.35 - 5]

[Target - 0.35 - 2.5] → L-Thyroxine × Lifelong

↓

TSH 6 monthly

TSH	L-Thyroxine
10	75 µgm / day
↓	↓ +25
8	100 µgm / day

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

SUBCLINICAL HYPOTHYROID

↑ TSH, [FT_3 , FT_4] low (N)

Rx-

TSH >10 ⇒ Start L-thyr

↓

[5-10] L-Thyroxine.

→ ♀ → Infertility

→ ♀ → TBG↑ → ↓FT_3 , ↓FT_4

↓ +ve

↑ TSH

→ TPO Antibodies

ADRENALS

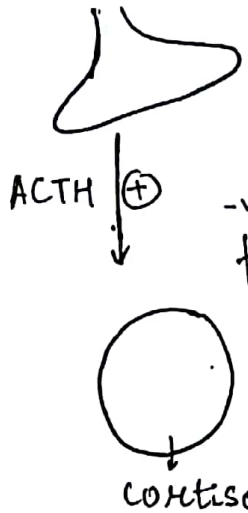
CUSHING SYNDROME

Loss of -ve feedback

ETIOLOGY

A> EXOGENEOUS / IATROGENIC [M/C/C]

B> ENDOGENEOUS



ACTH

DEPENDENT (90%)

- Pituitary 75% Adenoma [F:M = 4:1] — M/C endogenous cause
- → ECTOPIC ACTH 15% [F:M = 1.1]
  - M/c malignancy → small cell Ca of Lung
  - medullary Ca of thyroid
  - Phaeochromocytoma
  - CARCINOIDS → Bronchial, Thymus, Pancreatic

INDEPENDENT (10%)

→ ADRENAL [F:M = 4:1]

- Adenoma (5-9%)
- CA (1%)
- Hyperplasia (<1%)

M/C/C → CUSHING DISEASE

Cushing Syndrome due to Pituitary Adenoma.

C/F :-

↑ CORTISOL → ↑ Gluconeogenesis

1) PROTEIN → MYOPATHY (proximal)

↳ s/c Tissue Tear = STRIAE Purplish colour due to rupture of vessel.

↳ THIN SKIN

↳ EASY BRUISING.

2) FAT Redistribution of fat

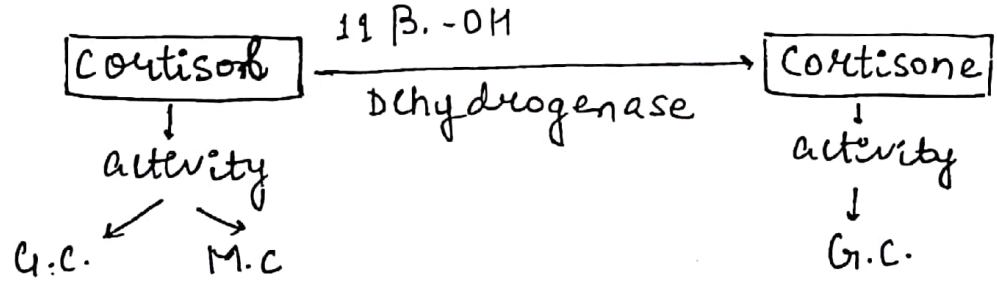
CENTRIPETAL OBESITY

↳ BUFFALO HUMP

↳ MOON LIKE FACE

3) DM

4) HYPERNATRENEMIA



- ↑ Na^+ reabsorpⁿ
  ⇓
  HTN
- ↓ K^+, alkalosis
  ectopic ACTH. pts.

5) ♀

Oligomenorrhoea ⟶ Amenorrhoea

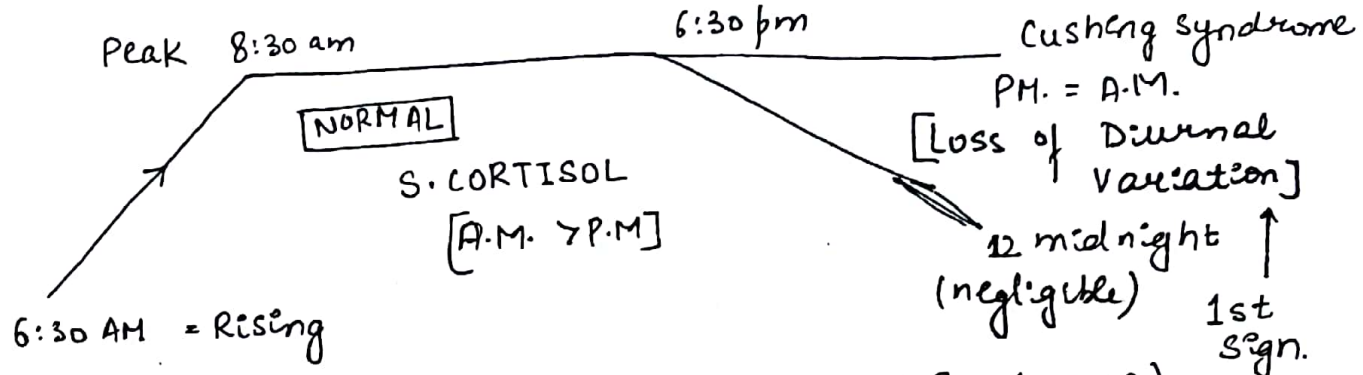
Hirsutism

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

6> CNS -

↑ appetite Euphoria

↓ sleep [Psychosis]



PSEUDO- CUSHING (mimic cushing Syndrome)

Chronic ~~atka~~ alcoholics

Cirrhotic pts.

Pts c Hyperthyroidism

Pt c Depression.

CLINICAL SUSPICION OF C.S.

WEIGHT GAIN (80%) = Thin skin > HTN
(80%) (75%)

1st M/C symptom

> central obesity (50%)

> ↓ K^+, alkalosis (15%)

↓

SCREENING TEST

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

SCREENING TEST

- 24 HR. URINARY CORTISOL ↑↑
- MIDNIGHT S. cortisol ↑
- ORAL DEXA CHALLENGE TEST [BEST]

1mg DEXAMETHASONE @ 11:00PM
(oral)
↓
S. CORTISOL @ 9:00AM
↳ (N) = (N)
↳ C.S. = ↑ (due to loss of -ve feedback)
↓
CONFIRMATORY

4mg 0.5mg DEXA I/V 6hrly x 2 days
↓
SR. cortisol → (N) = C.S. ⊖ ⊖
↳ ↑ . C.S ⊕ ⊕
[LOW DOSE DEXA TEST]
↓
ETIOLOGY H/O - exogeneous
↓
↑ ACTH ↓/(N)

DEPENDENT
↳ PITUITARY ADENOMA
↳ ECTOPIC ACTH.

INDEPENDENT
↓
ADRENAL ADENOMA
[CT Abdomen]

MRI can't visualize pituitary adenoma (2-5mm)

1) INF. PETROSAL SINUS SAMPLING (IPSS)

CRH
↓⊕
ACTH
↓
Sample → Petrosal sinus (PS)
→ Peripheral vein (PV)

RATIO

$\frac{PS}{PV}$ ↑ ⇒ Increased

$\frac{PS}{PV}$ ↓ = Decreased.

PITUITARY ADENOMA

ECTOPIC ACTH

2mg DEXA I.V. 6hrly × 2Days

↓

S. ~~cholesterol~~ Cortisol

↓ = Pituitary Adenoma

Unchanged = Ectopic ACTH.

2) High Dose DEXA TEST

	PITUITARY ADENOMA	ECTOPIC ACTH
C/F		
ONSET →	Insidious	Acute
PROGRESSION →	Slow	Rapid
HYPERPIGMENTATION →	⊕	⊕ ⊕ ⊕ ⊕
IPSS	$\frac{PS}{PV}$ ↑	$\frac{PS}{PV}$ ↓
HIGH DOSE DEXA TEST	+ve response	Unchanged.

℞

- Ketoconazole
- Metapyrone
- Etomidate
- Mitotaine

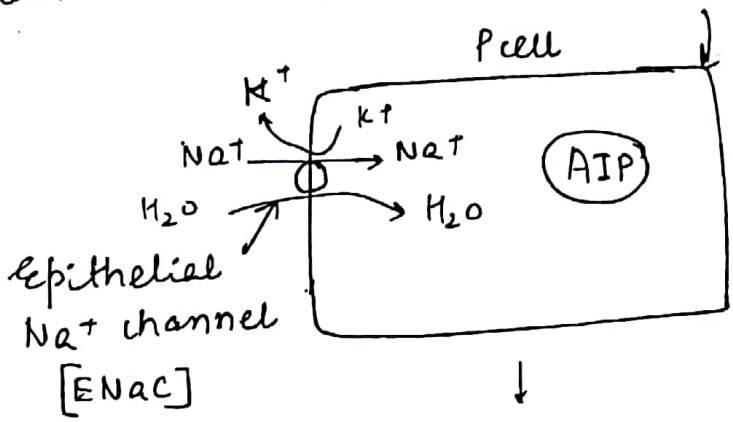
⊖ cortisol Synthesis

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

HYPER ALDOSTERONISM

2°

↓ volume → ↑ Renin → ↑ Aldosterone



AIP = aldosterone Induced Protein.

↓

↑ Na^+ → ↑ H_2O

↓

volume (N)

1° ← H.C.C. → Idiopathic cortical Hyperplasia (60%)

1) B/L

2) Adrenal Adenoma (40%)

↑

M/C/C – CONN SYNDROME

↑ Aldosterone

↓

(transient) ↑ Na^+

↓

↑ H_2O

↓

↑ volume (↓ Renin)

↓

↑ ANP

↳ NATRIURESIS → Polyuria

↓ K^+, alkalosis.

[No edema]

[ESCAPE PHENOMENA]

Cardiac Remodelling → Diastolic Dysfunction → Diastolic HTN

CLINICAL SUSPICION

Diastolic HTN

↓K⁺ — Alkalosis

↓

[SCREENING TEST]

ALDOSTERONE RENIN RATIO (ARR) >20

↓

[CONFIRMATORY TEST]

2 Litres of Normal Saline × 4 Hours

↓

↑Volume → ↓ Renin → ↓ Ald. ⇒ (N)

↓

NO Suppression of Aldosterone

or [SALINE INFUSION TEST]

↓

ETIOLOGY

↓

CT Abdomen

ADENOMA

↓

Age

<40 yrs → U/L ADRENELECTOMY

>40 yrs [Incidentilinoma] → Adrenal venous sampling

↓

ALDOSTERONE

HIGH → U/L ADRENELECTOMY

(N) = wait watch

↓

Medical Therapy

HYPERPLASIA.

Rx - Aldosterone (−)

↳ spironolactone

↳ eplerenone

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

D/D

1) Syndrome of apparent Mineralocorticoid excess [SAME]

Cortisol —(Deficiency of 11β OH dehydrogenase)→ Cortisone

↑ Na^+

↓ K^+, Alkalosis

R_x = STEROIDS → ↓ ACTH → ↓ cortisol

2) Glucocorticoid Remediable Aldosteronism [GRA]

Zona → glomerulosa → aldosterone

Zona → Fasciculata → cortisol (ACTH +, +)

Zona → Reticularis

R_x - STEROIDS → ↓ ACTH → ↓ Aldosterone

3) LIDDLES SYNDROME

↑ Functioning of ENaC → ↑ Na^+

↓ K^+, alkalosis

R_x - ENaC (−) → TRIAMTERENE

→ AMILORIDE

ADRENAL INSUFFICIENCY

ADDISION DISEASE

1° ADRENAL
- Autoimmune (MCC In world)
- TB (MCC In India)

2° PITUITARY
- Surgery
- Trauma
- Radiation
- Apoplexy

↓ CORTISOL
↓
DEFECIENCY

↓ G.C. ← Activity → M.C ↓

↓ G.C.
↓
↓ GLUCOSE
↓
↑ Protein Breakdown
↓
Lot. loss
↓
Thin
↓
ASTHENIA → Lethargy, Fatigue
M/C 1st Symptom

M.C ↓
↓
↓ Na+ ← Salt craving
↑ M/C Biochemical Ab (N)
↓
↓ ECF
↓
↓ BP
[↑ K+, alidosis]

↑ ACTH
Hyperpigmentation. (localised)
- Oral mucosa
- Conjunctiva
- Palmar crease
- Nipple, areola region
- moles, scars

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

ACTH administration

- (N) → CORTISOL ↑
- Addison's pt → CORTISOL (unchanged)

[ACTH STIMULATION TEST / COSYNTROPIN / SYNACTHEN TEST]

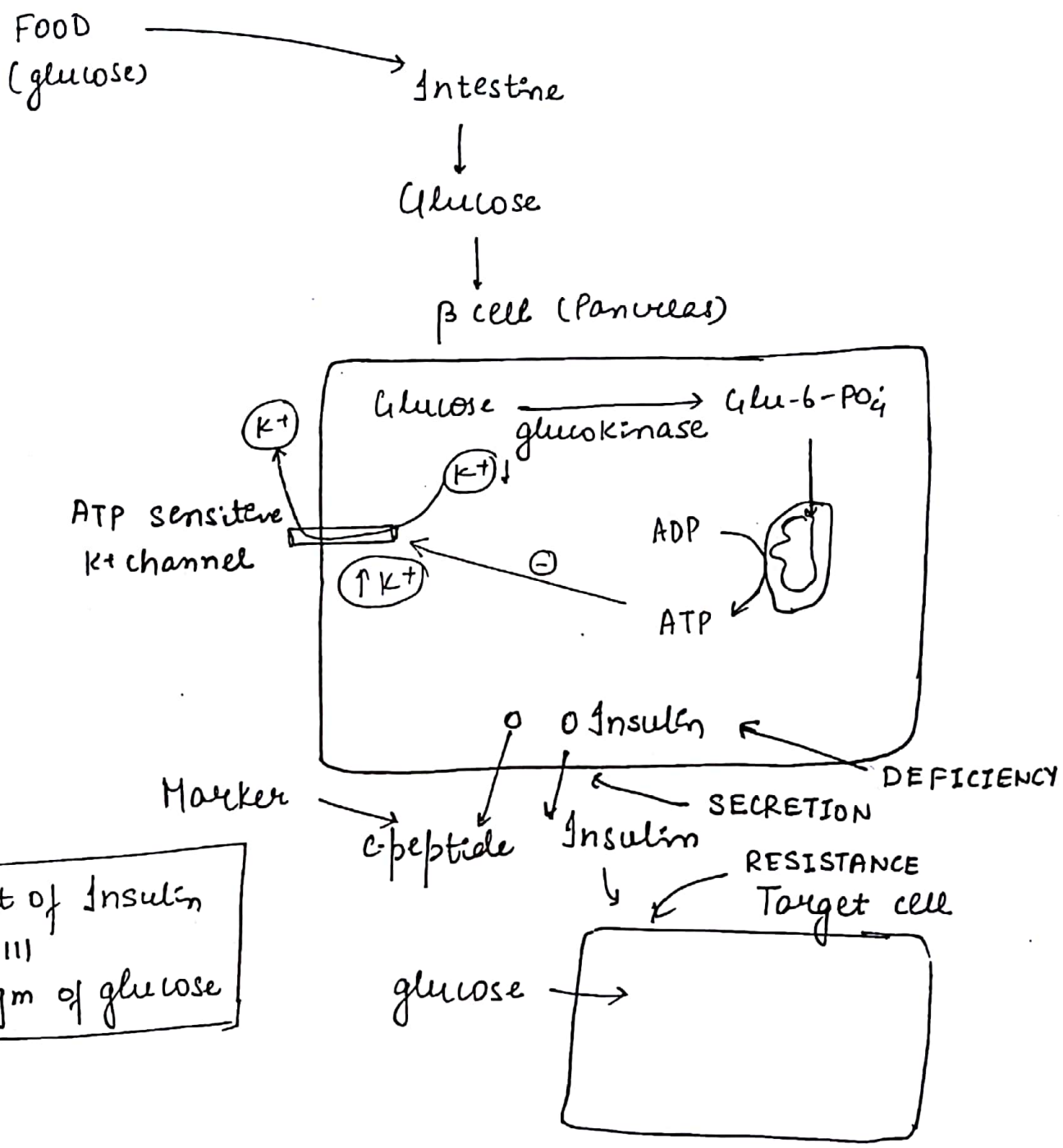
~~Dig~~ Diagnostic Test

℞ = STEROIDS

Hydrocortisone (DOC)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

DIABETES MELLITUS (DM)



1 unit of Insulin
≡
2.5gm of glucose

Deficiency = TYPE-I

Secretion
Resistance
} TYPE-II

Insulin t½ → 4

TYPE - I

- β cell Destruction (>90%)
- HLA Mediated

Aninsulinemia

Age of onset	<30yrs
Habitus	Thin
Family H/o	⊕
HTN	⊖
Dyslipidemia	⊖

DKA

TYPE - II

Secretory Defect

Insulin Resistance

Hyperinsulenemia

>30yrs

obese

⊕ ⊕ ⊕ ⊕

⊕

⊕ [↑ TG → ↓ HDL]

Hyperosmolar Non-Ketotic coma

20yrs ⟶ 25 yrs

RBS ↑↑↑

K.B. ⊕

Obese

Insulin (Type 1)

RBS - controlled.

Insulin ↓↓

(OHA)

(Type 2)

KETOSIS PRONE DIABETES (KPD)

30yrs ⟶ 35yrs

RBS ↑↑↑

Thin

K.B. ⊖

OHA (Type2)

RBS ↑↑↑

OHA ↑↑↑

Insulin (Type 1)

1.5 DM

LATENT AUTOIMMUNE DIABETES IN ADULTS (LADA)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

MATURITY ONSET DIABETES IN ADULTS (MODY)

Onset 5-15yrs of Age.
Thin
OHA Response
AD Inheritance
DKA ⊖
HTN ⊖

6 types of MODY
↓
TYPE 3 (MIC type)
↓
HNF -1 α Deficiency

TYPE-3 DIABETES / BRAIN DIABETES / ALZHEIMER

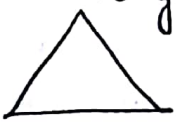
Insulin Resistance. , Deficiency
↓
PPt the Cond"

TYPE-4

Elderly >60yrs.
OHA response (minimum dose)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

DIAGNOSIS



± Polyphagia
± non-healing wound.
+ RBS ≥ 200 mg/dL

or.

Fasting 8hrs ← Fasting BS ≥ 126 mg/dL

or

Oral GTT
75gm glucose (oral)
↓
2hr BS ≥ 200 mg/dL.

or

HbA1c > 6.5%
[glucose + globin]

ACUTE COMPLICATION of DIABETES

DIABETIC KETOACIDOSIS

Type-1

(I) RBS = 250 - 600 mg/dL.

(II) Ketone Bodies → Blood → KETONEMIA (Reliable)
→ Urine → KETONURIA (Best Bedside)

(III) ↓ pH

C/F

1> nausea, vomiting (persistent)
K.B. (+) CTZ

2) Abdominal Pain ± Tenderness

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

3) ↑ HR

4) ↑ RR [KUSMALL BREATHING]

Metabolic acidosis ⟶ Resp. alkalosis

CO_2 → ↑ acidosis
↘ ↓ alkalosis

5) Fruity Odour → due to acetone

6) **Dehydration** (severe)
M/c C of mortality

Rx -

1) I.V. fluids (4-6 L)
↓
Most effective Rx.

0.9% NS ⟶ To prevent ↑ Na^+, ↑ Ca^{2+} ⟶ **0.45% NS**
4-6 hrs

To prevent hypoglycemia ↓
5% Dextrose
RBS < 200

× ~~RL~~ ×
×

2) Insulin
Regular → 10 units/ IV Bolus
↓
0.1 U/Kg/hr

3) KCl @ 20-40 mEq/hr.

4) $NaHCO_3$
pH < 7.

HYPEROSMOLAR NON-KETOTIC COMA

TYPE=2

RBS = 600 - 1000 mg/dL

↑ Sr. Osm.

KB ⊖

Altered sensorium

Rx =1) IV fluid (6-10L)

2) Insulin

CHRONIC COMPLICATION

DIABETIC NEUROPATHY

(A) POLYNEUROPATHY

Distal symmetry sensory (M/c type)

→ glove
→ Stocking
} (S) Loss

1st (S) lost Vibration [128 Hz Tuning Fork]

PARAESTHESIA → ANAESTHESIA

Rx

1) Improved Glycemic control

2) Pain ↓

AED = Prebagalin

TCA: Amitryptiline

(B) MONONEUROPATHY

M/c cranial N/V

III > VII

[Pupillary sparing]

Mononeuritis multiplex = Patchy involvement of

↳ M/C/C – metabolic = DM [(B) in India & world]

Infective = LEPROSY

Vasculitis = POLYARTERITIS NODOSA

(C) ~~AUTOIMM~~ AUTONOMIC NEUROPATHY

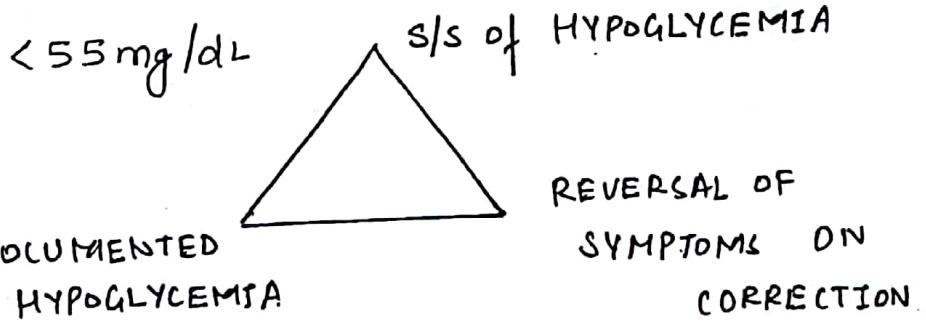
Hypoglycemic Unawareness

β⊖ avoided in diabetic pts.

Intensive control is avoided ⇒ ↑ Risk of hypoglycemia

HYPOGLYCEMIA

WHIPPLES TRIAD



1) ↓ Insulin
2) ↑ Glucagon
3) ↑ cortisol
   epinephrine
   GH

EXTENSIVE FASTING × 72 hours

↓

↓ GLUCOSE

↓

↑ INSULIN

HYPER-INSULINEMIA

↑ Insulin ↑ C-Peptide → ENDOGENEOUS

only ↑ Insulin → EXOGENEOUS

Insulinoma → Radiological

Insulin : glucose ≥ 0.3

Sulphonylurea Induced

↳ SU Levels

SOMOGYI EFFECT

(40) **3-5 A.M.** Hypoglycemia [↑ night Insulin]

counter regulatory hormones

(240) **8 AM** Hyperglycemia

Rx = Long Acting Insulin.

DAWN PHENOMENA

(240) 3-5AM Hyperglycemia
- Insulinopenia
- Insulin resistance

↓

(340) 8 AM Hyperglycemia

Rx = ↑ night Insulin + Insulin sensitiser

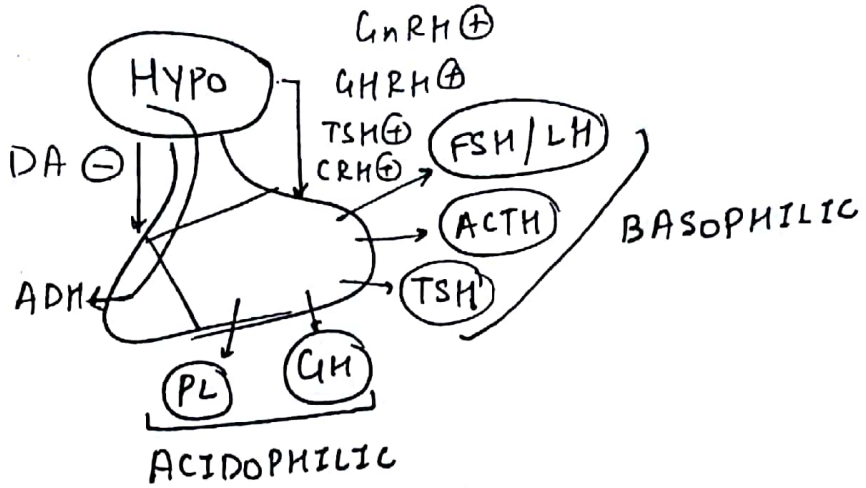
Rx of TYPE-2

FBS

126-200
Diet
Exercise

>300
Insulin

200-300
Obese metformin.
Non-obese - Sulfonylurea
[GLICAZIDE]
↓
10-14 Days
GLIPTIN



STALK LESIONS

↑ Prolactin

Hypothyroidism (central)

↓ glucose

↓ BP

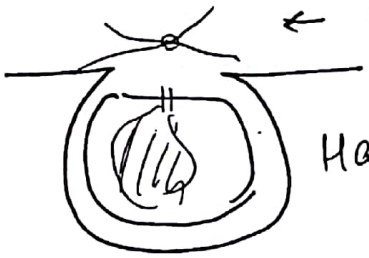
Central DI

PITUITARY APOPLEXY

↳ SHEEHAN SYNDROME

↑ Incidence = Sickle cell Disease
DM
HTN
] Predisposing Factors

← ↓ vision → progressive
Decompression.



Haemorrhagic necrosis

GH → LH → TSH → ACTH

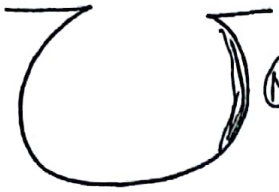
↓

↓ cortisol → ↓ BP

⇓

STEROIDS

↓ after few months



Ⓝ functioning Pituitary

EMPTY SELLA SYNDROME (Incidental finding)

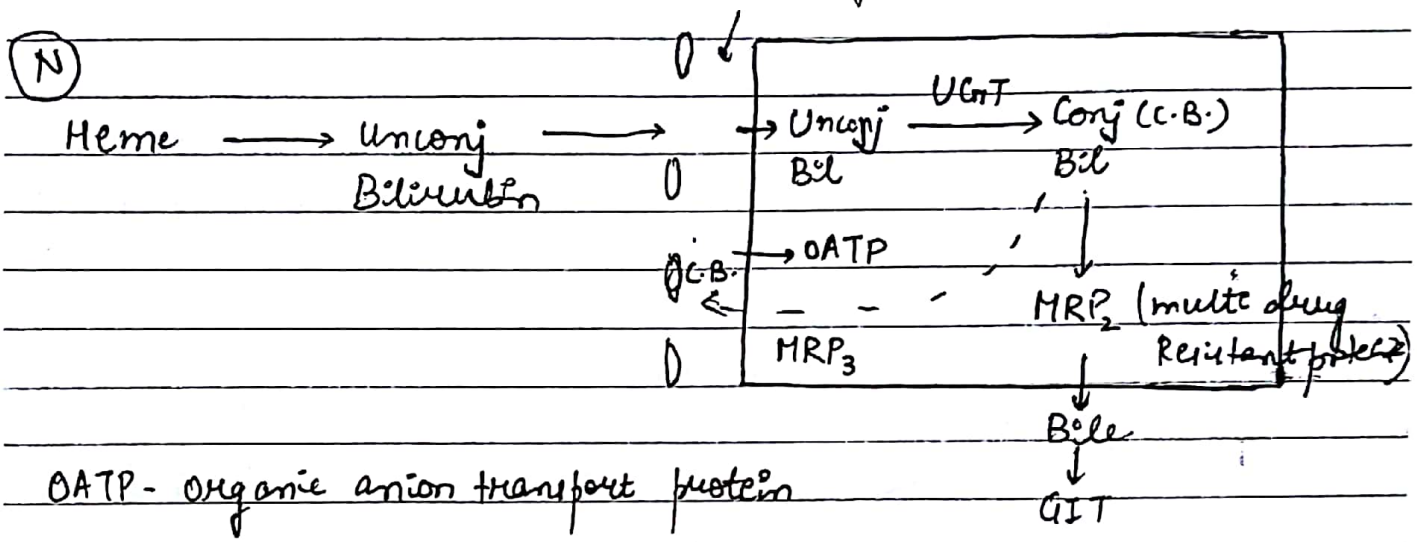
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

MEDICINE (GIT)

Liver	Intestine
* Disorder of Bilirubin met	* Malabsorption syndrome
* Acute Viral Hepatitis	* Diarrhoea
* Chr. hep / cirrhosis	* GI infec"
* Comp" of Liver failure	* IBD
	* IBS

BILIRUBIN METABOLISM



OATP - Organic anion transport protein

DISORDERS OF BILIRUBIN METABOLISM

I ↑ Unconjugated Bilirubin

1> Increased synthesis -

a) Hemolytic anaemia → ↑ premature destruction of RBC in periphery

b) Ineffective erythropoiesis → ↑ premature destruction of RBC in Bone marrow

Cause

- Thalassemia
- Megaloblastic anaemia
- Severe Fe def.
- Pb poisoning

c) Large haematoma

d) Lobar pneumonia (↑ RBC destruction in d exudate)

II 2) ↓ Uptake :-

Cong	Acquired
Gilbert Syndrome-	Drugs- Rifampicin Probenecide (prophylaxis for gout) Ribavirin (for Hep C virus)

3) ↓ UGT :- (UDP Glucuronyl Transferase)

* Cong. causes-

	Crigler Najjar I	CN II	Gilbert Syndrome
UGT activity	0%	10%	33%
Mode of inheritance	AR	AR	Both (AR>AD)
S. Bil (Total)	>20	6-20	<4
Kernicterus	(+)	Rare	(−)
Mortality	Before 1 year @ about t/t-	Adulthood	Not ↑.

Imp

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

	CN I	CN II	Gilbert Syndrome
Inv.	N	N	Lipofuscin pigment = Brown colour
Liver B_x			
R_x	Liver Transplant	Enzyme inducer Phenobarbital ↓ 25% ↓ in S. Bil. ⇓ If no response then go for Liver Transplant	No T/t Needed

*Acquired causes :-

1) Drugs – Gentamicin
Chloramphenicol
Pregnandione

2) Breast Milk Jaundice (Self-Limiting)
:
FA ⊖ → UGT of neonate →
No need to stop feeding

3) Lucey Driscoll Syndrome :- (Self Limiting)
Maternal serum Ab ⊖ UGT of neonate

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(II) ↑ Conjugated Bilirubin (Isolated).

Liver enzyme (N)

	Dubin Johnson Syndrome	Rotor Syndrome
Mech	⊖ Mutation of MRP_2.	⊖ Mutation of OATP
Mode of inheritance	AR	AR.
S. Bil.	< 4	< 4
Kernicterus	⊖	⊖
Mortality	not ↑	not ↑
Inv		
Liver Bx	Black Pigmentation. (Epinephrine metabolite (N) excreted by MRP_2)	Normal.
BSP clearance test (Bromsulphlein)		

I.V. BSP → Liver → MRP_2 (X) → CIT

IVBSP → Liver → MRP_2 → SOU

(N) BSP clearance ≤ 90 min

∵ MRP_2 absent, hence no clearance of BSP_2

Delayed clearance of BSP.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Rx not Req — Not Req.

Q. ℰ feature will suggest cause of ↑ of unconjugated Bil except :-

a) GB pigmented stones (H. anaemia) True
b) P/s → spherocytes (H. anaemia) True
c) ~~of~~ Acute hep C viral infection Enzyme ↑ + conj bil ↑↑
d) H/o gout . True (Probenecid)

ACUTE VIRAL HEPATITIS

caused by hep A to E

	Hep A	Hep E
① Mode of Transmission	— H/c Feco-oral	H/c Feco-oral → sewer line
② Transmission to close contact	— common	Rare ↓ community spread. ↓ 'New epidemic in community'
③ Rare	• Blood Transfusion Viremia during late incubation period • Sexual	Vertical
④ Not a mode of transmission	Vertical	BT Sexual

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

	Hep A	Hep E
C/F	M/C cause of Ac. Viral Hep. in children. [M/C of Viral Hep - B]	M/C of Ac Viral Hep in adults. M/C of Ac. Viral Hep. in. ♀ [M/C of Viral Hep in ♀ = B]
	Relapsing Hepatitis 2 clinical episodes by same virus in ac. phase (<6mnth)	Cholestatic hepatitis. swollen hepatocytes cause obstruction to intrahep. Bile flow. [ALP also T].
Inv		
Serology	IgM Anti HAV = Acute Hep. A infn	IgM Anti HEV = Acute Hep E infn
	IgG Anti HAV - Pt is immune	IgG Anti-HEV - Pt is immune
	↓ Possibilities.	
	• Post vaccination ✓	±
	• Remote recovered past infn ✓	✓
	• Chronic infection. ✗ (virus ⊕ >6mnth)	✗
Complications.	1) Fulminant hepatitis - 0.1% (encephalopathy < 2wks of Jaundice)	♂ // non ♀ → 1-2% ♀ → 10-20%

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

2) Chronic Hep (viral ↑ +ve for >6mnth + Liver damge ⊕)	0%	0%
3) Carrier (virus + >6mnth Liver damge ⊖)	0%	0%

LMP Topic

Hep B

1. Mode of Transmission
   - ① M/c - vertical
     - Mother HbeAg ⊕ → Risk - 90%
     - Anti Hbe Ab → Risk - 10%
   - ② Percutaneous
     - Needle → 6-30% risk; viability of virus 7 days
     - BT → 1 in 2 lacs of BU transfused
   - M/c BT related virus = (B)

Hep C

① M/c - Percutaneous
- Needle → 1.8-6% risk; viable < 4 days.
- BT → 1 in 18 lacs of Blood units transfused.

MOT	HIV	RISK.
Needle	IV drug	0.6%
	accidental	0.3%
BT		1 in 22 lacs

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

	MOT	HBV
(Some donors have low level HBsAg & it NOT detected by routine lab method).		Vertical - 5% risk
③ Sexual variable		Sexual 5% risk
Rare. MOT		
secreted into saliva = yes		yes.
Human Bite	yes	yes.
Not MOT		
• Virus secreted into stool	yes.	yes.
• Feco-oral transmission (destroyed in stomach)	No	No.
• Breast milk secreted	yes	yes
• " " transmission	No	No

• ~~Secreted~~ :

Q. All are transmitted by blood except

a) Hep A	a) Hep A	a) Hep A
b) B	b) B	b) B
c) C	c) C	c) C
d) E	d) HIV	d) G

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Q. All cause AVH, transmitted by blood except
a) Hep A
b) B
c) C
d) G. → never cause AVH.

Q. M/c mode of transmission of hep B
1) Vertical vs ~~Horizontal~~
2) ~~Vertical~~ vs Percutaneous vs Sexual vs Human Bite

Q. Hep B not transmitted by
a) Saliva
b) Semen
~~c)~~ Feco-oral
d) Breast feeding.

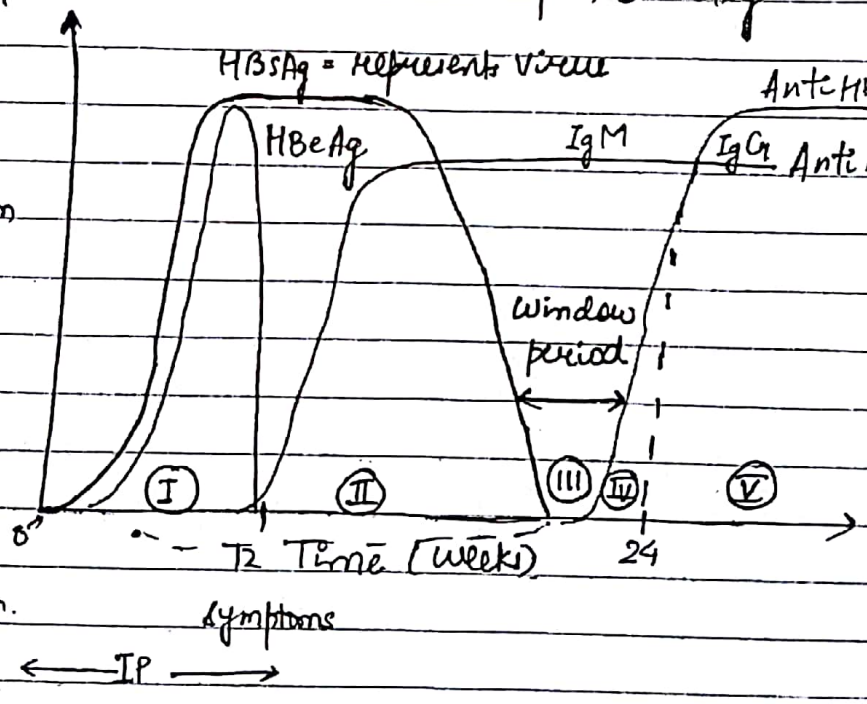
C/F	Hep B	Hep C
	Mcc of viral cause of HCC	Mcc viral cause of cirrhosis
	↓	
	express HBxAg	[Mcc of cirrhosis = Alcohol]
	⊖ p53 ⊕ Viral Replication	
	Mcc viral cause of chr. Hep (Prevalence wise)	Mcc AVH leading to chr. Hep. or Max. Risk of chronicity
	Mcc of Carrier	

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Serum sickness like illness ↓ HBsAg + Ab Joint pain + rashes In children = LN + Hepatosplenomegaly + Rash Gianotti Crosti Syndrome	Insulin Resistance by ⊖ insulin action ↑ Risk of T_2DM

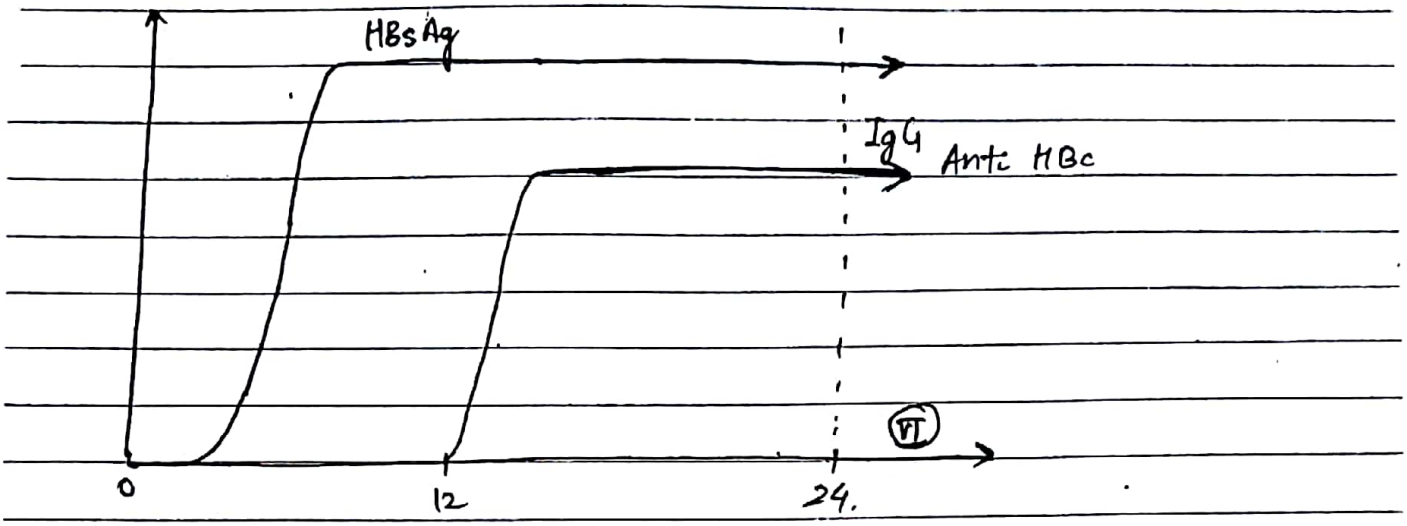
* Serology of Hep B Infec^n

1) If Hep B limited to Acute phase only



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

2) If hep B converted to chronic infection



Phase	Marker
① I.P.	HBsAg, HBeAg. ↑ Earliest marker of HBsAg.
② Acute (symp) Hep B infection	HBsAg, IgM Ante HBc ↑ Most reliable marker of Ac Hep B infection.
③ Window period	IgM Anti HBc
④ Recovery period of Ac. Hep B	IgM Ant HBc, Ante HBs
⑤ Remote past infection	IgG, Ante HBc, Ante HBs ± (disappear after yrs)
⑥ Chronic infection	HBs Ag + IgG Ante HBc

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Chr. Hep B

- Carrier
  - Bx
  - Liver Damage (−)
- Chr. Hepatitis
  - Liver Damage (+)
- Cirrhosis
  - Fibrosis + Nodules

HAI (Histological Activity Index) ≤ 3

- ≤ 3
  - Active
    - Replication (+)
    - DNA copies.
      - ≥ 1000 /mL
- > 3
  - Inactive.
    - (−)
    - < 1000/mL

Replication markers :-

1) Quantitative marker → DNA copies ← Most reliable replication marker

2) Qualitative marker → HBe Ag.

↓

exception Pre core Mutants of hep B virus

↓

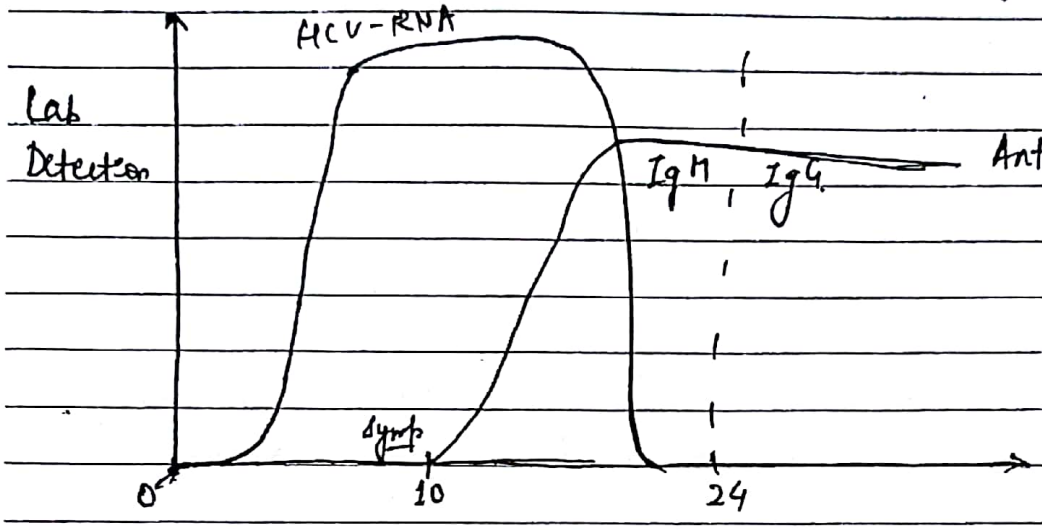
unable to make HBeAg but replication (+)

	DNA	HBeAg	Δ
①	(+)	(+)	Replicative phase of hep B virus
②	(+)	(−)	Pre-core mutants of hep B
③	(−)	(−)	Non-replicative phase

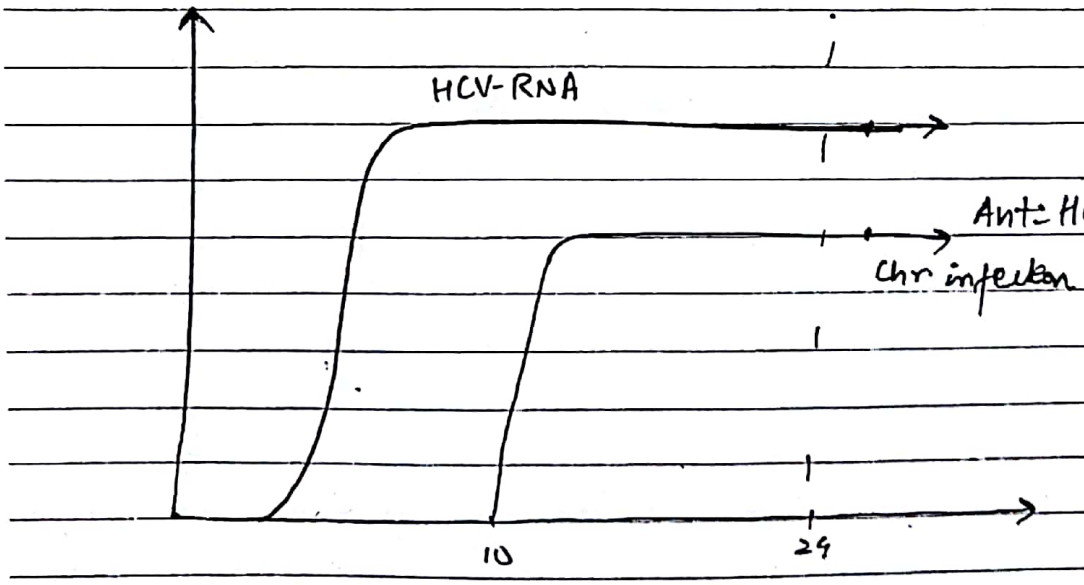
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Serology of Hep C Infection :-

1) If Hep C limited to Acute phase only



2) If Hep C converted into Chronic Infection



Complications	Hep B	Hep C
① Fulminant Hepatitis	0.1 - 1%	0.1%
② Chr. Hep	1 - 10%	85%
③ Carrier State	0.1 - 30% Mean - 15%	1.5 - 3.2% Mean - 2.5%

Hep D

Mode of transmission - ① Percutaneous (Non-endemic Indi zones)
② Close contact (endemic zones)

C/F -

① M/c AVH leading to Fulminant Hepatitis = D or max risk

② Always associated w Hep B

Serology -

? co-infection. = Acute hep D + Acute hep B
↓ IgM Anti HDV
↓ IgM Anti HBc

2) Superinfection. Acute hep D + Chronic hep B
↓ IgM Anti HDV
↳ IgG Anti HBc

% Comp^{n}

① Fulminat Hep. 5% in Co-infection.
20% in Superinfection

② Chr. Hep } → depend on Hep B.
③ Carrier }

T/t

① AVH

i) Supportive care (mostly self limiting)

↓

I.V. fluid of choice = Dextrose as hypoglycemia risk

Min. Dextrose Req. = 150 g/day.

If 5% Dx = 3000 mL/d
(5g/100ml)

If 10% Dx = 1.5L/day → Fluid of choice

If 25% Dx = 600 ml/day. ⇒ may cause thrombophlebitis.
↳ not used for maintainance
reserved for emergency

ii) 2) Antiviral.

for Acute Hep C

↓

Interferon α. 12-24 wks

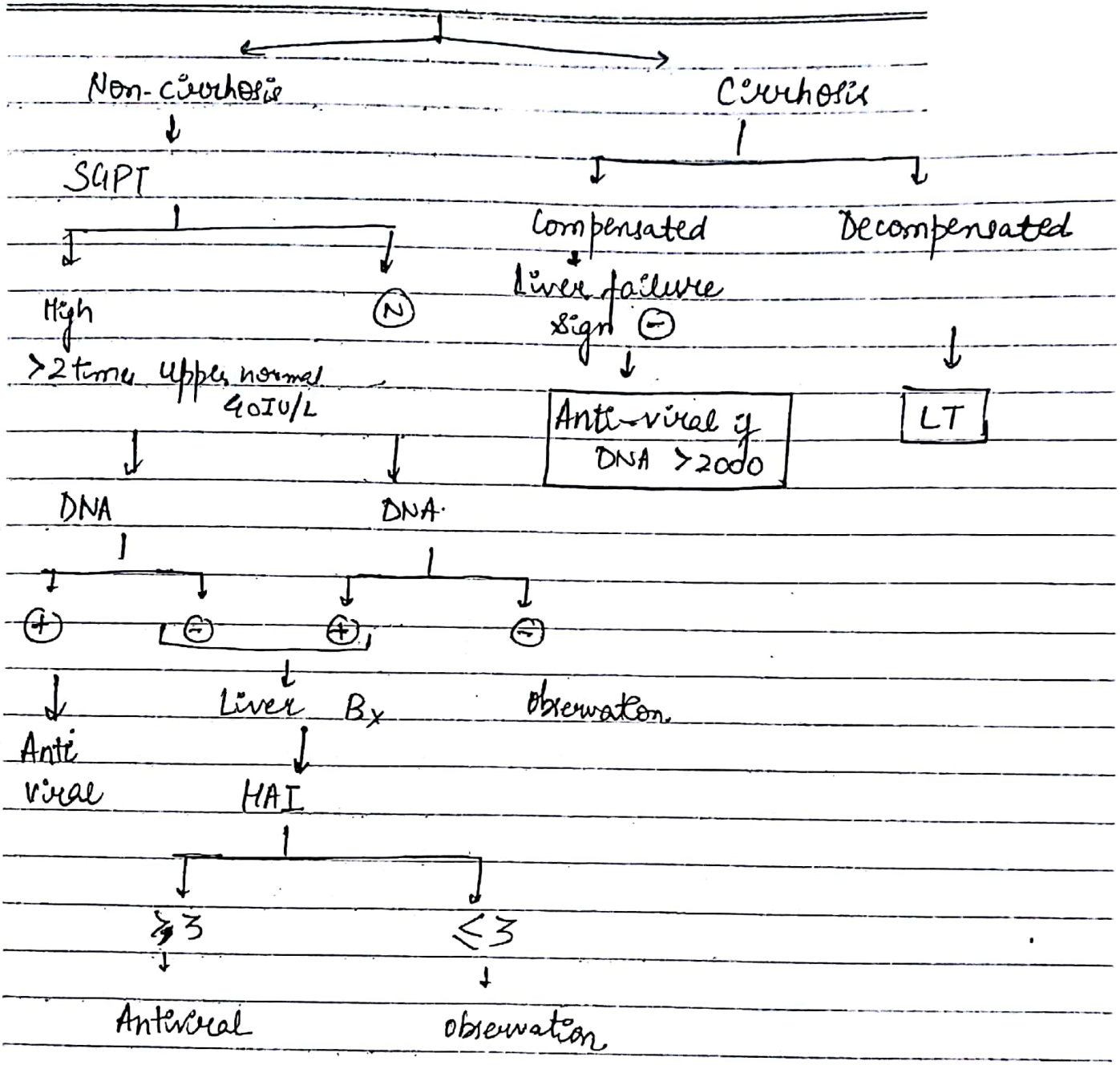
LMP Topic

II Chronic Viral Hepatitis

Approach to Chr. Hep B infection

↓

http://mbbshelp.com WhatsApp: +1 (402) 235-1397



DNA is ⊕ for Anti-viral if ≥20,000 IU/mL. in HBe Ag ⊕

if ≥ 2000 IU/mL in HBeAg ⊖
(Pre-core mutants).

Anti-viral for Hep B

① Initiate ± Monotherapy from 1st Line agents

1) Interferon α -
- oldest
- Less effective in Cirrhosis

2) Entecavir -
- Most potent
- ↓ effectiveness in lamivudine resistant cases

3) Tenofovir → DOC.
- Safest + effective even in Lamivudine (R) cases
- Duration ≥ 1yr

(II) Chr. Hep. C Infection

Non-Cirrhosis
↓
Start Anti-viral if
1) HCV-RNA detetable
2) Bx - mod-sev hepatitis [HAI > 3]

Cirrhosis (Fibroscan)
- Compensated → Anti-viral
- De-compensated → LT

Antiviral for Hep C

Initiate ± Dual therapy (oral combination therapy)

INFα → outdated. nowadays

http://mbbshelp.com WhatsApp: +1 (402) 235-1807

Sofosbuvir + Velpatasvir → effective in all 6 genotypes.

>

Sofosbuvir + Daclatasvir

Duration – 12 wks. for all genotypes.

FATTY LIVER

Alcoholic Liver Disease

Patho

Dose → 40-80 g/d = fatty Liver

80–160 g/d = cirrhosis

↳ Duration 10-20 yrs

♀ → Dose is half.

Stages — **Mech**

① Fatty Liver ← Ethanol ⊖ → N FA metabolism ↳ ↑ free FA → TG → TG deposit

② Hepatitis ← TNFα

F.L + Enzymes ↑

Non-Alcoholic Liver Disease

Dose of alcohol → 0-20 g/d.

cause – Insulin Resistance

Stages — **Mech.**

① Fatty Liver ← TG deposit ← ↑ TG.

Insulin Resistance → Lipolysis → ↑ free FA → ↑ TG.

② Hepatitis ← oxidative injury

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

③ Cirrhosis ← Stellate cell → ③ Cirrhosis

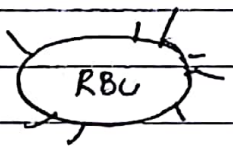
↑

Chr. Hepatitis

C/F

1) Peripheral Neuropathy
- direct alcohol effect
- Pure sensory Pyridoxine def. induced by alcohol.

2. Zieve's Syndrome.
Deep Jaundice due to additional effect of haemolysis induced by alcohol



= irregular Acanthocytes

1) Causes of Insulin Resistance
① M/c obesity
② Type 2 DM
③ Steroid (⊖ insulin action)
④ Hep C

Q. C/F suggest alcohol as a cause of cirrhosis
- ⓐ Spider angioma } due ↑ Estrogen → ↓ Catabolism in Liver
- ⓑ Gynaecomastia }
- ~~ⓒ~~ Loss of deep tendon reflex
- ⓓ ascites.

Ix

① SGOT / SGPT > 2 Highly specific for ALD
(SGPT synthesis need pyridoxine)

① SGOT / SGPT ≤ 1.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

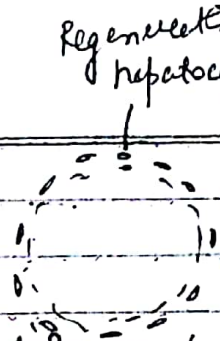
② γGT - ↑ ← (ER) Site = Bile duct + ER Fat Squeeze ER to release γGT.	③ γGT - ↑
③ Peripheral Neutrophilia (+) TNFα recruits if neutrophil > 5500/mm³ = Poor Prognosis	(-)
Rx.	
① Fatty Liver. = Reversible after cessation	FL = Reversible ∵ Rx of underlying cause → obesity
② Hepatitis Doc - Steroid ↓ act on TNFα. Indication if MADDREY's alcoholic discriminant func^n. > 32 = 4.6 x [PT of pt. - PT of control (12sec)] + S. Bil	Vit E. ↓ act as ante-oxidant
③ Cirrhosis Best Rx → Liver Transplant Recurrence of 1° disease after LT = Nil if underlying cause Remain treated	Cirrhosis Liver Transplant

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

AUTOIMMUNE

Autoimmune Hepatitis	1° Biliary Cirrhosis
Patho	
Direct Ab damage to the hepatocytes. (Type II HS)	Autoimmune fibrosis of intrahepatic Bile duct → Bile accumulation → Damage hepatocytes
C/F ♀	♀
Age 20-40 yrs	40-60 yrs
Recurrent (Recur over years)	Pruritus Xanthelesma (cholesterol deposit in the eyelids)
Inv Ab depends on type of AIH	MC/Most sensitive/Most specific Ab → Anti mitochondrial Ab
I - M/c → ANA Most sensitive Ab → Smooth ms cell P-ANCA	
II → Anti LKM I (Liver kidney microsome) ↓ (also +ve in Hep C infection)	
III - Least common, most severe Ab → Liver soluble antigen Most specific	

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Bx  'Rosette pattern'	Non-suppurative inflammation of intrahepatic Bile ducts
Rx ① Hepatitis = Steroids (DOC) ② Cirrhosis Decompensated → LT Recurrent after LT → (common upto 50%)	① Compensated cirrhosis Ursodeoxycholic Acid (UDCA) (solubilise bile to non toxic) ② Decompensated cirrhosis LT. Recurrence after LT → rare

LHR Topic

GENETIC

	WILSON'S DISEASE	HAEMOCHROMATOSIS
Patho	AR mut^{n} of ATP7B ↓ ↓ Cu excretory protein in Liver ↓ Cu overload in the body	AR muta^{n} of HFE ↓ ↕ Hepcidin [Ⓚ ↓ Fe absorp^{n}]. ↑ Fe absorption Fe overload
4F	Liver Most c or earliest organ age < 20yr	Liver >40yr
Chr. Hepatitis	+	+

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Cirrhosis. Macronodular	Mixed or Micronodular
HCC +	++ (M/C cause of death even in t/td. pt.)
2nd organ affected — CNS → Basal Ganglia	CNS → Hypothalamic pituitary axis
M/C CNS manifestation — Tremor	Hypogonadism
Frontal lobe → neuropsychiatric abnormalities.	
Cr. N/v → XII (M/C Cr. N/v affected) (Dysarthria)	
Autoimmune dysfunction. → Postural Hypotension.	
Not affected → 1. Sensory system 2. Motor power. (Pyramidal pathway)	
3rd Colour Change Eyes	Skin.
↓ daytime vision = sunflower cataract	due to Fe + melanin deposits ↓ Bronze Pigmentation.
Kayser-Fleischer Ring (Vision (N)) — Peripheral	

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

④ Functional Effect

Kidney

↓

Proximal Tubular Dysfunc^{n}

↙ ↘

RTA - 2 | Fanconi Syndrome

Pancreas

↓

β cells affected

↓

Bronze DM

↓

* Reversible after tt of haemochromatosis unlike other

⑤ Structural Damage

RBC Membrane

↓

Haemolytic Anaemia

Joints (2 & 3rd MCP jt)

↓

Fe in joints ⊖ Pyrophatase

↓

Ca Pyrophosphate ↑

↓

Pseudogout

⑥ ×

CVS - Fe infilterate inside myocyte

↙ ↘

Myocyte Contraction ↓ | Myocyte relaxation ↓

↓ | ↓

DCMP > RCMP

M/c cause of death ⇒ CVS in untreated pt.

Inv

Ⓝ Free Cu + Apoceruloplasmin

↓

Ceruloplasmin (Bound Cu)

Ab (N) ↓ binding of free Cu ē apoceruloplasmin

1. S. Free Cu → ↑
2. S. ceruloplasmin → ↓
3. S. Total Cu = ↓ (mainly in bound form)
4. Urinary free Cu level → ↑
5. Bx - Liver Cu > 200 µg/g dry liver wt

Rx

Hepatic → Zn (DOC) [50mg tds]
↓
⊖ Cu absorption

2> Cirrhosis -

According to NAZER SCORE

- SGOT
- S. Bil
- PT.

<7 | 7-9 | >9

Zinc + Trientine

LT pt. will be lifelong Zn therapy

Recurrence after LT → NIL

1. S. Fe ⇒ ↑
2. % Transferrin saturation → ↑
3. S. Ferritin ↑
4. TIBC ↓
5. New UIBC ↓↓ = TIBC - S. Fe ↓ ↑ (unsaturated)
↑ Most sensitive Inv

6. Bx → ↑ Fe.
Prussian Blue Stain

Hepatitis →
Rx OC → Phlebotomy

- 1mL Blood will remove → 0.5mg Fe
- Single phlebotomy → 500mL Blood. (250mg Fe removed)
- Fe overload. >/20g
↓
So phlebotomy Req.

Cirrhosis → Liver Transplant

Recurrence after LT → rare <10%

Q. ⊆ causes ↑ Cu in Liver ∴ KF ring -
a) autoimmune cholangitis
b) 1° Biliary cirrhosis
c) 1° sclerosing cholangitis
d) All
} Ch4. Cholestasis condition

Q. After Phlebotomy manipulation of haemochromatosis ?

Reversible
- Hepatomegaly
- Skin pigmentation
- Diabetes
- CHF

Irreversible
- Cirrhosis
- Arthritis
- Hypogonadism

Q. HFE mutation ↑ risk of ⊆ cancer = Breast
Colon cancer

COMPLICATIONS OF LIVER FAILURE

1> HEPATIC ENCEPHALOPATHY

Mech - ↓ Urea cycle
↓
↑ NH_3 .
↓
Astrocyte Damage

C/F - West HAVEN's Grading

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Restless I Earliest symptom = altered sleep cycle
" sign = altered handwriting (constructional apraxia)

Drowsiness II

↓

Trail making test
join to (1) to (25) numbered circle

Stuporous III

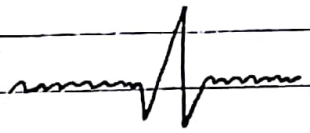
(N) time 15-30s.

Coma IV

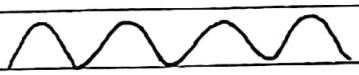
Deep coma V

Inv

EEG → (1) most characteristic Triphasic large amplitude wave (Grade II IV)



(2) S Wave - Grade V (1-4 Hz)



Rx

1> Rx [Ppt. cause] Mech. Rx

(1) GI infection ↑ bacterial proliferation Ab of choice Rifaximin. (550 mg BD)

(2) Upper GI Bleed (ruptured oesophageal varices) Blood protein ↓ reach gut bacteria i.e. ↑ NH_3 If Vital Hobbe → Ryle's tube aspiration.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Rx OC → Endoscopic Band Ligation of Varices
DOC → Octreotide
2° prophylaxis - β blocker (never in acute bleed)

③ S. K^+ ↓ — ↓ Peristalsis → ↑ Bacterial Proliferation — I.V. KCl infusion 10-20 mmol/hour.

④ Metabolic alkalosis ↑ vomiting (HCl loss) — $NH_3 + H^+ \rightleftharpoons NH_4^+$ (toxic) (Non-toxic)
if pH ↓ → eq. shifts to ®
if pH ↑ → eq. shifts to ⓛ
— Rx underlying cause

⑤ Constipation — Bacterial proliferation ↑ — Laxative of choice : Lactulose → cause acidic pH. → Target 2-3 stools/day otherwise may cause diarrhea

⑥ Hypovolemia — ↑ Renin → ↑ aldosterone → ⇓ S. K^+ ↓ & Met. alkalosis — CI → RL → Lactate → ↓ Liver → HCO_3^- → Met. alkalosis → So, IV. fluid → NS

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

② ASCITES

*Mech. ↑ Sinusoidal pressure (compression by nodules)
+
Na & H_2O retention ← Aldosterone ↑

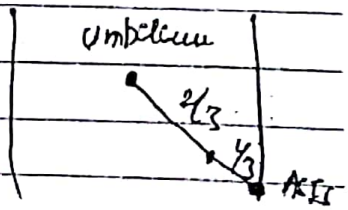
↑ NO synthase (N degraded in Liver)
↓
↑ NO
↓ Systemic vasodilatation (Blood pooling in systemic circulation) → Renal perfusion ↓ → Renin ↑
↓ Pulmonary vasodilatation
↓
Hepato-Pulmonary Syndrome

Hepato-Renal Syndrome

*C/F

Sign	Min fluid needed
Min PUDDLE	← 120mL
Shifting dullness	← 500mL
Fluid Thrill	← 1500mL

*Inv Ascitic fluid
- Preferred site → (L) lower quadrant
- Needle Size = Diagnostic 20-22G
  Therapeutic 15G

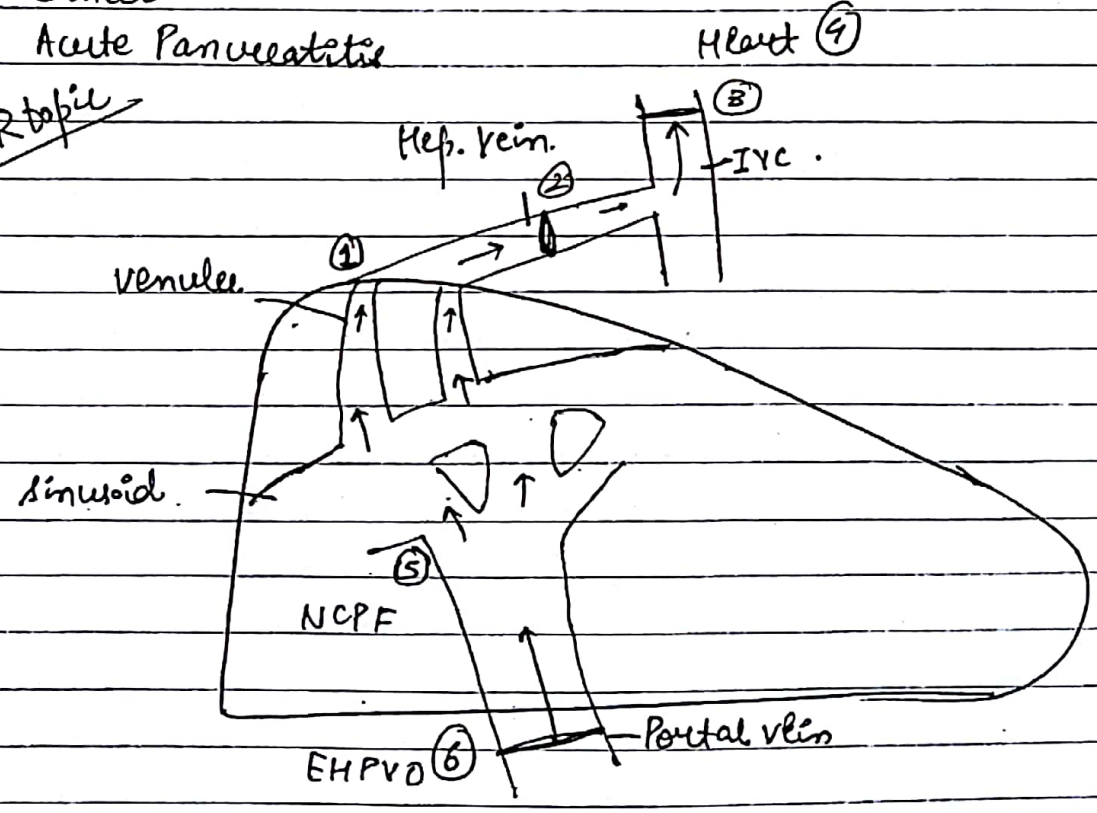


http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Step ① S. albumin - Ascitic Albumin (SAAG)

< 1.1	> 1.1
(N Sinusoidal pressure)	↑ Sinusoidal pressure
1) ↓↓ S. albumin ↓ eg. Nephrotic Syndrome	1) ↓↓ Ascite albumin ↓ • ↑ Sinusoidal pressure. • Sinusoidal wall is impermeable to albumin leak.
2) ↓↓. Ascite albumin ↑ due to ↑ Peritoneal vessel permeability eg. TB peritonei Cancer Acute Pancreatitis	

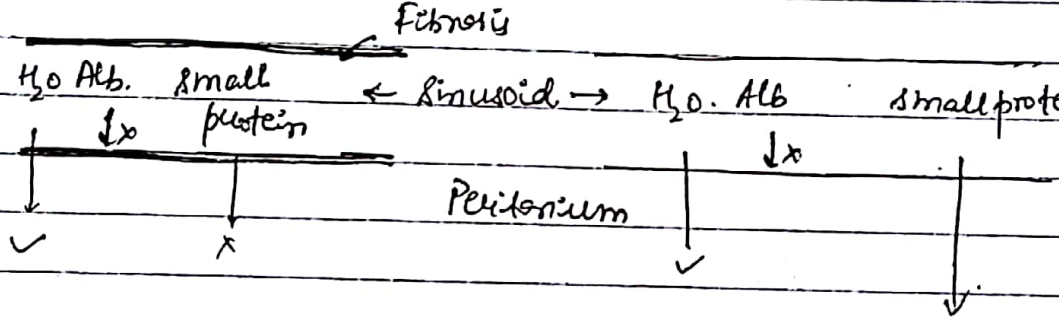
LHR topic



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Step 2 - Ascitic Total Protein ← if SAAG > 1.1.

- Cirrhosis < 2.5
- Non-cirrhotic (Post-sinusoidal obstruction) > 2.5
  1. Veno-occlusive Disease
  2. Budd-Chiary
  3. IVC obstruction
  4. CHF / Constrictive Pericarditis



Rx	Grade	Defn	Rx
	I = Mild Ascites	No clinical signs	salt restriction
	II = Moderate "	Clinical signs +ve Respiratory distress -	Add Diuretics Spironolactone (max - 400mg/day) Furosemide (max - 160 mg/d)
	III. Severe	Resp. Distress +	Large vol. paracentesis (5-6L removed) + I.V. albumin (to retain I.V. fluid)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

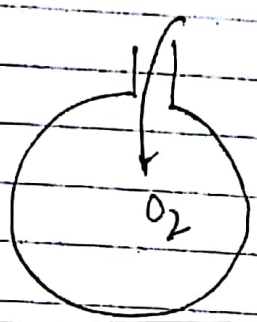
IV Refractory Ascites	No response >7 days of Max dose of Both diuretics	Same as Grade III

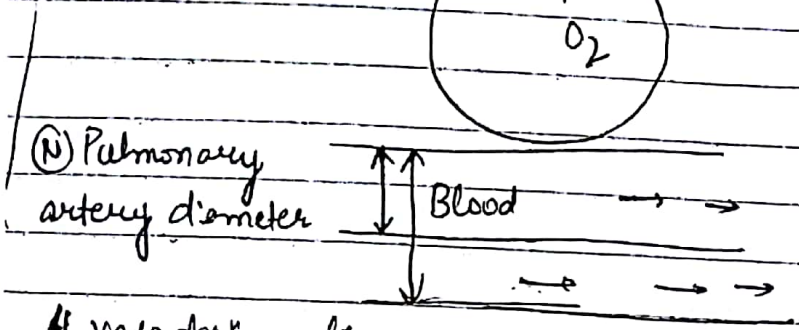
⑤ Non-Cirrhotic Portal Fibrosis	⑥ Extra-hepatic Porta vein Occlusion
Age >20 yr	<20 yr.
c/f upper GI bleed +	+
↑	
Portal HTN +	+
↓	
Spleen +	+
>7 cm below Costal margin	<7 cm below costal margin
Jaundice ⊖	⊖
Encephalopathy ⊖	⊖
Ascites ⊖	
Rx - Endoscopic Band ligation +	+

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

3. HEPATO - PULMONARY SYNDROME.

Mech. Pulmonary vasodilatation





↑ vasodil" occurs = diam increase

mixing ē deoxygenated blood on (L) side

R to L shunt

C/F

Platypnoea - dyspnea ↑ on standing [diaphragm moves down ↓ shunt open ↓ hypoxia ↑]

Inv

① ↓ in O_2 saturation by 3% on standing from supine
Orthodeoxia

Rx → 1) Sclerosis of dilated vessel

2) Rx Oc = Liver Transplant

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

INTESTINAL

MALABSORTION DISEASES

due to SI disease

Proximal	Distal
↑	↑
Fe, FA, Ca, Mg	Bile, Vit B_{12}
Fat, CHo, Protein ++	+

Tests for malabsorption

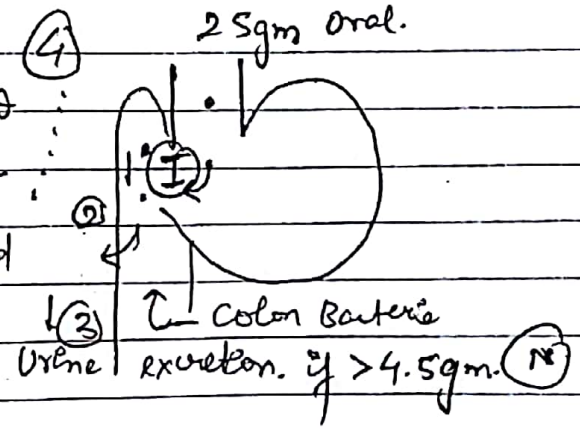
I) For Fat :-

① Gold Std → 72 hour Stool fat estimation.
if fat excretion >6% ⇒ Steatorrhoea
↑
M/C abnormality seen in any malabsorption syndrome

② Spot Ix → Sudan III stain.
+ve if stool fat > 10%

II) For Carbohydrate :-

① Most specific Ix → D xylose Test



Causes of <4.5gm excretion
1) Pyloric stenosis
2) Proximal SI disease
Eg. Celiac sprue
3) Bacterial overgrowth Syndrome
4) 3rd space Coll → Ascites
Pleural Effusion

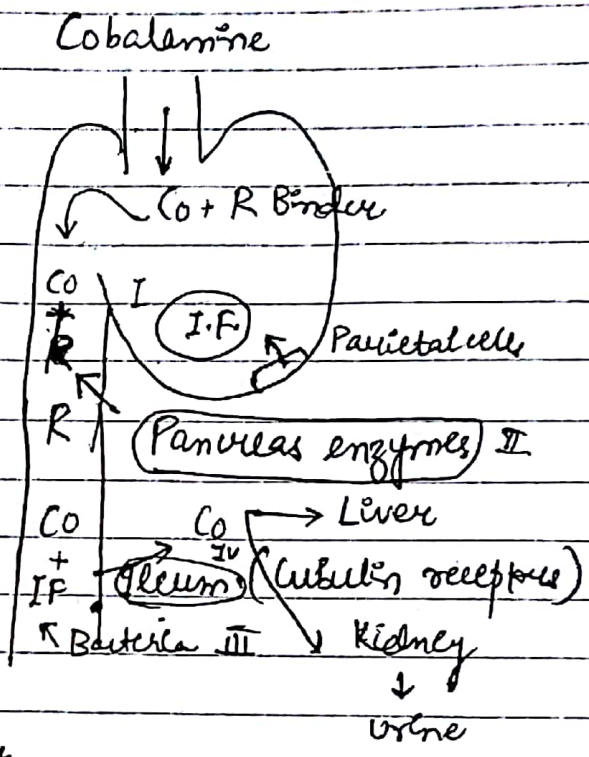
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

⑤ Renal failure

(III) Vit B_{12} malabsorpⁿ:

SCHILLING's TEST

① Oral radiolabelled cobalamine
+
I.M. vit B_{12} (1mg)
to fill Liver
↓
24 hour Urine collection.
↓
↓ <10% → malabsorpⁿ
↓ >10% of excretion → (N) test



If excretion <10% AND becomes >10% after adding.

1) I.F. → Pernicious Anaemia

2) Pancreatic enzyme → Chr. Pancreatitis

3) Ab x 5 days → Bacterial overgrowth syndrome
↓
if remains <10% → Ileum disease

Q. In dietary deficiency of B_{12}, schilling test (N)

Q. Mut' of cubulin ® ⇒ IMERSLUND GRIESBEECK's SYNDROME

IV Intestinal Biopsy
Gold Std. Ix or Most Specific Ix for malabsorption.

Etiologies of Malabsorption-

COELIAC SPRUE	TROPICAL SPRUE.
Cause GLIADIN Hypersensitivity (+ve in gluten) ↓ Local contact HS	Bacterial Toxins. + Folic acid deficiency (↓ mucosal repair)
Prox SI > Distal SI	Distal SI > Prox SI.
C/F * Age- Typical 6-12 months can occur at any age Spontaneous remission - 2nd decade	Adults
* Steatorrhoea (large vol, foul smelling) leading to ↓ Chronic >4 weeks. Non-inflammatory (No blood or pus in stool)	✓
* Extra-intestinal manifestation. M/c- Dermatitis Herpetiformis Other - T1DM, IgA deficiency	

	COELIAC SPRUE	TROPICAL SPRUE
Inv		
① Serology	+	−
Most specific Ab = Anti-Endomysial Ab.		
Most sensitive Ab = Anti tissue Transglutaminase (TTG)		
Most sensitive + specific Ab/Mc/Best = Anti TTG		
② Biopsy		
• Loss of villi	+ (reversible after gluten free diet)	+
• Flat mucosa	+	+
• Lymphocyte infiltration	+	+
③ HLA DQ2	(+) in 100% cases.	−
HLA DQ8	but non-specific	−
Rx		
1. Gluten free diet		Antibiotics → Doxycycline or Rifaximin. + Folic acid. Duration of Rx → 6 months
2. Steroid. Indications		
1) Refractory sprue		
2) (no response upto 12 months) of gluten free diet		
2) Celiac shock (↑ gluten load)		
3) SI Lymphoma		
M/c cause of death		

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

WHIPPLE'S DISEASE

~~Ato~~ Cause - Tropheryma Whipelii

C/F

Acute

1) Acute GE
2) Pneumonia

OR

Chronic (HS reaction).

1) Mc presentation = migratory Poly/oligo arthritis

2) CNS

M/c → Dementia

Most characteristic CNS manifestation

Oculo Masticatory Myorhythmia

(conv./diverg. nystagmus.)

Other CNS manifestation.

- Cerebellar ataxia
- Myoclonic seizure
- Encephalopathy
- P. Neuropathy

3) CVS - Pancarditis

M/c - Pericarditis.

4) Eye - Uveitis

5) Polyserositis = Ascites
Pleuritis

Q. organ not involved in whipple's

① ~~Kidney~~
② Lung
③ CVS
④ CNS

Inv Bx - PAS +ve macrophage containing

D/D → TB

Bacilli	TB
AFB ⊖	AFB ⊕

Rx ① GIT → Ceftriaxone (2wk) → Cotrimoxazole (1yr)

② CNS/CVS → Ceftriaxone (2wk) → Doxycycline + Chloroquine or Hydroxychloroquine (1 year)
(↑ risk of recurrence)

BACTERIAL Overgrowth Syndrome

Proliferation of colonic bacteria in prox SI

Causes -

Communication bet" LI & SI	Anatomical stenosis of SI	Functional Stenosis of SI
↑	↑	(↓ Peristalsis)
fistula	stricture	↑
	+ Intussepteon	DM
		systemic sclerosis

CF -

1) Steatorrhoea — Bile is deconjugated by bacteria in S.I.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Inv.

1) 72 hour stool test. >6%

2) D-Xylose Test
excretion <4.5 gm

3) Schilling Test ab (N)

4) S. Folic acid level ↑ (Synthesis by bacteria + reabsorbed by Prox. SI mucosa).

5) Lactulose Breath test or H^+ Breath test.
↓
+ve in Breath 2-8 hour after giving lactulose as Bacteria in SI metabolise.

6) Endoscopic jejunal aspirate culture
↓
M/c organism E.coli $>10^5$/mL

Rx

1) T/t underlying cause

2) Cyclic ~~Ab~~. antibiotics [Co-amoxyclav.
Ab x 1 week
↓
gap 3 wk.
↓
Ab 1 wk

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

APPROACH TO DIARRHOEA

Essential Criteria for Diarrhoea
Stool vol. > 200 mg/d
Stool wt. > 200 mg/d

Duration.

Type

< 2 wk	2-4 wk	> 4 wk
Acute	Persistent	Chronic
90% Due to infections Acute & Persistent		≥ 90% due to non-infectious

If Infectious Diarrhoea

Toxin induced (↑ electrolyte + H_2O secretion)	Inflammation induced (exudative
• Fever ⊖	⊕
• Pus in stool ⊖	⊕
• Blood in stool ⊖	⊕

If Toxin induced

Preformed	Enterotoxin
I.P. ↓ in hours	1-2 days
1) Bacillus cereus (Chinese Restaurant diarrhoea	1) Vibrio cholerae (↑ HCO_3 in stool - Rice ~~stool~~ watery stool

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

2) Staph. aureus.

2) Enterotoxic E.Coli
M/c c of Traveller's diarrhoea

3) Clostridium Perfringes

If inflammation induced

I. Mild = mucosa limited. (blood in stool ⊖)

II. M/c Viral diarrhoea in adults = Noro virus
" " " children = Rota virus

II Mod. = submucosa

1) Salmonella → involves ileum
↓
Bile reabsorpⁿ ↓
↓
Bile in stool.

III Severe

2) Yersinia → Severe ileum inflammation
Pseudo appendicitis

(3)
II Campylobacter J. M/c infectious cause of GBS

III Severe = Deep layers

1) Shigella → Toxic encephalopathy
Ekiri Syndrome

2) E. histolytica → flask shaped ulcer

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Rx - acute/persistent diarrhoea

① Essential - Rehydration

I.v. fluid of choice → RL contains

	mmol/L
K^+	4
Na^+	130
Ca^{2+}	2
Cl^-	109
Lactate$^-$	28
Osmolarity	273

slightly hyposmolar

② Antibiotics

Indication - Mod to severe inflammatory infectious diarrhoea

If ≥ 1 of 3 criteria (+)

a) Fever > 101°F

b) Blood in stool

c) Pus in stool

Empirical = Flouroquinolones.

Chronic Diarrhoea

Non-inflammatory	Inflammatory
eg. Malabsorption Syndrome	LMR Topic: Ulcerative colitis, Crohn's Disease } IBD

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

	UC	CD
*Risk / associated		
① Smoking	↓	↑
② appendicectomy	↓	↑
③ Drugs		
OCP	↔	↑↑
Methyldopa	↑	↔
Ab use in 1 year	↑	↔
④ Infections	↔	↑ MC = Mycobacterium Para TB.
		Infection & risk of CD – H. Pylori
⑤ Turner's	↑	↑ NOT DOWN SYNDROME
⑥ IL-10 Receptor deficiency → ⓝ anti-inflammatory → Early onset IBD.	↑	↑
C/F Intestinal		
M/c site →	Rectum + Sigmoid > Rectum only	M/c site → SI + LI > SI only.
		M/c isolated site – Ileum.
M/c isolated site – Rectum		Rectum is usually spared
Site not involved → SI.		

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

① Malabsorption Synd ⊖	⊕
② Bleeding PR (Tenesmus) ⊕	⊖
③ Fistula formation ⊖	⊕ (Transmural involvement)
④ Toxic Megacolon. ⊕ (dilatation of colon >6cm)	⊖ Bowel wall or thick resist dilatation.
Ulcer → Collar Button ulcer (non-crossing)	Cobblestone ulcer (Crossing)
Inv	
① Stool Examn. Lactoferrin ⊕ correlate ī disease activity	⊕
Calprotectin ⊕ Predicts ~~relapse~~ relapse	⊕
② Serology. M/c → ANCA	Mc Anti Saccharomyces cerevisiae Ab
Role → ↑ risk of Pancolitis	Role - ↑ risk of early complication
③ Confirm Bx	Bx

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Rx of Ulcerative Colitis

(I) Mild to mod. severity (stool freq. < 6/day)

- Distal Dis
  - DOC.- Per Rectal ASA
  - Mesalamine
- Pancolitis
  - DOC - Oral ASA
  - Mesalamine + Sulfasalazine
  - ↓ If no response in 4 wks.
  - Oral steroid therapy

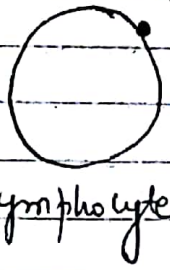
II Severe IBD (Stool frequency > 6/day or shock).

DOC - I.V. Steroid

- Steroid response
  - ↓ Taper + Stop
- ~~Taper + Stop steroid~~ Steroid Dependent
  - ↓ Steroid sparing agent
  - Azathioprine
- Steroid resistant (no response in 5 day)
  - ↓ TNF α Ab or cyclosporine
  - ↓ if unresponsive
  - only for CD - Anti - Integrin

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Only in Crohn's Disease (Resistant steroid)



Integrin (N) helps in vascular adhesion

β_1 ↙ ↘ β_7 subunit

Lymphocyte ↓ specific for GIT vessels

Ab against β_1 & β_7 = NATALIZUMAB.
(used in Multiple sclerosis)

↓

S/E → Reactivate JC virus

↓

Progressive multifocal leuko encephalopathy

Ab against β_7 = VEDOLIZUMAB

Rx of Crohn's Disease

I. Mild to Mod. IBD

↓ ↓

Ileum limited — Small + large Intestine

DOC - Ileal Release Budesonide — DOC - Oral prednisolone

↓ no response in 4wks

Methotrexate.

* Miscellaneous Points :-

1) MC cause of death → Cancer

2) Colonic cancer risk → Ulcerative colitis = Crohn's Disease

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

3) Colonic Ca risk ↓ → Folic acid, 5-ASA agents.

4) Extraintestinal Manifestation of IBD (usually more in CD)

Correlated with Bowel activity	Independent of Bowel activity
Skin - ① Erythema Nodosum (red, hot, tender, nodules on shin)	N - neutrophil infiltration N - non-infective N - necrosis of skin, ① Pyoderma Gangrenosum
Joints - Migratory Polyarthritis (Peripheral joints)	Ankylosing spondylitis
Eye - Episcleritis	Uveitis
Liver - Non-alcoholic fatty Liver Disease	~~Se~~ 1° B Sclerosing Cholangitis → Risk factor for Cholangio carcinoma

Q. M/c extra-intestinal organ affected in IBD - Joints

Q. M/c " " manifestation. → Erythema Nodosum

Q. C " " " more in UC → Pyoderma
1° sclerosing cholangitis

Addition Harrison selected.

Part I → Involuntary wt. loss – Defn
Causes
Inv (Table)

Ascites

Table of causes of diarrhoea

Part II – Table of T/t of Hepatitis C
(exclude doses or regimen)

Table of intestinal Biopsy findings

Protein losing enteropathy
(1st 2 para - causes
inv)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Obstetrics and Gynaecology

MBBS Help

http://mbbshelp.com

http://www.youtube.com/mbbshelp

http://www.facebook.com/mbbshelp.com

Name: _____

Subject: **Obstetrics and Gynaecology**

MBBSHELP.COM

25/4/18

OBS & GYNAE

RELEVANT ANATOMY

GONADS

Internal genitalia

External genitalia

Internal Genitalia :⇒ Uterus; cervix; Fallopian tube; vagina

embryological structure from which it develops :→

↳ Mullerian ducts
⇓
Klau" ParaMesonephric duct"
— Female Internal genitalia
⇓
Uterus; Fallopian tube; vagina; cervix.

Wolffian duct
⇓
" MesoNephric duct"
— Male Internal genital
⇓
S ⇒ Seminal vesicle
E ⇒ Ejaculatory duct
E ⇒ epididymis
D ⇒ Ductus deferens/ Vas deferens.

* Both the ducts appear in every foetus @ 6 weeks.
↳ either ♂ or ♀
* Mullerian duct is Lateral to wolffian duct,
* Mullerian disappears in ♂ @ 9 weeks & wolffian disappears in ♀.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Mullerian ducts

Disappear ⇒ In Male

Why?? Testis

MIS (Mullerian Inhibiting Substance)

↳ * Ipsilateral

Released by "sertoli cells"

↳ Start producing @ 7 weeks

- Mullerian duct will present In female b/c of Absense of MIS

Wolffian duct

In Female

Why?? b/c absense of testosterone

- Wolffian duct is persist In Male child

⇓

Testes

↓

Testosterone → Leydig cells ⇓ @ 8 weeks

⇓

Cause development of wolffian duct

* Estrogen is Not Required for development of Uterus; Vagina; Cx etc ; for it absense of testosterone Required.

* Remnants of wolffian duct In Female

i) Epoophoron – Cranial Remnants of Mesonephric tubules

ii) Paroophoron – Caudal Remnants of Mesonephric tubules

iii) Gartner's duct – caudal Remnants of Mesonephric ducts

Paroophoron ← Medial part of broad Ligament

Klay" organ of Rosen Muller"

- Epoophoron
- Gartner's duct
- Hydatid of Morgagni

} Lateral Part of Broad Ligament

all all contents of broad Ligament

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Gartner's duct sometimes prt as cyst in the vagina

* Gartner's cyst ⇒ In Antero Lateral wall of vagina (2)

D/D → Bartholin's cyst ⇒ In Posterior Lateral wall of vagina

M/c cyst of vagina / vulva ⇒ Inclusion cyst

↓

Located @ Lateral wall.

* Remnant of Mullerian duct in Males ⇒

While { Appendix of testis = Klas. "Hydatid of Morgagni".

Appendix of epididymis is Remnant of wolffian duct. }

* Mullerian duct ⇒ 2 in No.

↳ both ducts fuse & form uterus in 10 weeks

We can differentiate external genitalia @ 10 weeks

→ direction of Fusion — Fusion begins from centre then it Moves cranially / caudally.

direction is from caudal to cranial.

* Initially Uterus is solid organs; Later cavity formation occur @ 18-20 weeks.

⇓

by dissolution of a midline fibrous septum

↳ Potential cavity

↳ to accommodate something.

* if Fundus is convex upwards ⇒ No fusion Abnormality

if Fundus is dipping ⇒ Fusion Abnormality seen.

* Complete septate defect ⇒

* Incomplete septate defect ⇒

* M/c Mullerian Anomaly ⇒ Septate Anomaly

* 2nd M/c Mullerian Anomaly ⇒ Bicornuate uterus ⇒ Septate Anomaly

two uteri, one cervix

Bicornuate unicollis

Bicornuate bicollis

two uteri, 2 cervix

* M/c Mullerian Anomaly a/w abortion
* M/c Mullerian Anomaly a/w Infertility
* Worst Reproductive outcome

} Septate Anomaly

* In Didelphius uterus both Mullerian duct form Anomaly (complete Lack of Fusion)

↳ complete failure of Fusion

↳ vaginal septum

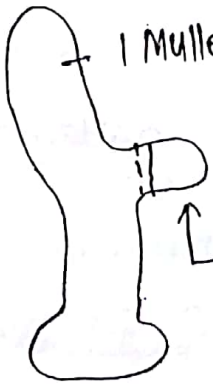
* Mullerian Anomaly ± vaginal septum ⇒ Didelphius

* Bicornuate Uterus has good Reproductive outcome
  ↳ What pregnancy complication: !→ Pre-term Labour / Abortion
  Most Likely to do

* Didelphius Uterus also has good Reproductive outcome
  ↳ What pregnancy complication !→ Pre-term Labour
  Most Likely to do

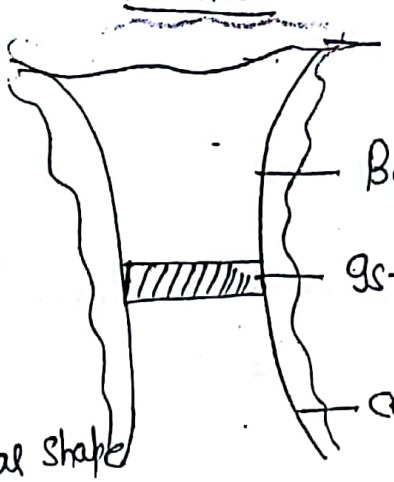
* Usually Corrective Surgery is Not Required
  ↳ if we want then do Unification Surgery
  ⇊
  "STARSSMAN METROPLASTY"

* Unicornuate Uterus !→



1 Mullerian duct = develops → May cause ectopic ♀
Unicornuate — Communicating
Unicornuate — Non-communicating
↳ 2nd Rudimentary
↳ May cause Severe dysMenorrhoea (Unilateral dysMenorrhoea)

UTERUS



Pear shaped Uterus

cavity ⇒ Triangular shape

Length of Uterus ⇓ 6–8 cm Long***

Wt. → Multiparous (80 gm)

→ Nulliparous (50–70 gm)

↳ In pregnancy (term) = 1000 gm (1.1 kg) / 1 kg

} dl+ hypertrophy > hyperplasia

Volume of Non-pregnant = 10mL

Volume of Pregnant = 5L

} dl+ hypertrophy >> hyperplasia

QQ Weight of Uterus six week after Post-partum = 80 gm

* Body ⇒ Is Made up of Smooth Muscle (Myometrium)

Inside → Endometrium

Outside → Serosa

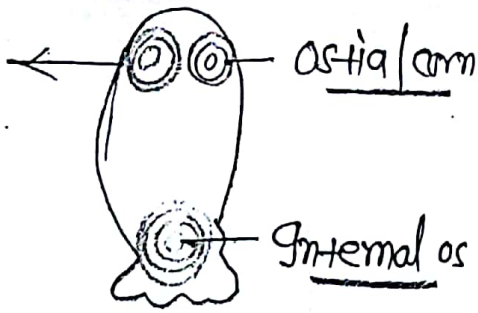
- Myometrium = 2–2.5 cm thick

3 Layer ⇒ Inner – Circular Muscle

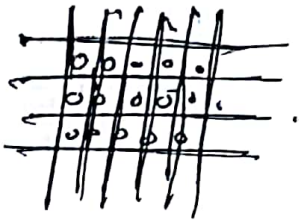
Middle – criss-cross

Outer – Longitudinal

Few Inner Muscle
Works as sphincter



⇒ Middle Layer – criss-cross
⇓
Work as Living Ligature**



⇒ EndoMetrium

↳ Gland + Stroma
⇓
Simple tubular

↳ Single Layer columnar epithelium
cilia prt. only Near gland opening

↳ Superificial Layer = Functional ⇒ Shed off every Month
in Menses

Basal Layer = Not Shed off
↳ function = Regeneration

↳ So thickness of endometrium changes

		Thickness
Just after Menses (D5)	=	0.5mm
Periovulatory	=	2-3mm
Secretory	=	5-6mm
Implantation	=	10-12mm

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Vigrous curettage ⇒ damage the basal Layer

⇓

Result in Intrauterine Adhesion

↓

Asherman's Syndrome

Result in ~~Asherman's syndrome~~

Post partum hemorrhage

↳ Highest Risk in to Manage the ~~Post-partum hemorrhage~~

↓

~~Pt. is Amenorrhoea~~

~~Infertility~~.

Pt. is with Amenorrhoea infertility

⇒ Outside part of Myometrium = Serosa

Anteriorly Loose fold of Peritoneum ⇒ Uterovesical fold

Posteriorly Loose fold of Peritoneum ⇒ Rectouterine Pouch

* At what Level uterus opens - Into cervix ! → Internal os

  - Anatomical (Above)
  - Histological (Below)

  0.5 cm ⇓ constriction ⇓ Kla "Isthamus"

* Isthmus is brt. b/w Anatomical & Histological Internal os.

* Isthamus — Stretch — LUS

  ↳ Lower Uterine segment

In term LUS Isthmus (7cm) + Cervix (3cm) ; cervix comes above in cervical effacement (taking up of cervix).

(5)

Cervical effacement

↳ Shortening + Softening

* At term LUS ⇒ 5cm

In complete (Manual Labor) LUS = 10cm

* LUS shortly forming after 1st Trimester.

L.S.C.S. ⇒ At Lower segment

How to identify??

by Loose fold Peritoneal

Most common Incision ⇒ Low Transverse Incision

Shape ⇒ Transverse or Transmesteir

↳ Kias " Kerr's Incision"

Low vertical Incision

↳ Kias " Kronig's Incision"

classical Incision

↳ Kias " classical Incision"

Risk of Rupture

* Low transverse Incision ⇒ 0.2-0.9%
* Low vertical Incision ⇒ 1-7%
* Classical Incision ⇒ 4-9%
  ↳ Weakest Incision

* Classical Incision / scar is already given
  ↳ it is Absolute Indication for Repeat cesarean section
  but Not an Indication for Repeat classical Incision

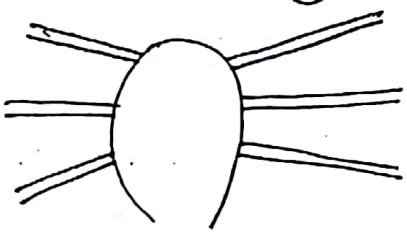
* Indication of classical ⇒ ① ♀ c CaCx;
  ② Dense Adhesion b/w bladder & Uterus (May Injured bladder)
  ③ Repaired vagino-vesical fistula
  ④ Post Mortem C.S.

N.B: Anterior Located Placenta previa (only if a Not trained enough doctor)
↳ So; for Anterior Placenta previa ⇒ LSCS do

* On other side of Uterus 3 structures are attachment :- (6)

Mnemonics ⇓ RTO

- Round Ligament
- Fallopian Tube
- Ovarian Ligament



Adnexa ⇒ Fallopian tube + ovary

Antero-Posteriorly ⇒ Round Ligament → Fallopian tube ↓ Ovarian Ligament ⇓ Utero ovarian Pedicle

Superio-Inferior ⇒ Fallopian tube ↓ below it Round Ligament / ovarian Ligament @ Same Level

They assist you in tubal Ligation Surgery

↳ M/c cause of failure of Tubal Ligation Sx ⇒ Ligation of wrong structure

FUNDUS :→ Part of Uterus Lies above the attachment of Fallopian tube

Round Ligament Path ⇒ Upper Uterus → deep Inguinal Ring ↓ Inguinal canal ↓ Superficial Ring ↓ Inserted on Labia Majora

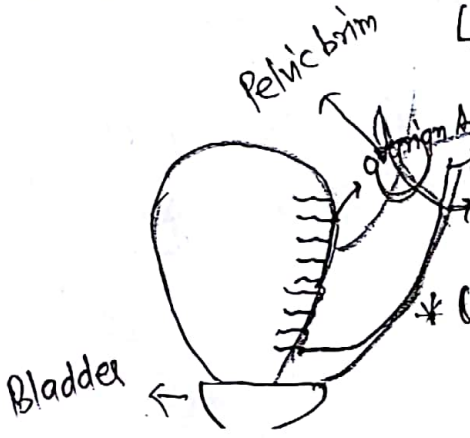
Pulling Uterus Anteriorly i.e. in Anteverted position.

* CANAL OF NUCK (Present in Fetus only) :
Fold of Peritoneum in fetus that contains Round Ligament & extends into Inguinal canal.
It carries Round Ligament.

* Round Ligament, Ovarian Ligament } developed from Gubernaculum
↓
Not derived from Mullerian duct.

Proximal ⇒ ovarian Ligament
Distal ⇒ Rand Ligament

Blood supply ⇒ Uterine A.
↳ Branch of Anterior division of Internal iliac Artery.



2nd M/c site of ureteric injury*
"Water under bridge" ⇒ Danger Area
* Uterine A. is crossing over the ureter
↓
M/c site for ureteric injuries

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Location of "Water Under bridge" Area ⇒ 2 cm Lateral to cervix[13]
OR
1.5 cm Lateral to fornix.

* Ureter is Posterior to ovarian & Uterine Artery; (7)
but it is Anterior to Internal iliac A

⇒ Branches of Uterine A. ⇒

U ⇒ Uterine A.
↓
A ⇒ Arcuate branches ⇒ Supply outer 1/3rd of Myometrium
↓
R ⇒ Radial branches ⇒ Supply inner 2/3rd of Myometrium
B ⇐ Basal ⇒ Supply Basal endometrium
S ⇐ Spiral ⇒ Supplies the Superficial / Functional endometrium

- Always do B/L Ligation & do @ the Level of Internal os.
* Uterine A gives a special branch ⇒ Sampsons A ⇒ for Round Ligament
- Nerve supply ⇒ T_{10}, T_{11}, T_{12}, L_1
  - ↳ Pain during Uterine contraction travels via this Root
  - ↳ Pain Relay via ⇒ "Frankenhauser ganglion"

We give "Labour Analgesia" (Level of block for vaginal delivery
↳ via Epidural Anesthesia ⇓ T_{10})
give "Bupivacaine"
↳ "0.125 – 0.25%" (Dose)
↳ Sensory block; if given more than Motor block.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Level of block for cessarean Section

⇓

At T_4 (b/c to knockout the peritoneal Nerve supply)

→ M/c Anesthesia ⇒ Spinal Anesthesia

* Labour Analgesia may Prolong Labour (Active phase by 1hr)

↳ but doesn't ↑ Incidence of cessarean section,

* When we apply forceps (outlet/Low) – Pudendal N. Block

done only when complete dilatation head @ +3. to block it we

pierces Sacrospinous Ligament

. Direction of Needle (Posterior Medial)

⇓

S_2, S_3, S_4

⇓

Previously K/as "Saddle block"

* Lymphatic Drainage ⇒ Internal iliac + Ext. iliac L.N

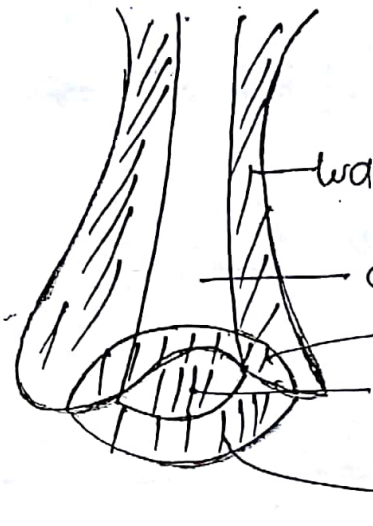
Fundus ⟶ Para-aortic L.N.

Ostia ⟶ Superficial Inguinal L.N.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

CERVIX ⇒ 9+ opens into vagina* (8)

- Conical in shape
- 3cm Long
- Cavity ⇒ Spindle shape/ Fusiform



Compound Racemose glands
Tall columnal epithelium
Made up of Numerous branching glands
(Endocervix)
↳ Arbor vitae appearance
Ectocervix
⇓
Stratified squamous Non-Keratinized epithelium

External os ⇒ Shape

- Nulliparous ⇓ Circular
- Multiparous ⇓ Transverse slit

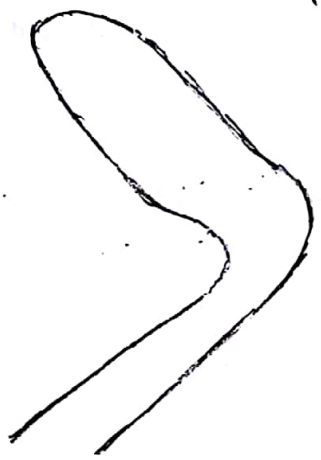
- Wall of cervix ⇒ Made up of connective tissue (collagen)
  ⇓
  10-15% Smooth Muscle
  ↳ Result in effacement (there will be ↓ in collagen & ↑ in hyaluronic acid & ↑ water content & ↓ in dermatan sulfate)
  ⇐ Softening & taking up

* Broad Ligament is a potential space; contains blood vessels etc.

* Angle b/w cervix & vagina ⇒ Anteversion
  ↓
  90°.

* Angle b/w Long axis of body of Uterus & cervix ⇒ Anteflexion
  ↓
  120°
  ↳ @ Internal os

* In 80% women Anteverted & Antiflexed uterus ⊕
  ↓
  Two Ligament Responsible for it
  ↳ Round Ligament
  +
  Uterosacral Ligament.



* If Fundus is More towards Bladder ⇒ Anteflexion
  If Fundus is More towards Rectum ⇒ Retroflexion.

* In P/V examination ⇒ Which Lip you hitting 1st
  - Anterior Lip ↓ Anteversion
  - Posterior Lip ↓ Retroversion.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Ration of Cervix & corpus :-

At birth = 1:1

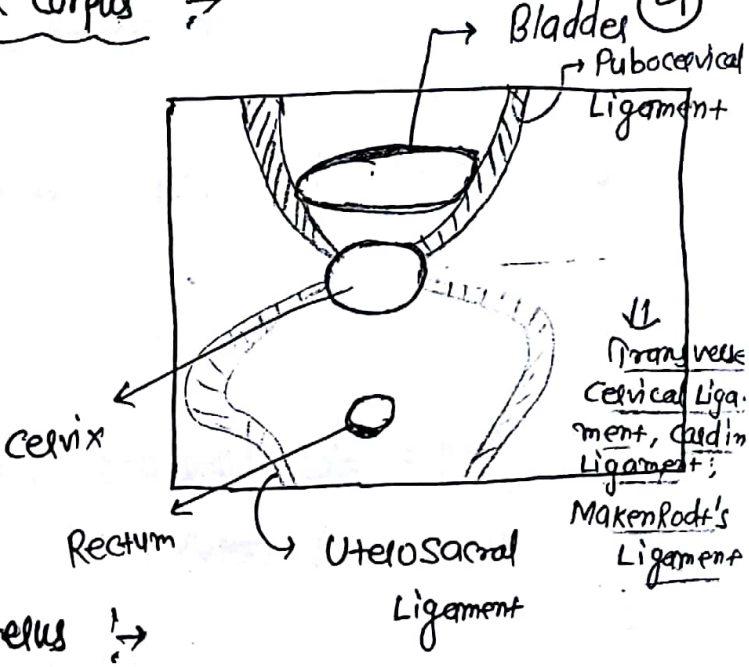
Prepubertal = 2:1

after Puberty = 1:2

Reproductive Life = 1:3

Post Menopausal = 1:1

(9)



* Main Support of Uterus :-

Anterior ⇒ Pubocervical Ligament

Posterior ⇒ Utero sacral Ligament

Lateral ⇒ Transverse / cardinal / MackenRodt's Ligament

Inferior ⇒ Levator Ani

Hammock / Triradiate Ligament = Pubocervical Ligament + Utero Sacral Ligament + Cardinal Ligament.

QQ All are Main Support except

↳ Round Ligament (Support, but Not Main)

Broad Ligament (Not a support) ← It is Nothing, but fold of Peritoneum

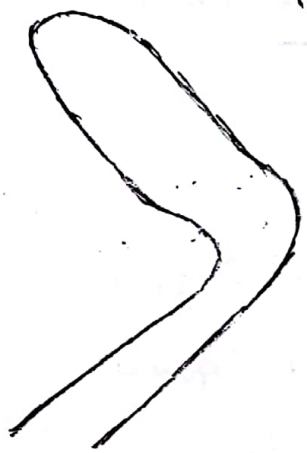
↳ False Name

* Broad Ligament is a potential space; contains blood vessels etc.

* Angle b/w cervix & vagina ⇒ Anteversion
  ⇓
  90°.

* Angle b/w Long axis of body of Uterus & cervix ⇒ Anteflexion
  ⇓
  120° @ Internal os

* In 80% women Anteverted & Antiflexed uterus ⊕
  ⇓
  Two Ligament Responsible for it
  ↳ Round Ligament
  +
  Uterosacral Ligament.



* If Fundus is More towards Bladder ⇒ Anteflexion
  If Fundus is More towards Rectum ⇒ Retroflexion.

* In Plv examination ⇒ Which Lip you hitting 1st
  - Anterior Lip ⇓ Anteversion
  - Posterior Lip ⇓ Retroversion.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

FALLOPIAN TUBE **

(10)

- Unfused part of Mullerian duct*
- Length = 10 cm (10–12 cm)*

* Part of Fallopian tube (Medial – Lateral) :→

- Intramural / Interstitial part (1–2 cm) = Narrowest part of Fallopian tube ↳ 0.1mm diameter
- Isthmus ; (3 cm) = 1mm diameter
- Ampulla ; (5 cm) ⇒ Widest part of Fallopian tube = 6mm
- Infundibulum ↳ Fimbrial end

→ Site of fertilization / M/c site of Ectopic ♀

↓

b/c here fertilization takes place & d/t Mucosal fold in the Ampulla (R/as "plicae")

* M/c site of Ligation ⇒ Isthmus.

* Conceptus Remains in Fallopian tubes ⇒ 3 days
* Conceptus enter the Uterine cavity on the 4th day. ↳ Post-fertilisation
* Anatomical Sphincter of Fallopian tube ⇒ Intramural part.
  Physiological sphincter of FT ⇒ Isthmus

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

QQ Main Reason for transport of Conceptus

↳ Tubal Peristalsis *

Anything that ↓ Tubal Motility Leads to "Ectopic ♀" ***

↓

In Pelvic Inflammatory disease;

Tubal Surgery;

Progesterone only pills;

- Epithelium of Fallopian tubes :-

↳ Single Layer ciliated Columnal epithelium.

3 cells - Secretory

ciliated

Peg cells → Resting cells of Fallopian tubes.

* Direction of ciliary Muscle is towards Uterus **

- Blood supply ⇒ Dual blood supply *

Medial 2/3rd ⇒ Uterine A.

Lateral 1/3rd ⇒ Ovarian A

↳ dilates 3 times in ♀

↳ Site of Ligation for Management of PPH.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

- Lymphatic drainage ⇒ Paraaortic Lymph Node * (11)

Intramural + ostial

↳ Superficial Inguinal Lymph Node *

extra edge

* N. Supply ⇒ T_{11} T_{12} L_1 .

⇓

Pain Sensation from UnRuptured ectopic (tubal stretch)

* Ectopic is Vascular accident

↓

dies dlt

VAGINA **

Embryological development →

Upper 1/3rd of va from Mullerian duct (Mesoderm)

Lower 2/3rd of vagina ⇒ from Urogenital sinus (Endoderm)

↳ from Sinovaginal bulb

Hymen is Remnant of this

* Mucous Membrane of vagina ⇒ from Endoderm of urogenital sinus

* Muscles of vagina ⇒ from Mesoderm of Mullerian duct.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Vagina has four walls ⇒ Anterior
Posterior
Lateral - 2 in No.

↓
7-10 cm Long

- Posterior wall is Longer than Anterior wall by 2cm.*
- A-P wall apposed together
  ↳ after cut "H" shaped

* Cervix comes inside vagina & Space b/w them k/as "Fornix"

Recess = Fornix
↓
Total 4 in No.

↓
4 in No. (Ant, ; Post; 2 Lateral)
— Posterior fornix is deepest*

if More than 100ml collection in Pouch of douglas ⊕
↳ it is significant **

Pouch of douglas | Cul-de-sac ⇒ Culdocentesis
↓
Recto uterine fold Posterior to Vagina

if we get blood — which doesn't clot
↳ Hemoperitoneum.

used in Ruptured ectopic.

If blood clot ⇒ then it comes from blood vessels.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Colpotomy ⇒ Opening of the Pouch of douglus to drain Pelvic Pus. (Abscess) (12)

Enterocele ⇒ Prolapse of bowel wall (Pouch of douglas herniates)
↳ upper 1/3rd of Posterior wall

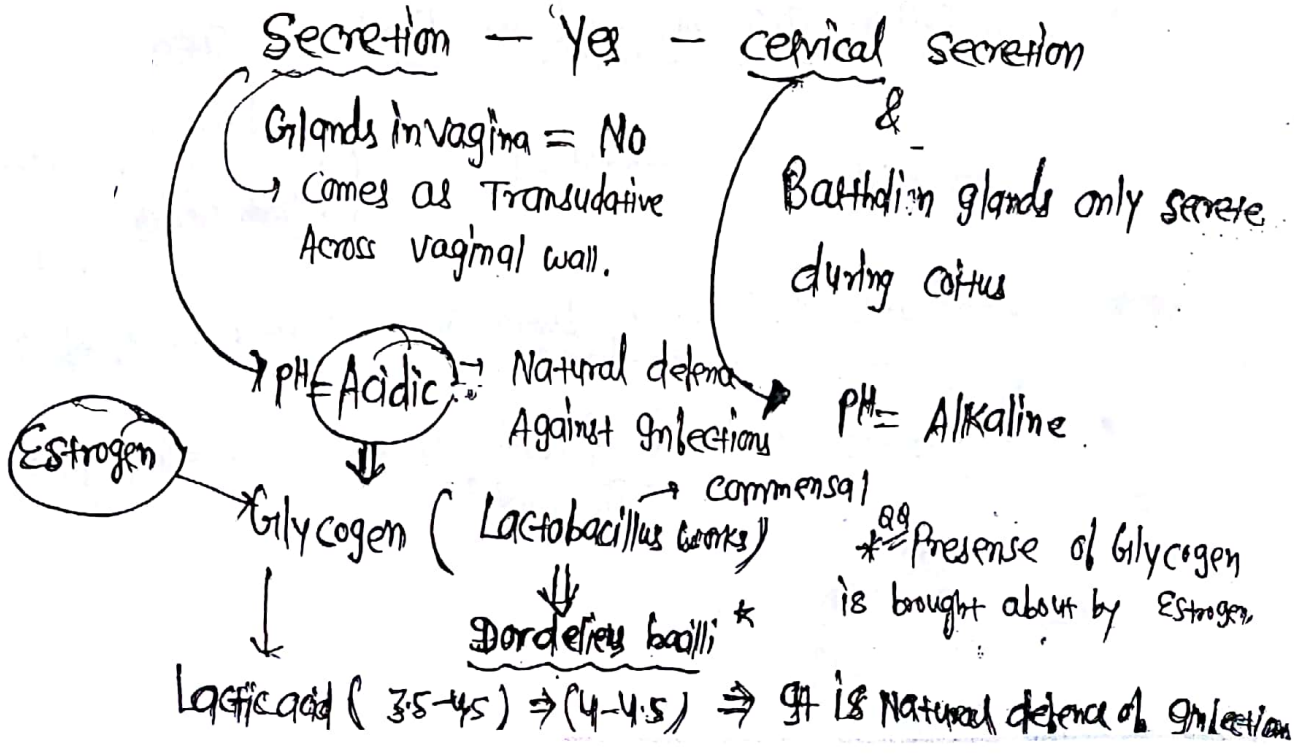
QQ. Which of the following is Cystocele??
↳ Protrusion of bowel wall into the upper 2/3rd of Anterior wall of Vagina.

a) ~~upper~~ 2/3rd of wall;
b) Lower 2/3rd of wall;
c) Upper 1/3rd of wall;
d) Lower 1/3rd of wall ⇒ Urethrocele
↳ Protrusion into Lower one-third of Anterior vaginal wall.

* Rectocele ⇒ Prolapse into Middle 1/3rd of Posterior vaginal wall

* ∠ the H3-line passing through Pelvis, vagina forms ⇒ 45°

* Epithelium of vagina ⇒ Stratified Squamous Non-Keratinized



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

QQ. Deficiency of 5α Reductase :→

Male Pseudohermaphrodite (Genotype – Male
Phenotype – Female)

* by looking external genitalia we differentiate Male & female by 12 weeks.

Female		Male
* Bartholins gland	Homology	Bulbourethral gland (Cowper's gland)
* Glands of Skene (Para-urethral)	Homologus	Prostate.

* Lymphatic drainage of clitoris ⇒ Superficial Inguinal Lymph Node
* Lymphatic drainage of Glans clitoris ⇒ Deep Inguinal Lymph Nodes (Lymph Nodes of Cloquet)
* Lymphatic drainge of Labia Minora ♂ glands ⇒ Deep Inguinal L.N.
* Lymphatic drainage of Labia Majora ♂ glands ⇒ Superficial Inguinal L.N.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Vaginal part	Blood supply	Lymphatic drainage (13)
Upper 1/3rd	Descending Uterine Artery	External + Internal iliac
Middle 1/3rd	Inferior vesicle Artery	Internal Iliac
Lower 1/3rd	Middle Rectal Artery	Superficial Inguinal

EXTERNAL GENITALIA

Female	Male (Homologus structure in Male)
Genital tubercle → @ 6 weeks	Clitoris	Penis
" Fold	L. Minora	Penile urethera
" Swelling	L. Majora	Scrotum

Absense of DHT Require for Female like organs.

To convert in Male form Testosterone → 5α-Reductase → Di-hydrotestosterone → Tubercle / Fold / Swelling.

QQ. Deficiency of 5α Reductase :→

Male Pseudohermaphrodite (Genotype – Male
Phenotype – Female)

* by looking external genitalia we differentiate Male & female by 12 weeks.

Female		Male
* Bartholins gland	Homologus	Bulbourethral gland (Cowpers gland)
* Glands of Skene (Para-urethral)	Homologus	Prostate.

* Lymphatic drainage of clitoris ⇒ Superficial Inguinal Lymph Node
* Lymphatic drainage of Glans clitoris ⇒ Deep Inguinal Lymph Nodes (Lymph Nodes of cloquet)
* Lymphatic drainge of Labia Minora ♀ glands ⇒ Deep Inguinal L.N.
* Lymphatic drainage of Labia Majora ♀ glands ⇒ Superficial Inguinal L.N.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

** VESTIBULE

(14)

⇒ Anteriorly ⇒ Clitoris

Posteriorly ⇒ Fourchette

Lateral boundry ⇒ Hart's line

⇒ Structures opening in vestibule ⇒ Urethral opening;
Vaginal opening;
2 Bartholin's gland opening;

* Bartholins gland cyst ⇒ Pea Size;

Bartholin gland ⇒ Located b/w L. Minora & L. Majora groove & @ the junction of Ant. 2/3rd & Post. 1/3rd;

- Cuboidal epithelium
- duct travels Medially & forward; & opens b/w L. Minora & hymen (@ 5o'clock; 7o'clock).
- @ opening its squamous; while along whole length it is transitional epithelium.
- all kinds of cancer seen in Bartholin gland cancer ⇓ by "HONANS CRITERIA".

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

i) Asymptomatic Bartholin cyst ⊕ ⇒ No Rx *

ii) Symptomatic | Recurrent cyst ⊕ ⇒ Marsupilization

⇓

Exteriorization of the duct to prevent Recurrence.

iii) Σ 40yr & have Bartholin cyst ⊕ ⇒ Excision

⇓

Yes Ca Risk *

Bartholin Abscess ⇒ i) E.Coli > Gonorrhoea;

ii) Initial Tx = I & D

↓

Marsupilization on Later date

* Secretion of Bartholian gland ⇒ Alkaline; ⌜Released during coitus⌝

b/c Acidic environment is spermicidal.

* they are content of Superficial Perineal Pouch;

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

** RELEVANT EMBRYOLOGY

(15)

* Gonads 2 ⇒ develop by Genital Ridge – 5 weeks

Ovary (8 weeks) *

- Absense of Y chromosome

In XO genotype ⇒ ovaries appear Normally

↓

Abn functional

↓

Streak Ovaries

↳ Seen in Turner Sx. *

Testis

- Y chromosome
- SRY functional part of Y chromosome

↓

@ 6-7 weeks

→ Distal segment of short arm

↳ b/c "XX" genotype Require for function. of Y-chromosome

SRY ⇒ For testis *

WNT4 ⇒ For ovary

if Nothing Mention; differentiation b/w ♂ & ♀ @ 12 weeks of P.O.G.

* Gonads can be differentiated into ♂ & ♀ by 7 weeks
* Internal genitalia differentiates @ 10 weeks;
* External genitalia differentiates @ 12 weeks;

– Ovary prt. in "ovarian Fossa"

↳ prt. in Lateral Pelvic wall

* Posterior to ovarian fossa ⇒ Ureter; Internal iliac vessels;
  Anterior to ovarian fossa ⇒ Obliterated umbilical A.; Mesovarium
  Lateral to ovarian fossa ⇒ Obturator Nerve & vessels

Pain from ovaries Referred to Medial aspect of thigh b/c of Cutaneous br. of obturator Nerve.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Medial ⇒ Ovarian Ligament

Superior ⇒ External iliac vessels.

Inferior ⇒ Levator Ani

Ovaries ⇒ 3 Supports

- Ovarian ligament — Ovarian ligament
- Infundibulo Pelvic Ligament (Suspensory Ligament) — Infundibulum pelvis ligament
  - Ovarian vessels (it carries ovarian A. & veins)
  - to Lateral Pelvic wall (Attaches ovary to Lateral Pelvic wall)
  - Cut – for oophorectomy
- Mesovarium — False Ligament — False Ligament
  - Fold of Peritoneum to posterior leaf of Broad Ligament

Mesovarim

OVARY ⇒ In Reproductive age Average 7-8 cc upto 20cc Normal.
in Post Menopausal age average 2-3 cc upto 10cc Normally

Blood supply ⇒ *Ovarian Artery ⇒ br. of Abdominal Aorta @ L_2

Ovarian vein ⇒ Rt. ovarian vein → (R+) drains into → gvc (16)

(L+) drains into → Left Renal vein → gvc

L+ ovarian vein

Varicocele ⇒ M/c on left side; b/c it makes 90' ~~Make 90°~~

↳ L+ testicular vein joins @ Left Renal vein at 90°

↳ M/c Reversible cause of Male Infertility

(Lymphatic Drainage ⇒ Para-aortic group of ∧ at L2 Lymph Node)

Epithelium ⇒ Germinal epithelium

(Single layers cuboidal)

↳ Germ cells all formed here

1° Germ cells (Primordial Germ cell)

↳ Epiblast (Ectoderm) ⇒ older days from Yolk sac

* Ovary has — Cortex — Follicles
— Medulla — vasculas

* Menopause ⇒ Follicles goes into Programme cell death cause it

↳ Max^m follicles @ intrauterine life 5th month (20 week) → 7 million

Epiblast
↓
Yolk Sac (@ 3 weeks)
↓
Genital Ridge (@ 6 weeks)
↓
oogonia (@ 9 weeks)
↓
1° oocytes (@ 12 weeks)
↓
Follicle formation begins (@ 14 weeks)
↓
Follicle formation complete (@ 24 weeks)

on Birth = 2 million (1-2)

on Puberty = 400,000

ovulate = 400 ovulate

1000 atresia // Month

Follicle / oocyte ⇒ Folliculogenesis → What is happening in surrounding cells

Oogenesis → What is happening in Germ cells

- 1° Follicle – Flattened granulosa cell
↓
1° Follicle – cuboidal granulosa cell.
↓
2° Follicle – Theca cells ⊕
↓
Antral Follicle – Cavity ⊕

* all follicles have 1° oocyte @ centre; but ovum have 2° oocyte.. * oogenesis begins IUL ⇒ @ 9 weeks

2n Oogonia
↓ Mitosis
1° oocyte – diploid
↓
Meiosis I

(17)

Meiosis – I

Arrested in ⇒ Prophase

↓

diplotene

↓

* Dictyotene → Arrested stage *

(Stage b/w Prophase & Metaphase)

When completed?? – just before ovulation

@ ovulation (3–4 hours before ovulation)

Ovum → More cytoplasm

2° oocyte (n)

I st Polar body → Less cytoplasm (n)

· Genetic Material equally divided

↓

Enters into Meiosis – II

Arrested – ?? – Metaphase *

Completed – After fertilization

Female ProNucleus * II nd Polar body

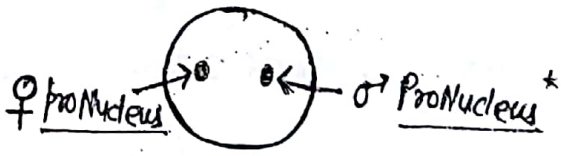


Fig. Fertilized ovum *

* Life span of ovum = 24 hr.

* Size of Mature ovum = 120 µm in diameter

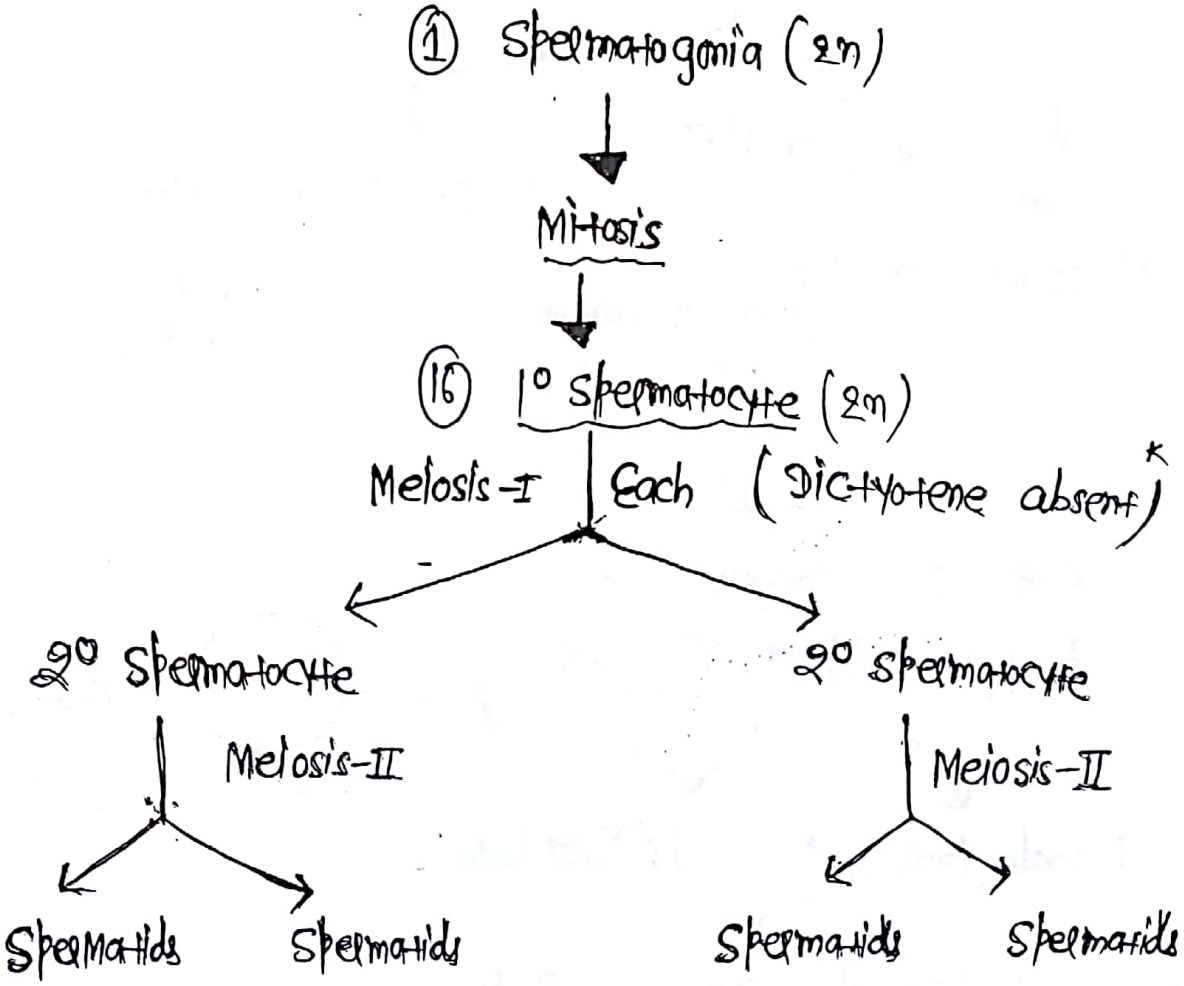
Size of Mature follicle = 18-20mm in diameter

Size @ which follicle Rupture = 18-20mm *

SPERMATOGENESIS

*Begins — Puberty in Seminiferous tubules.

*duration — 72 day



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* One 1° Spermatocytes gives ⇒ 4 Sperms @ Spermatids.
* one Spermatogonia gives ⇒ 16 1° Spermatocytes* = 64 Sperm
* Fertilizeable Life span ⇒ 3 days; (18)
* Mature sperm ⇒ 55 µm in Length (Smaller than RBC)

* No. of Sperms produced in one day = 100 million*
(Average Sperm count)

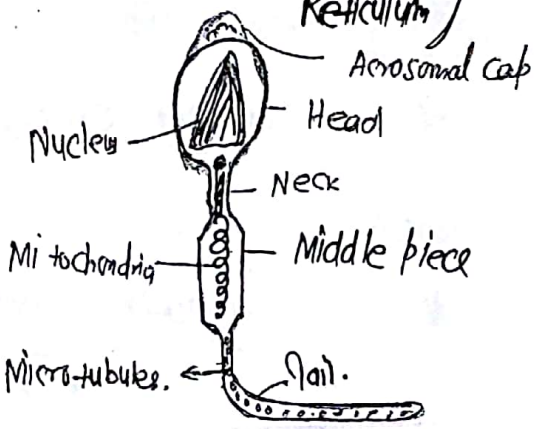
* Spermiogenesis ⇒ 12-14 days
↓
* gM Mature sperm → Site of Maturation & Motility
↓↓
Spermatids * → Epidydimis * (Tail/caudal part of epididymus)

⇒ Acrosomal cap → Golgi apparatus
Head → Nucleus
Middle piece → Mitochondria
* (energy house of Sperm)
Tail → Micro-tubules

. Sperms don't have aa endoplasmic Reticulum (Rough endoplasmic Reticulum)

✓ gm Responsible for Motility of Sperm ⇒ Calcium aa

* Gene for Motility ⇒ CATSPER



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

FERTILIZATION

Capacitation → begins in cervix

- Major site = Fallopian tube
- Sperms = Reach the ampulla ∈/in 30 min
- takes 7 hours.
- cause ⇒ Sperms take ability to bind Zona pellucida
  - lost just before Implantation on D5
  - Prevent polyspermy
  - Receptor for sperm: ZP61
  - ZP61-3

Sperms get the ability to undergo Acrosomal Rxn ⇓

Sperm Recep.

Memb. Permeability — Ca++

↳ hypermotility

* Acrosomal Rxn ⇒ Main Enzyme: Hyaluronidase QQ

* For all Embryological events :
  - → Days ⇒ from Fertilization
  - → Weeks ⇒ from LMP (1st day)

3 Rules ⇒
1. 28 day;
2. 14th day – ovulation
3. days of ovulation = days of Fertilization

* 1st clevage occurs ⇒ 20-30 hour after fertilization
* Conceptus enters in Uterus ⇒ Morula stage @ 4 days
  ⇓
  16 cell stage > 8 cell stage
* Implantation occurs ⇒ in Blastocyst form
  - ↳ on D6 begins (D6-D7)
  - ↳ on D5 it form

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(19)

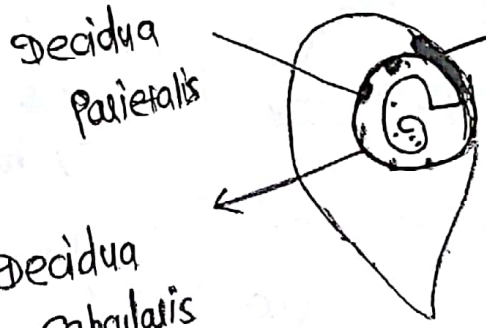
* Implantation occurs in 3 Phases :→

1. Apposition ⇒ Selectins
2. Adhesion ⇒ Integrins
3. Invasion ⇒ Matrix Metalloproteinase.

* Implantation completed @ D10.

* M/c site = Upper posterior wall (Eccentric*)
  ↳ one half bigger than other side.

* Endometrium of ♀ ⇒ K/as "Decidua"*



- Obliteration of uterine cavity by fusion of capsularis | parietalis
  ⇓
  14-16 weeks** (After fusion K/as "Decidua Vera",

SUPERFETATION

- Fertilization of 2 ova by 2 different sperms by 2 different acts of coitus
  ↑ Different Menstrual cycle
  • Not documented in Human
- Theoretically twinning can happen upto 16 weeks.

SUPERFECUNDATION*

↑ 2 Same Menstrual cycles

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

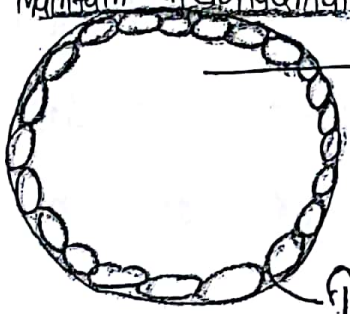
* Embryonic phase lasts upto 8 weeks post fertilization & 10 weeks from L.M.P.

Implanted embryo ⇒ Invade Blood Vessels on placental bed, Make blood vessels Resistant to vasopressors, Maintain Uteroplacental circulation.

Endovascular / Interstitial

Forms: Placenta ↑ Villus

Goes into decidua & Myometrium ↑ Extra-villus (outside placenta)



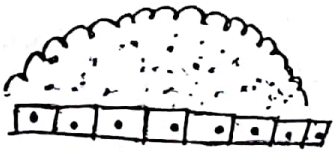
Inner cell Mass ⇓ Fetus proper

Trophoblast ⇓ Placenta / Fetal Membrane

In Pre-eclampsia ⇒ Invasion of trophoblast is Absent.

Cytotrophoblast

Syncytiotrophoblast ⇓ Source ↓ Formed by Cytotrophoblast



exchange

Hormone → Protein / → Steroid

Fetal Membranes

Amnion → i) Inner Most; ii) Avascular; iii) Tensile Strength; iv) Latest ⇒ Fetal ectoderm in origin

Chorion

Allantois

Yolk sac

Chorion Laeve ⇓ Fusion ⊂ Amnion

Chorion frondosum ⇓ Placental tissue

Form placenta ↑ (Chorion frondosum + Decidua basilis (Placental bed))

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Allantois ⇒ Diverticulum from hindgut grows into connecting stalk. (2D)

↳ Umbilical vessels (it gives Rise Umbilical vessels).

Yolk sac ⇒ 1st site of hematopoiesis

↳ 3rd – 6 weeks (Portland, Gower 1, Gower 2)

Portland: $\zeta_2\gamma_2$ (I), $\zeta_2\beta_2$ (II)

Gower 1: $\zeta_2\varepsilon_2$

Gower 2: $\alpha_2\varepsilon_2$

> 6 wks – Liver ∴ HbF ⇒ $\alpha_2\gamma_2$

> 20 wks – Long bones

- Bigger in size & shorter in life span.
- ↳ higher affinity for O_2
- ↓ les 2,3 DPG & carbonic Anhydrase; Hb–O_2 curve shift to Left.

* Fetal Hb is Resistant to both alkali & Acid denaturation

ALKALI DENATURATION TEST	ACID DENATURATION TEST
APT (test) ⇓ 1% NaOH used	• KB (Kleihauer Betke) • Citric acid & PO_4 buffer used.
Bed side test	• Laboratory test
Qualitative test ⇓ differentiate Maternal blood & Fetal blood from each other (Mom's ⇒ ⊖ve (colour change); Baby's ⇒ ⊕ve (colour Resistant))	• Quantitative test ⇓ Fetal RBC from Maternal RBC → count ⇓ Used in Rh⊖ve ♀ to calculate dose of Anti-Rh.
• Singer's test (other kind of alkali test)	

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

In Antepartum hemorrhage we can do "APT test".*

* Fetal RBC ⇒ Larger in size
Shorter Life ⇒ 90 days*

- Hb of baby @ birth ⇒ 18 gm%.
↓
75-80% of HbF & Rest Adult Hemoglobin.

- @ 6 Month < 1% HbF prt. out of total.

PLACENTA*

- Hemochorial ⇓
  - Maternal & fetal blood doesn't mix.
- Deciduate ⇓
  - Sheds off
- Discoid ⇓
  - Shape

Wt. of term placenta = 500 gm
volume of term placenta = 500mL (volume)
diameter = 20 cm
Thickness = 2.5 cm

At term; Placenta: Fetal wt = 1:6

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Maternal side

⇓

Facing decidua

⇓

Lobes (divided into 15-20 Lobes).

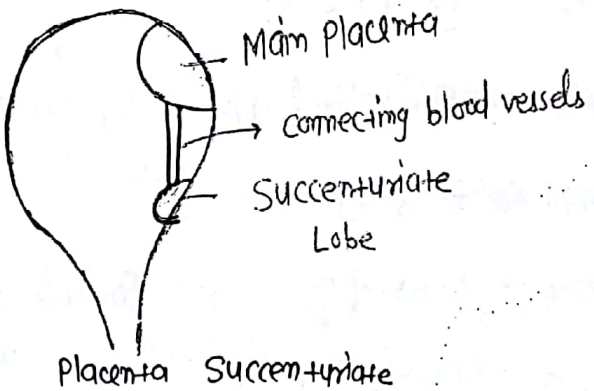
⇓ → each lobe divided into 3-5 Lobules

Lobules (Functional unit)

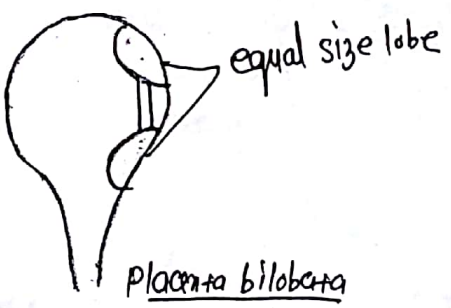
↳ Kias "cotyledon"

* **Placenta bilobata** :⇒ placenta is separated into lobes;
  - division is incomplete & the vessels of fetal origin extends from one lobe to the other before uniting to form umbilical cord.

* **Placenta Succenturiate** ⇒
  ↳ having Accessory Lobe; which is connected to the Main part of placenta by blood vessels.



Placenta Succenturiate



Placenta bilobata

CS-do ← Obstetric emergency

Fetal side

⇓ (21)

Facing the fetus

⇓

Identify ⇒ Smooth / shiny (b/c of Membrane)

- Umbilical cord attached

⇓

(a) centre of Placental disc

- if cord attached to the periphery ⇒ Battledore Placenta

⇓

It can cause Post partum hemorrhage ∵

- **Velamentous Placenta** ⇒ if fetal vessels travel outside the cord for some distance before Reaching placenta (∴ More Chance to injury).

- **Vasa previa** ⇒ vessels are travelling over the internal os.
  - type of velamentous placenta;
  - Rare type of APH (Fetal blood Loss).

⇓

Result in severe Fetal stress

* Intervillous space ⇒ Maternal blood *

Inside villi ⇒ Fetal blood *

1° villous ⇒ → Solid — D_{13}

2° villous ⇒ Mesodermal core — D_{16}

3° villous ⇒ Blood vessel — D_{21}

* Fetal blood flow through placenta ⇒ 400 ml/min.

Fetal circulation Established @ D_{21}

Uteroplacental circulation = D_{12}

↳ @ Term = 450–650 ml/min.

* Intervillous space ⇒ 140 ml blood

↓

· PO_2 in Intervillous space

↓

- 35–40 mm of Hg.

→ 120 spiral arterioles ⊕ Inside.

O_2 Saturation = 65–75%

Low pressure = 10 mm of Hg

↳ Invade spiral A

↓

Permanent vasodilatation

↓

Good Uteroplacental circulation

↓

Vascular Remodelling

Class "endovascular Cytotrophoblast"

Extravillous trophoblast

Syncytiotrophoblast + Cytotrophoblast

Maternal blood

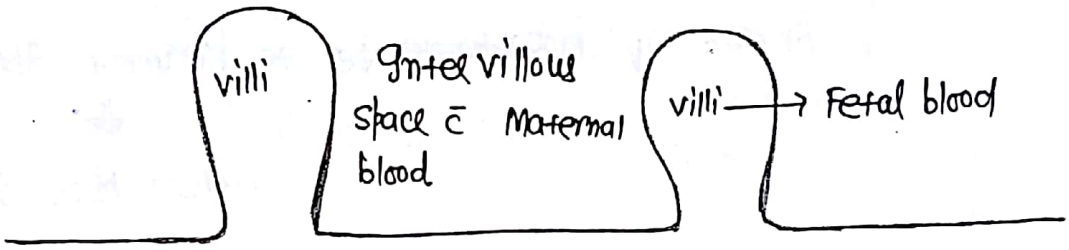
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Vascular Remodelling is controls by decidual Natural Killer cells. (22)

* completed 2 phases — 12 weeks
                    — 16 weeks

* Absent Vascular Remodelling ⇒ Pre-eclampsia
                                IUGR

* (AbN) Vascular Remodelling ⇒ Adherent Placenta *



PLACENTAL FUNCTIONING *

· Placental formation begins @ 6 weeks.

Anatomically — Placenta completly formed by 16 weeks.

Physiologically — Maturation continues

↑ POG ⇒ · Cyto-trophoblast ↓ — term (X) → No Cyto-trophoblast @ term
· Syncytio-trophoblast Thickness ↓ (thin)
· ↓ Stroma
· ↑ Fetal blood vessels.
  ⇓
  also keep Moving towards periphery of villus
· Hofbauer cells (+)
  ↳ Fetal Macrophages

Function of Placenta ⇒ Nutritional
Excretory
Respiratory
Endocrinal (Most imp)

↙

Progesterone | Estrogen | HPL | HCG
↳ Human Placental Lactogen

Progesterone ⇒ Maintainence of ♀
↳ Smooth Muscle contracts
↳ ↓ Amount of progesterone ↓es ⇒ Recurrent Abortion
⇓
Luteal Phase Defect (L.P.D.)
↳ also do decidualization (Hypersecretory change)
⇓
On HPE ⇒ "Arias Stella Reaction"
↳ No Progesterone
⇓
No Arias Stella Reaction.

* Source of Progesterone in early ♀ ⇒ Corpus Luteum
Pregnancy ← HCG Maintain it corpus Luteum survive
Natural late ⇒ Luteolysis *
Rescue the corpus luteum from Luteolysis
⇓
Pregnancy

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(23)

* Placenta will take over the function of corpus luteum.
  - ⇓
  - 8 week (8-10 week)*
  - Make Progesterone by precursor ⇒ Maternal LDL cholesterol**

* corpus luteum of pregnancy will Regress
  - 12 wks

* Ovarian cyst of 1st Trimester ⇒ May be enlarged corpus Luteum
  - Observation & Resolve after 12 weeks.

Estrogen ⇒ Specific to ♀ = E_3 Estriol.*
- E_2 = also formed; but Not specific
- Growth of Uterus
- Mask of ♀ = Melasma
  - Hyperpigmentation
  - (Stimulates Melanocytes)
- Retain salt/water
- obstetric cholestasis
- Thyroxin binding globulin ↑es.

* Placenta can't synthesize estrogen on its own
  - ↳ b/c 17α hydroxylase Lacks
  - ↳ dependent on the fetus for synthesis of estrogen.
    - ↳ Fetal DHEAS (from Adrenal glands)
      - ↓
      - Placenta
      - ↓
      - Sulphatase / Aromatase → Estrogen (E_3)
      - ⇓
      - Tells about fetal well being

HPL (Human Placental Lactogen) | HCS (Human Chorionic Somato Mammotrophin)

∴ It tells about i) Placental functioning

⇓

As P.G.Tes ⇒ Matures ⇒ ↑HPL

Peak = 36 wks.

QQ Which hormone is produced by placenta in Max^m Amount at term = HPL (1gm/day).

ii) endocrinal function ⇒ Main function
  - ↳ Insulin Resistance in ♀
    (Placenta acts as Growth hormone)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

QQ. Which hormone is Responsible for fetal growth (24)

⇓

Insulin like growth factor / IGF

* Promotes Maternal Lipolysis – Levels of free fatty acids are ↑ which mother utilizes as a source of energy ; sparing glucose for fetus.

HCG Hormone ⇒ Glycoprotein hormone (α|β)

⇓

(Human chorionic Gonadotropin

α Subunit ⇒ identical

↳ Non-specific

LH | FSH | TSH

β ⇒ specific

Syncytiotrophoblast

as early as 8 days post-fertilization (ovulation) it secretes "HCG" (8-9)

QQ

→ This hormone has highest Carbohydrate content of Any human hormone

If we want to take hCG before 8 days

↳ do Serum hCG ⇒ Quantitative

Very sensitive

↳ detect 1 IU/L.

Urine hCG ⇒ Qualitative

↳ 20 IU/L ⇒ ⊕ve after Missed Period.

based on "Sandwich ELISA"

* Serum Sensitivity ⇒ F.I.A. > R.I.A > ELISA = RRA > IRMA

F.I.A. ⇓ Fluorescent Immunoassay

R.I.A. ↑ Radioimmunoassay

IRMA ↑ Immuno Radiometric Assay.

ELISA = RRA ⇓ Radioreceptor Assay

⇒ hCG Value Tes as P.O.G. Tes → normal Tes

Maxim = @ 10 wks.*

Doubling time of β-hCG
↓↓
48 hrs.
↳ it Means Tes in 55-66% Minm after 48 hrs..
↳ it does N't Mean 100% or double

After 10 weeks = ↓es

Minm = @ 16 weeks

After 16 weeks = Plateau

v.v.g.
QQ

1st $\mathcal{D}_1 | \mathcal{D}_3$ — Tes by 55-66% ??

(N) Intrauterine Pregnancy

2nd $\mathcal{D}_1 | \mathcal{D}_3$ - Tes by <55% ??

Ectopic ♀

3rd $\mathcal{D}_1 | \mathcal{D}_3$ - ↓es

Non-viable ♀ / Abortion

* Critical value of hCG for TVS = 2000 I.U.

TAS = 6500 I.U.

If hCG is More than or equal to these value & we don't see Sac In the Uterus ⇒ Likely to be ectopic ♀.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(25)

* QQ // Condn Where hCG ↑es than Expected

- Multifetal ♀
- GTD (Gestational Trophoblastic Disease :)
- Down's Syndrome
- Hyperemesis gravidarum
- Underexpected Gestational Age.

* condn where hCG ↓es than Expected

- Non-viable
- Ectopic ♀
- over expected gestational Age
- Trisomy 18.

- Functions of hCG ⇒ . Maintainence of ♀ :
  - ↓ Uterine contraction ;
  - Growth & development of umbilical cord ;
  - 1st stimulus for Release of testosterone from Male Testis – hCG
  - Immunosuppressant

QQ Why the Conceptus Not Rejected ??

i) Villous trophoblast Lacks HLA (MHC) ;

ii) EVT (Extravillous trophoblast) – that have HLA-G → only in Human Shes Immunosuppressive

Thin decidua → NK cells have deficient cytotoxicity.

↱ M/c insertion ⇒ center.

UMBILICAL CORD (Attached to fetal side of placenta).

- Average Length = 55cm (30–70 cm)
- 3 vessels ⇒ 2 Umbilical A. (deoxygenated blood)
  1 Umbilical vein (Left) "Right U. vein disappear
  ↳ oxygenated blood

* Short cord < 30 cm
* Long cord > 70cm

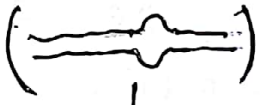
Umbilical vein from placenta → ductus venous → GVC → Heart

* Max^m O_2 saturation prt. in ⇒ Umbilical vein ⇓ 80%.
* M/c Vascular Anomaly of cord ⇒ SUA (2 vessel cord) (Single Umbilical A) then check GICA (Gross Congenital Anomaly)
  - ↳ CVS ⇓ M/c gross Anomalies
  - Renal ⇒ M/c Anomalies c SUA (Not gross)

* If we see SUA + GCA
  ↳ ↑ Risk of Aneuploidy * (26)
  (Trisomy 18) **

* Isolated SUA ⇒ doesn't Tes Risk of Aneuploidy *

* Incidence of SUA is higher in ⇒ Twin ♀ / Multifetal ♀
  ↓
  ↑ Risk of true Knot of Umbilical cord.

()
↓
False Knot ⇒ Protrusion of Wharton's Jelly containing loop of umbilical vessels.
↳ No clinical significance

True Knot ⇒ Tes the Risk of still birth;
↳ Cause ⇒ Fetal Movement.
↳ dlt Active fetal Movements
↳ Tes in Twin.

1st Umbilical Artery
↓
Umbilical vein
↓
Ductus venosus
↓
Ductus Arteriosus
↓
Foramen ovale

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

DOWN'S SYNDROME *

- Trisomy 21.
- Causes ⇒ Most common cause * ⇒ Non-dysjunction (95%) (during Meiosis-I)
  ⇓
  It is by chance; so; Non-heritable in Nature.
  - Recurrence = 1%.
- H/o 1st baby down's → Antenatal testing done in Next ♀.
- 5% → Inheritable
  - 4% ⇓ Translocation
  - 1% ⇓ Mosaicism

Q) 1st baby → Down → (Translocation 21, 21) (Robertsonian Translocation seen in Down Sx.)
↓
Risk = 100%
↳ Abortion. (in 2nd baby)

* all ♀ women
↳ offered down's screening. (Opt-out Screening).

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

SCREENING :→

1st Trimester

USG
- NT ≥ 3mm ⇒ +ve (Nuchal translucency) ↳ Fluid collection behind Neck;
- 11–13+6 weeks

Dual test ⇒ @ 11–13 weeks
- β HCG ⇒ ↑es
- PAPP-A ⇒ ↓es

(Pregnancy associated Plasma protein A)

* USG for NT + Dual test ⇓ Combined test*

2nd Trimester (27)

USG
- SOFT MARKERS* (Not specific)
- ≥2 Soft Markers ⇓ ↑es Risk of Aneuploidy
- 15–20 weeks 99

Maternal Serum Markers ↳ do @ 15–22 wks.
- Triple test ↳ hCG, AFP, UE3 (Unconjugated Estriol)
- Quadruple test ↳ hCG, AFP, UE3 + Inhibin A ↑es ↳ Produced by Placenta during ♀ & corpus luteum in Non-pregnant female

**

*Soft Markers ⇒ Most imp. ⇐
- Absent Nasal bone (Hypoplastic) ⇒ can be seen @ 1st trimester also
- Nuchal fold thickness ↑ed. ↳ (≥ 6mm) → Screening +ve

echogenic cardiac foci
echogenic bowel foci

- Short femur
- Short Humerus
- Short frontal lobe
- Short ear length
- Simian crease (single palmar crease)
- Short 4th middle phalanx (clinodactyly)
- Sandle gap
- Pyelectasis (Mild dilatation of Renal pelvis)

QQ M/c Congenital cardiac Abnormality in Down's Sx child ⇒

Endocardial cushion defect > VSD > ASD

↳ Not central (More towards one side)

QQ Gastroschisis is Not seen in Down's Sx patient ??

Omphalocele ⇒ Covering Membrane (+)

↳ central

* Confirmatory test ⇒ Karyotyping

M/c Method :- "G Banding"

↓

In Metaphase

↓

Drug: colchicine

1st Trimester

↓

Chrionic villous Sampling

⇒ ≥ 10 weeks

M/c ⇒ 11-13 weeks

don't do before 9 weeks

↓

b/c it May cause

↓

Limb defects

- can Result in False +ve test (Placental secell Lete hain)
- Riskly fetal loss 1-4%
- easily Result trophoblast (48-72 hr)

2nd trimester

↓

Amniocentesis

≥ 15 weeks

M/c = 16-18 weeks

don't do 11-14 weeks

↓

Early amniocentesis

↳ Fetal Loss

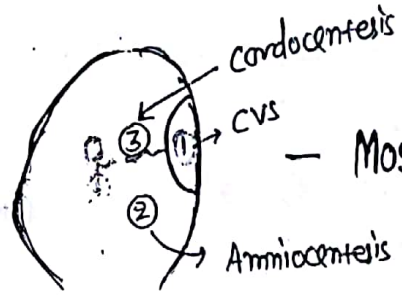
- More accurate
- More Safe < 0.5%
- delayed (7-10 days) Result

↓

Amniocytes Fibroblast.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Cordocentesis → Umbilical cord blood cells
⇓ (28)
from Umbilical vein (placental end)
⇓
b/c it is stable end.



– Most Risky ⇒ 3% fetal Loss.

* Amniocentesis all USG guided procedure; Not blind-procedure.

* NIPT (costly) (Non-Invasive Pre-Natal test) :⇒

- Genetic Material ⇒ cell free fetal DNA
- done on Maternal blood (Some amount of cell free DNA circulating in Maternal blood)
- ≥ 10 weeks
- this test is used as 2° screening (costly)
- has to be followed by confirmatory test;
- takes 7-10 days in Results.
- tells us about Trisomy 13, 18, 21
  Monosomy – XO

*** PHYSIOLOGICAL CHANGES AFTER PREGNANCY

Presumptive sign ⇓
Women experience
Result (eg ⇒ Amenorrhoea; Morning sickness etc)

Probable sign ⇓
· Seen by doctors

Positive sign ⇓
· Confirmatory
Earliest Dx = hCG (Serum / Urine)
USG
O/E ⇒ Fetal parts
↳ Fetal heart Rate

Probable sign ⇒ i) **Hegar's sign** ⇒ Softening of Isthmus (on Bimanual examination)
↳ Seen on 6th week

ii) **Good sign** ⇒ Softening of cervix
↳ Seen on 6th week

@ 8th weeks
iii) **Chadwick's (Jaquemier's sign)** ⇒ Bluish discolouration of vagina / vulva
iv) **Osiander's sign** ⇒ Lateral vaginal fornix Pulsations
v) **Piskacek's sign** ⇒ one half of uterus feels more enlarged (Asymmetrical)

(29)

vi) Palmer's sign ⇒ Regular Rhythmic uterine contraction
↙
@ 8th week (No Pain ; only felt by examinee)

vii) Hartmann's sign ⇒ Implantation bleeding (Not a problem)
↳ @ 8th week

On USG ⇒ 1st sign of Pregnancy on USG *

⇓

Gestational Sac **

On TVS ⇒ 4-5 weeks (± 1-3 day)
↙ empty bladder

On TAS ⇒ 5 weeks
↖ Full bladder

TVS is ∈ higher frequency (≥ 5 MHz)

TAS is ∈ Lower frequency (3 MHz).

Intradecidual sign ⇒ Marker of (early) Intra-uterine ♀

Yolk Sac appear ⇒ TVS = 5-5 week

TAS = 6 week

Fetal Pole ⇒ Cardiac activity → TVS ⇒ 5-6 weeks
→ TAS ⇒ 6-7 weeks

* Double-decidual sac sign ⇒ Marker of early Intra-uterine ♀.
↙ Decidua capsularis
↘ Decidua Parietalis

* Double bleb sign ⇒ Sign of early Intrauterine ♀.

↙ Amnion ↘ Yolk sac

QQ. earliest to see Gestational sac on USG ⇒ 5th week

QQ. Earliest time Gestational sac can be identified on TVS from LMP ??

QQ. Earliest time Gestational sac can be identified on TVS from fertilization ??

↳ LMP - 15days = 30 - 15 = 15days

⇒ What ever Seen on TAS can be Seen in TVS (vice versa is Not true)

⇒ In Ectopic : Ring in Uterus ⇒ Single Ring in Uterus

⇓

"Pseudosac" ⇒ Prt. in centre of Uterus.

General changes ⇒ ① Additional calorie Requirement

⇓

350 Kcal/day

↳ In 1st Trimester = No additional calorie Requirement

In ♀; everywhere Progesterone except ⇒ Obstetric cholestasis ⇒ estrogen
Salt & water Retention ↑

Brought about by ↑↑ Retain Salt/water

② Average wt gain ↳ 12 Kg (10-14 Kg)

③ BMR ⇒ ↑ by 20%

④ Salt/water ⇒ 6-5 L

(4) Plasma osmolality ⇒ ↓ves (10 mosm/kg)

(30)

(5) Plasma volume → ↑40%.
Red cell Mass → ↑20%.
⇓
Hemodilution condition ⇒ Anemia of Pregnancy

Anemia ⇒ Hb < 11 gm%; Hematocrit < 33%.
↳ M/C = Iron deficiency Anemia *

Total Fe Requirement = 1000 mg
300 mg (Ferus)

Best test = S. Ferritin

Prophylaxis = 9FA (100 mg Fe (in Ferus form) + 500 Mg FA)
→ 1 tab
→ 6 month during Pregnancy
6 month after delivery

T/t of Anemia ⇒ IFA tab (2 tabs) iv/ Acute blood loss & Hg < 6 gm%
↑ Blood transfusion

Parenteral
i) If the patient is Not compliant by oral tab
ii) Not tolerating oral tab
iii) Malabsorption sx.

Blood transfusion
i) if > 34 weeks @ ♀ & Hg < 7 gm (even ∧ Heart failure No sign/symptom)
ii) if < 34 weeks @ & Hg < 5 gm (even No sign/symptom of Heart failure)
iii) Anytime sign & symptom of CHF.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

⑥ TLC ⇒ ↑es (It doesn't Mean Infection)

↳ 15,000 during Trimester

25,000 after Postpartum.

⑦ DLC ⇒ Neutrophilia

ESR ↑

CRP ↑

⑧ Platelet count ⇒ Average platelet count ↓es

↳ Not Causes Thrombocytopenia

⑨ Clotting factors ⇒ all ↑es except ⇒ Factor II & IX.

⑩ Insulin Resistance ⇒ Hyperinsulinemia

↑as Polo ↑es

Significant > 24 weeks

↳ Fasting - Hypoglycemia

Post-prandial - Hyperglycemia

QQ

* Anemia : < 11 gm/dl

Severe Anemia : < 7 gm/dl

Very severe Anemia : < 4 gm/dl

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Systemic *

CVS **

(31)

↳ Plasma Volume ⇒ ↑40%
Red cell Mass ⇒ ↑20%
Cardiac output ⇒ ↑40%

O_2 demand of tissue = ↑20%

O_2 carrying capacity = ↓ves *
← feature of Hb; Not of Red cell Mass

A-V O_2 gradient of tissue = ↓ves

- all heart Sounds are loud = Loud S_1
- S_3 (gallop Rhythm)
- Systolic Murmur (Ejection systolic Murmur)
  ↳ Physiological upto grade 2.

Diastolic Murmur
↳ almost/ Always Pathological

- Heart Rate ↑es (by 16-18 beats/m above baseline) (<100)
- split S_1
- Apex beat ⇒ heard @ 4th ICS (b/c Heart is Rotated Anteriorly & Pushed up).

On CXR ⇒ cardiac Silhoutte (appears big)
Cardiomegaly ⇒ always pathological

On ECG ⇒ LAD ⇒ Physiological
↳ Left Axis deviation**

- Blood pressure = DBP > SBP ↓es (Both Fall)
(10 mm Hg) (all vasopressure Res)

E|P (Estrogen | Progesterone)
→ i) Vasodilation
ii) Resistance against vasopres.

begins – 5 weeks (↓ in DBP begins @ 5 weeks)
Maxim = 24-26 weeks
after 26 weeks = begins Res
(Come back to Prepregnancy value)

* > 20 weeks ⇒ Supine hypotension syndrome
⇓
Gravid Uterus compresses IVC
Changes position to Left Lateral Position
↳ Res Utero-placental circulation
Fetal O2 saturation by ↑

* Preload ⇒ ↑
afterload ⇒ ↓ (dt fall in systemic vascular Resistance)

* Ejection fraction = No change

- Central venous Pressure = No change (32)

⇓

Persistently distended Neck veins

⇓

Pathological Always *

- CHF (Highest Risk)

⇓

Cardiac output Tes seen

(Immediate Post-partum (3rd stage) > 2nd stage of Labour > 32 weeks)

↳ CO is Not Tes Until it goes to 2nd stage of Labour. after 32 week of P.O.G.

QQ CO is Maxm @ :-

a) 28 week; b) ~~32 week~~; c) @ term; d) 36 weeks

QQ Pre-eclampsia Not Commonly dx in

↳ 3rd Trimester.

26/4/18

KIDNEY

⇒ Tes Renal blood flow by 80%.

GFR Tes by 50%.

⇒ S creatinine / BUN | Tes;

S Uric acid Level ⇒ No change b/c Reabsorption.

* S. Creatinine ↑ } Pre-eclampsia*
  S. Uric acid ↑ }

* Kidney - enlarge by 1cm

* Hydroureter - b/c of Progesterone
  ↳ Smooth Muscle Relaxant
  ↳ Rt side > Lt side; Why??
  Gn ♀ Uterus becomes dextro Rotation towards Rt. side
  ↳ Compresses Right Ureter @ the Pelvic Brim.
  ⇓
  Bladder Pressure ↑es
  ↳ From 8cm H_2O
  ↳ To 20cm H_2O.
  but still doesn't become Gn continel as Urethral pressure also ↑s

* Urinary Stasis :→

Urine — Routine - Asymptomatic Bacteriuria > 10^5
       Microscopic
  ⇓
  Treat; if we don't treat than chances of Pyelonephritis becomes high.

* Glycosuria - b/c Renal threshold ↓es.

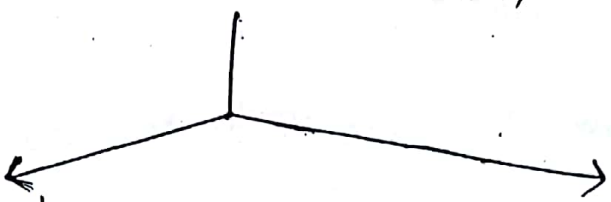
* Proteinuria - ≥ 0.3 gm/24 hr of Urine Sample
  ↳ Not Physiological; it is Pathological

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Respiratory system

(33)

* Tidal volume ↑es
* Minute ventilation ↑(40%)



No change in Respiratory Rate

↑ depth of Respiration
⇓
By Progesterone
⇓
↑ sensitivity of Respiratory center to CO_2

PCO_2 ↓ } Mild Respiratory
PO_2 ↑ } Alkalosis

pH = No change ; b/c Renal excretion of HCO_3^-
S. HCO_3 ↓es (to 22 mmol)

* Diaphragm Rises by 4cm
↑ transverse thoracic diameter = 2cm

Total Lung capacity = ↓es
Vital capacity = No change

So; ERV ↓es ; IRV = No change — pH, RR (Respiratory Rate), FEV_1, PEWP
RV ↓es

* Diphragmatic Excursions ⇒ ↓ in Pregnancy.

GIT

* GERD Seen ⇒ b/c LES tone ↓ by Progesterone & Gastric Pressure ↑.

* Gastric emptying time shows No change in all trimester.

* Nausea, vomiting = d/t hCG hormone
  - ↳ 1st Line drug in ♀ = Pyridoxine
    - ↓ No Response
    - Doxylamine + Pyridoxine

* Hyperemesis Gravidarum ⇒ Nausea & vomiting causes either ≥ 5% wt. loss &/or Ketonuria
  - ↳ d/t hCG
  - ↳ Infection of H. Pylori
  - Seen in Multifetal ♀ ; & female sex Fetus ;

* 2 vit. deficiency → Vit. K – Coagulation defect
  → Vit B_1 – Wernicke's encephalopathy,

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

- Can cause esophageal tear (Mallory-Weiss tear);
- Renal failure - (Acute Renal failure). (34)

Rx ⇒ Stop all oral intake
give i/v Fluids + i/v Antiemetics.

* Liver ⇒ ALP ↑ Gross Tes
↳ b/c Placental-ALP
↳ Not a Marker of cholestasis (it is Physiological Tes)

- Tes Production of Albumin/Globulin
- S. proteins → Fall (b/c Production is less than Volume Tes)
- AST; ALT both ↑es

Endocrine system*

Pituitary ⇒ N In Size 135↓

b/c Lactotroph ↑↑ (Vascular supply ↑↑)

In Severe PPH — Vascular supply — ↓ to Pituitary
⇓
Infarction
⇓
"Sheehan's syndrome"

Sheehan's Sx ⇒ M/c Presentation ⇒ Failure to Lactate

2nd M/c ⇒ Amenorrhea

Usually – Ant. Pituitary affected

⇓

Post. Pituitary spared.

⇒ if a ♀ doesn't Lactate – Menses by 6-8 weeks.

S. Prolactin Level – Higher

Pregnancy

Lactation

⇓

After delivery S. Prolactin ↓es by 50%

Prolactin – Milk Synthesizing hormone

Oxytocin – Milk Let down / ejection hormone

1st Stimulus ⇒ Initiation of Lactation

(↓ $\bar{E}+\bar{P}$)

Fall of E&P also causes ⇒ Post-Partum depression (Blues)

THYROID ⇒ · Thyroid binding globulin ↑ (d/t Estrogen) (35)

· Total T_3 & T_4 ↑
· Free T_3 T_4 ↑ (slightly)
} ⇒ ↑ Production from the gland

· TSH ↓es (slightly)

Why ?? ⇒ b/c of hCG

⇓

α = TSH (Same as TSH)

· I_2 Requirement ↑ (♀ & Lactation) both have RDA = 250 µg/day.

Pregnancy is Euthyroid condition

· I_2 excretion ↑es.

* M/cc of hypothyroidism in ♀ ⇒ Hashimotos ds

M/cc of hyper thyroidism in ♀ ⇒ Graves ds.

Q K/c/o hypo-thyroidism ; L. thyroxine 25 µg

Dx = Pregnancy ⇒ ↑es ∧ by 50% (b/c Some part of Thyroid become degenerated) doses

Hypo-thyroidism May cause abortion.

Maternal Nerve Injury ⇒ M/c in Lithotomy position

⇓

Common Peroneal Nerve

* M/c in Post-partum / Peri-partum / Intra-partum / extended Lithotomy position

⇓

Lateral Cutaneous N. of thigh > Femoral N.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Foot drop in ♀ is dft "Lumbosacral plexus compression."

*

Fetal Swallowing ⇒ 10 weeks

Fetal breathing Movement ⇒ 11 weeks

Fetal Urine production ⇒ 12 weeks

Fetal Meconium production ⇒ 16 weeks

IgM production in baby ⇒ 20 weeks

by Mother ← IgG transfer in baby ⇒ 16 weeks

Sulfactant synthesis begins ⇒ 20 weeks

Sulfactant appears in Amniotic Fluid ⇒ 28 weeks

Glucagon production ⇒ 8 weeks

Insulin production ⇒ 12 weeks

H-P (circulation) ⇒ 12 weeks *

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

AMNIOTIC FLUID

(36)

Major Source ⇒ Fetal Urine

Major Removal ⇒ Fetal Swallowing

Major Source → in 1st 12 weeks ⇒ Ultrafiltrate of Maternal plasma.

In 12–20 weeks ⇒ Transudate across fetal skin

in 720 weeks ⇒ Urine.

* 98% Amniotic fluid ⇒ Water (Nutrition)
  ↳ Not help in Nutrition.

* Colour of Amniotic fluid ⇒ Straw coloured

Green colour = Meconium-Stained

Dark = Abruption

Golden = Rh Incompatibility

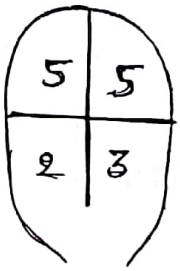
Tobacco Juice (Dark brown) = GUD

Greenish Yellow (Saffron) = Post Maturity

* pH = 7–7.5
* Osmolality = 260 mosm/.
* Water is Replaced in every 3 hrs.

	AFI (Amniotic Fluid Index)	DVP (Deep Vertical Pocket)
Normal	5-24 cm	2-8 cm
Polyhydramnios	≥ 25	≥ 8
Oligohydramnios	≤ 5	≤ 2
	More common Method	Better (No quadrant so, Less error)

AFI :→



⇒ divide in 4 quadrant Arbitrarily

15 = Amniotic fluid

DVP → Not divided in quadrant; only Pocket division.

* Absolute value ⇒ Polyhydramnios = 2L

Oligohydramnios ≤ 200 mL

* In twin ♀; We can't use AFI ; only use DVP;

↳ b/c we don't know about quadrant of both Fetus.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(37)

Mild — Poly. — Idiopathic
— oligo.

Moderate - Severe — Poly → Gross congenital Anomaly
— oligo.

Gross congenital Anomaly
⇓
GIT > NTD
Leakage of CSF in Amniotic Fluid.
⇓
b/c of Fetal Swallowing Problem
duodenal Atresia
⇓
double bubble sign.

oligo → B/L Renal Agenesis
Posterior Urethral valve
↳ "Key hole sign" on USG seen.
Urethera ← Bladder (dilated)

Lady comes c Poly | oligo (Moderate - Severe)
⇓
diabetes
↳ Leaking Amniotic fluid
⇓
Seeby Per speculum examination.

* Polyhydraminos have high Risk of → (Moderate - Severe)

① Maternal Respiratory distress;

② Pre-term Labour - <37 weeks

③ PreMature Rupture of Membrane — Membrane Rupture before Labour.

Pre-term preMature Rupture of Membrane - <37 wks & PROM.

④ Abruption — Sepration of Placenta from Underlying decidua.

↳ prevented by Controlled ARM

⇓

Multiple pin prick holes into the Membrane

⑤ Cord prolapse

↳ Obstetric emergency b/c of temperature change to cord → vasospasm

↳ Severe fetal distress.

⇓

do emergency C.S.

i) Reposit the cord above the presenting part;

ii) Fill the bladder;

iii) elevate the buttock;

iv) Og by mask v) IV fluids given.

http://mbbshelp.com - WhatsApp: +1 (402) 235-1397

* We do emergency c.s. ; depends on (38)
  - ↳ Cord pulsation (Absent)
  - Fetal heart Rate (Absent)
  - ↳ do vaginal delivery.. (GUD case)

6. Malpresentation ;
7. PPH ;
8. GCA ;
9. Diabetes ;
10. Amniotic fluid embolism

* Oligohydraminos have high Risk of :-
  1. Pulmonary hypoplasia ;
  2. Fetal distress (cord compression)
  3. Malpresentation
  4. IUGR
  5. PE (Pre-e
  - Association c oligo. b/c of Uteroplacental insufficiency. (UPI)
  6. Early in pregnancy oligo.
     - ↳ viral infection (TORCH/zika)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

⑦ Amniotic band sequence :⇒

tears in Amniotic Membrane

↓

Severe oligohydramnios (clt leakage)

⇓

Bands & tight wrap around fetus.

M/c Anomaly in Amniotic band sequence ⇒ Limb Anomalis > craniofacial Anomalies

⑧ Amnion Nodosum

↳ S. oligo (severe) + Yellowish Nodules on the Membrane

⑨ Compression defect ⇒ CTEV (club foot)

QQ Diagnostic Amniocentesis :→ ① Karyotyping;

② Neural tube defect → AchE / AFP *

Best screening test for NTD ⇒ USG

Best test for NTD ⇒ AchE/AFP (Amniocentesis)

other screening test for NTD ⇒ Serum Alpha-feto protein

16-18 wk

> 9_0 [illegible]

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* AFP Peak — In Fetus — 13 weeks
  — In Mother — 32 weeks
  ↳ $t_{1/2}$ = 5-7 days.

(39)

* ↓ Level of AFP seen in ⇒ Down's Sx;
  Diabetes;
  obesity;
  Molal ♂♀;
  GUD.

(3) Lung Maturity ⇒ M/c = L/S Ratio ⇒ > 2 ⇒ Mature
↳ Best test ⇒ PG (Phosphatidyl Glycerol)
↳ Not affected by presence of Contaminants.
↳ in Diabetes Mothers.

(4) Hemolytic Anemia ⇒ in Fetus

(5) ASKs of acute viral infection in fetus
↳ Amniotic fluid Polymerase chain Reaction.

In Acute Maternal Infection ⇒ 4 fold Rise in Ab titre in Paired sera.

— Avidity test.

(6) Chorioamnionitis

P.O.G. –	Amount of Amniotic Fluid
* 12 wk →	50mL
16 wk →	250mL
20wk →	400mL
32 wk →	1 Litre (Maxm)
36wk →	900mL
Term | 40wk →	800mL
42wk →	200mL

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

POST-PARTUM HEMORRHAGE

(40)

3rd Stage ⇒ Placenta expulsion

↳ Avg. time - 15-20 min

Prolonged > 30min.

Signs ⇒ ① Gush of blood;

② Lengthening of cord; — Apparent

③ Suprapubic bulge; — Permanent

④ Fundal height Tes

Best sign ← ②

Best sign ⇒ Placenta lying in vagina > Lengthing of cord

Ⓝ Avg. Blood Loss ⇒ Vaginal delivery = 500ml

C.S. = 1000ml

Twin vaginal delivery = 1000ml

PPH

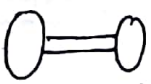
1° — < 24 hrs of deli

M/c cause ⇒ Uterine Atony

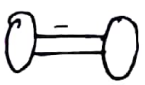
2° — > 24hr upto 12 weeks

Retained Placental tissue

Placental Abnormality which is RF for PPH ⇒



"Succenturiata



"Bilobata".

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

4 Ts — Tone (Uterine Atony)
Trauma
Tissue (Retained placental tissue)
Thrombosis (defect)

* R/F for Atonicity :→ i) Multifetal ♀
ii) Macrosomia
iii) Polyhydramnios
iv) Induction of Labour
v) Augmentation of Labour
vi) Precipitate Labour
(onset - expulsion c/in 3 hours)
vii) Any kind of APH
viii) Multiparity
ix) Diabetes Mellitus
x) Pre-eclampsia
xi) Chorio amnionitis

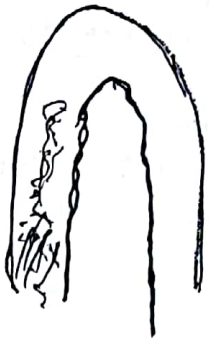
* Most Important things for placental separation
↳ Uterine contraction.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Plane of Placental separation ⇒ Spongiosum (41)

↳ Layer of decidua*

Methods by which placenta separates :-



• Placental separation ↳ Starting @ centre	Starts @ Periphery
• Schultz Method*	Duncan's Method*
• external bleeding — after complete separation	begins ∈ onset of separation
• Blood loss ↓ (Total)	Total blood loss ↑↑
• Side presents @ vulva = Fetal side ⇓ Shiny	Maternal side ⇓ Dirty ↳ Duncan's Method*
Shiny side ↳ Schultz* 80% Cases (M/c separation)	20% Cases
• Retroplacental clot or, is formed	• Absense of Retroplacental clot.

* M/cc of PPH ⇒ Atony > Genital tract Trauma > Retained tissue > Inversion > Rupture Uterus > Amniotic fluid embolism.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

QQ Prevention of PPH (AMTSL)

↳ by WHO
Active Management of Third stage of Labour.

Components ⇒

I) give Uterotonic Agent immediately after delivery
↓ ⇓ c/in 1 min.

a) Doc: Oxytocin
↓
10 IU — I/m bolus (onset c/in 3min, duration 3hr)
— i/v infusion (immediate, 1hr.)
↳ Not give bolus b/c it is R/F for = Hypotension
↓
Reflux Tachy. | Arrythmia | MI | cardiac Arrest QQ

MOA ⇒ by Tes Intracellular Ca^{+2}

• Oxytocin causes Release of $PGF_{2\alpha}$ from decidua.

– Naturally synthesis oxytocin ⇒ Nonapeptide
Artificially Synthesis oxytocin ⇒ octapeptide

– Synthesized from - hypothalamus
↓
Paraventricular Nucleus

– t1/2 = 3min (3-5 min)

– Stored in cold chain (2-8°C)
↓

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(42)

b) Methergin (ergometrine)

↳ 0.2 mg i/m

↓

don't give i/v → causes transient severe hypertension

So; C/I in ⇒ Pre-eclampsia

Eclampsia

CVS disease

Peripheral vascular disease

tetanic contraction (Acts More on LUS; while oxytocin on all Uterus).

Brown colour – b/c of Photosensitive Nature.

↓

c) Syntometrine (5 U oxytocin + 0.5 mg Methergin)

- Very Potent
- Not Doc → expensive
  → Not available

↓

d) Carbetocin = Synthetic oxytocin

↓

Octapeptide / Longer t1/2

↳ 100 µg Slow i/v over 1 min.

↓

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

e) Misoprostol = PGE_1 analogue

↓

Prophylaxis = 600 µg (per oral)

Route = oral (In India ⇒ per Rectal)

Asthma is Not a C/I.

M/c side effects ⇒ ** Hyperpyrexia (fever ± chills).

↳ directly proportional to dose

Other side effects ⇒ Nausea; Vomiting; Abd. Pain; Hypotension.

II) Delivery of placenta by Controlled Cord traction :-

Also " Modified brandt andrew Method "

↳ do only when trained birth staff present.

eg
Rt. hand ⇒ Hold cord
Lt. hand ⇒ Push Fundus up.

III) Delayed cord clamping :⇒

↓

≥ 60 Sec. (1-3 min)

↓

Goes More blood to fetus (80 ml)

↓

↑ Hb by 2 gm% ← 50 mg Fe

In HIV patient ⇒ Delay cord clamping done

↳ transmission happen during Labour.

Never done acc. to AMTSL in Normal Labour.

early cord clamping

↓

≤ 1 min 60 sec

Indications ⇒

- Baby Needs Resuscitation
- Rh Incompatibility
- Baby is known case of Heart disease

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(43)

IV) Intermittent Uterine tone assessment ⇒

Uterine Massage = Not done

↳ Not a component of AMTSL.

QQ Most Imp. component ??

(A) I; (B) II; (C) III; (D) IV

Management of PPH (Shock Index = Heart Rate / SBP)

↳ (N) = 0.5–0.7

if > 0.9 ⇒ Immediate Resuscitat.

Symptomatic T/t

i) 2 Large bore i/v Cannula (14/16 Gauge)

ii) i/v fluids – crystalloids

iii) Arrange blood & blood products;

iv) Catheterize – Urine output

v) Blood group/ Rh / CBC / Coagulation Profile

⇓

to decrease Morbidity & Mortality Rate.

Specific T/t (Algorithm)

↓

BiManual T

) B/M Uterine Massage

+

Call for help

+

Utero-tonics given

↳ Doc T/t

↳ oxytocin

⇓

20IU — 40IU / 500ml of NS/RL

Not in 5% dext.

⇓

If we give Large doses, Large duration, in electrolyte deficient media

⇓

Result in water intoxication.

↓ if Not Responding

Inj. Tranexa (Tranexamic Acid)

↳ Anti fibrinolytic drugs

↓

Antifibrinoly

1gm slow)

↓ if Not Responding

Methergin 0.2 mg (i/m) | Carboprost (Methyl PGF2α)

⇓

0.25 mg (i/m)

↳ H/o Asthma ⇒ Not given; Pt. dies of bronchoconstriction

Diarrhoea (M/c side effect of carboprost)

↓ if Not Responding.

Misoprostal → to be used when i/m ; i/v can't be given.

↳ Ht = 800mcg (Sublingual)

Not given P/V (Per vagina)

Can give P/R (Per Rectal)

* All drugs trial to happen upto 30min.

↓ if Not Responding.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(44)

Placenta – completeness

⇓

Uterus feel Like Intermittent atonicity

⇓

- i.e Not tonically contracted blc of Retain placental tissue

Genital Tract trauma

⇓

PPH ⇒ Uterus tonically Contracted then Reason is

No trauma

Placenta complete

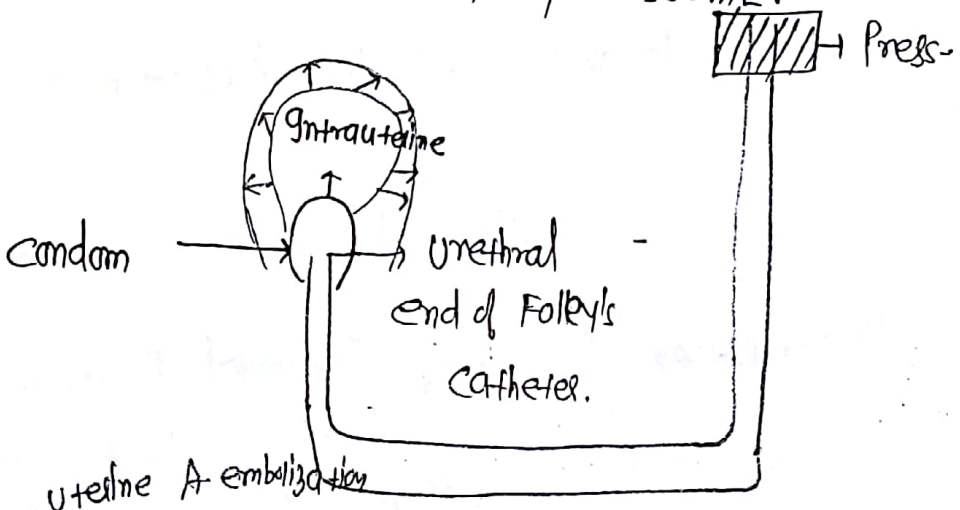
⇓

Balloon Tamponade — Bakri Balloon tamponade

Sengstaken Blakemore

⇓

Maxm Fluid capacity = 500 mL.



Uterine A. embolization

do UAE ⇐ Minimally invasive Method — if Not Responding

⇓

· do in hemodynamically stable pt.;

· Availability.

Surgical Method

Surgical Management

- Uterine compression Suture (B-Lynch suture) → Brace

⇓

Applied on Uterus & helpful only in Atonic PPH.

↓ if Not Responding

B/L Uterine A. Ligation

↓ if Not Responding

B/L - Anterior division of Internal iliac

↳ 4 5cm distal to bifurcation of common iliac

↳ It ↓es Pelvic Pulse pressure by 80%

↓ if Not Responding

Hysterectomy (Possible $\frac{to}{do}$ Sub total Hysterectomy

(Remove Uterus – spares the Cervix

K/as "Supracervical Hysterectomy"

↳ to Improve sexual life of female

↓ if bleeding continues think about "D.I.C."

9-CU.

↳ DIC **

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

TRAUMA :→ Perineal tear

↓

to prevent

① do Routine episiotomy ⇒ No

② one hand = Support the perineum

③ other hand = Maintain flexion of head

④ tell the Mother Not to push @ the time of head delivery.

⑤ NICE ⇒ application of warm
Guidelines Perineal compresses

Perineal tear differ from episiotomy (45)

↓

It is surgically planned incision.

· done in special cases

↓

Forceps ; Breech condn

MedioLateral

- ↑ Pain
- ↑ Dyspareunia
- breaks down easily
- ↑ Blood loss
- Poor cosmetics

Median

↓

extends

↓

Rectum sphi -ter & Mucosa

Degree of Perineal tear ⇒

Repaired In Labour Room.

- 1st degree — Vaginal Mucosa & Skin
- 2nd degree — Perineal Muscle
- 3rd degree — A — <50% EAS torn
  - B — >50% EAS torn
  - C — Both IAS & EAS torn
- 4th degree — Upto Rectal Mucosa

(Complete Perineal tears)

Complete Perineal tears ⇒ obstetric emergencies
c in 24 hrs
↳ 3 types

1st to be Repaired ⇒ Rectal Mucosa
↓
Internal Anal Sphincter (IAS)
↓
External Anal Sphincter (EAS)
↓
Vaginal Mucosa
↓
Muscle
↓
Skin

Episiotomy

Sphincter ⇒ End-end Anastomosis

Mucosa = Continous suture

Muscle = Interrupted suture

Skin = Mattress suture

M/c used suture = Vicryl (Polygalactin-910)

* Another Tear ⇒ Hematoma

↳ M/c Presentation = · Pain
· Inability to Pass Urine

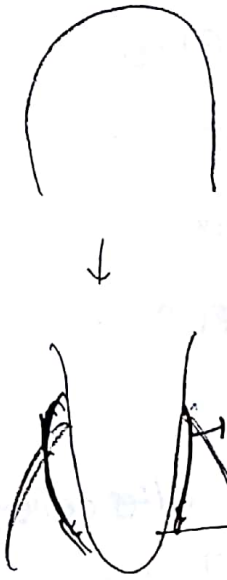
↳ Rx = Analgesics
Monitor
ice-packs (Local application) → Vasoconstriction

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

- Looks like bluish tender swelling
- Surgical Mx = ① shock
② expanding in size
③ excruciating Pain (hematoma expanding internally)
↳ Muscle.

(46)

* In Inversion ⇒ Stretch on the Ligament
⇓
Neurogenic shock (1st shock to develop
↳ Hemorrhagic shock
↳ death.



Rx ⇒ do Manual Repositioning
(Johnson's Method)
· Part which comes out Last;
has to be Reposited first.
↓ ib fails
Hydrostatic method (O sullevian Method)
↓ ib fails
Surgical Management

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Surgical Mangement for Inversion — Haultain
Huntington
Spinelli

- emergency; give general Anesthesia ; Not Spinal Anesthemia

↓

Relaxes uterus

also In Inversion

Manual Removal of Placenta

Hemodynamically Unstable patient

Qq. Pt. goes into Shock (or death) after delivery

Most probable cause ⇒ PPH

Qq Pt. goes into Shock Immediately after delivery

- Most probable cause ⇒ Inversion

Qq Pt. goes into Shock (unexplained) after delivery

Most probable cause ⇒ Amniotic fluid embolism

(Very Rare / diagnosis of exclusion)

K/as " Anaphylactoid syndrome of Pregnancy "

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

→ No Lab test to confirm or Refute diagnosis.

* clinical diagnosis of AFE :- (47)

1st phase ⇒ Sudden onset of breathlessness

⇓ ↓

highly Mortality hypotension

↓

Cardiac arrest

↓

Coma

2nd phase ⇒ Pt. goes into DIC + Hemorrhage

⇓

death seen

Test we can do ⇒ Sample from Pulmonary vessels

⇓

Lanugo / vernix / amniotic fluid seen

DIC

Mcc = - Abruption

also by = AFE

Massive Hemorrhage (APH / PPH)

Sepsis (septic abortion)

GVD (≥ 4 weeks ↑ Risk of DIC)

Management of GUD ⇒ Wait & watch

↓↓

Must go into spont. Labour ≤ in 2 weeks

↳ Signs ⇒ Robert's sign ⇒ comes @ 12 days
↳ gas in Major blood vessels

Spalding sign ⇒ comes @ 7 days

Ball sign ⇒ Hyperflexion of spine

Buddha sign ⇒ Subcutaneous edema
↳ seen in hydrops fetalis

↳ Not a sign of GUD.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

PREECLAMPSIA

(48)

* Gestational HTN ⇒ i) BP ≥ 140/90 on 2 occasions; 4-6 hr apart

ii) BP high > 20 weeks;

iii) Return to (N) ∈ in 12 weeks Post-partum.

iv) No evidence of Proteinuria

* Blood Pressure should taken in sitting position.

* 5th Korotkoff Sound head

* Pre-eclampsia ⇒ i) BP ≥ 140/90 on 2 occasions; 4-6 hr apart

ii) BP high > 20 weeks

∈ Any of the following

Proteinuria

= ≥ 0.3 gm / 300 mg

in a 24 hr Urine Sample

or

Urinary protein / creatinine ≥ 0.3

OR

Dipstick (1+)

End-organ damage

(It could be Any of the following).

i) platelet count < 1 Lakh;

ii) Serum creatinine > 1.1

iii) Liver enzymes all More than twice the (N) value

iv) Pulmonary edema

v) cerebral / visual symptoms

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Pre-eclampsia → Mild

→ Severe either / or both

1. BP ≥ 160/110mm Hg
2. End organ damage

→ CR

all Removed ∴ IUGR

Proteinuria ≥ 5gm/24hr

Oliguria

* Eclampsia ⇒ Pre-eclampsia + Seizures

* Chronic HTN in ♀ ⇒ i) If BP is high before conception;

ii) BP is high in 1st 20 wk;

iii) BP Remains high > 12 week post partum Period.

* Chronic HTN ± Superimposed Pre-eclampsia ⇒

i) New onset proteinuria beyond 20 weeks.

ii) End organ damage > 20 weeks

iii) Uncontrolled HTN > 20 weeks

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

- Impending eclampsia ⇒ if she has Any of the following sign & symptom ⇒ i) epigastric pain (49)
  ↳ Stretching of Liver Capsule.
  Spontaneous subcapsular hematoma

  ii) Headache / dizziness
  ↳ cerebral hypoxia

  iii)

  Blurring / diplopia / Blindness — Central — occipital Lobe hypoxia
  Scotoma — Peripheral = Retinal detachment
  ↳ Hypertensive Retinopathy

  iv) HELLP Syndrome
  ↳ Mostly – Feature of severe Preeclampsia
  ↳ Blood pressure in 15% of patient is (N)

Criteria ⇒ all should be present in Patient ⇐
- H = Hemolysis (a) Peripheral Smear
  ↳ Schistocytes (Helmet cells);
  b) S. Billirubin ≥ 12
- EL ⇒ Elevated Liver enzyme (ALT ≥ 70 gu)
- LP = Low Platelet count (Plt. count < 1 Lakh)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* M/c Presentation ⇒ Pain → epigastric Pain (Rt. upper quadrant)

⇓

Seen in 3rd trimester

D/D ⇒ ~~it~~ Acute Fatty Liver of ♀ (closet to HELLP)

of HELLP Sx (ii) Hepatitis

(iii) obstetric cholestatsis

differentiated by presence of

① Hypoglycemia

② Hepato Renal Sx

③ Coagulation defect

④ Pancreatitis

Pathophysiology ⇒ it (AbN) of β-oxidation of Fatty acids — Mother (Mitochondrial)

Mainly in 3rd trimester

(More severe form Liver injury) ... (ii) LCHAD enzyme deficiency — Fetus

by Postmortem Liver Biopsy confirmed if.

M/C cause of Acute Liver failure in ♀ = AFLP

- High Mortality Rate

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Acute hepatitis

↳ have Prodromal symptom. (50)

- Liver enzyme Raised
- Bilirubin - Markedly Raised

M|c Acute hepatitis in ♀ ⇒ Hepatitis E

↳ high Mortality Rate

* Obstetric cholestasis

- M|c Symptom ⇒ Pruritis
  - ∴ Seen in 3rd Trimester
  - Estrogen
  - Mutation in genes ABCB4, ABC B11
- Serum bile acids become accumulating
  - ↳ Diagnostic test
- TH ⇒ Urso deoxycholic Acid

→ Most Risky for Fetus = Preterm Labour;
Irritate the bile acids; ⇐ Sudden still birth;
Result in the all of three. Meconium Aspiration syndrome

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Termination of ♀ ⇒ (≡) 37 weeks ⟶ (≤) 38 weeks
In obstetic Cholestasis

** Recurrence Risk of HELLP = 4-7%.
Obstetric Cholestasis = 70%

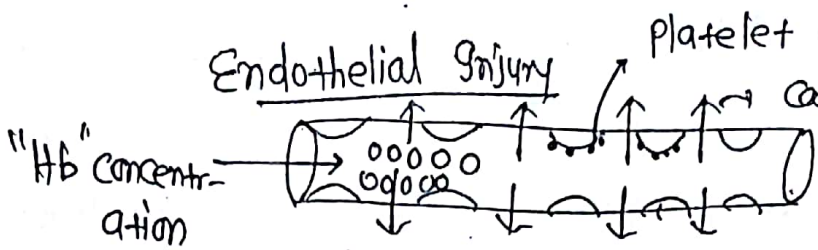
* Pathophysiology of Pre-eclampsia :→

Vascular Remodelling
Absent
⇓
Vessels in Decidua Basialis
↓ ↳ it means Remain sensitive to vasopressin
Result in Utero placental Insufficiency

↳ Pt Ischemic → Inflammatory Mediators Release
↓ → SFlt-1; S-Eng both ↑es
↑ vasodilators
PLGF, VEGF ↓es

- Pale & Small Placenta Seen in Pre-eclampsia,
- S-Flt-1 → Soluble FMs like tyrosine Kinase
  S-Eng → both are vasoconstrictes
  ↳ Soluble-endoglin
↓
Endothelial activation → HTN
↓ ↑ Ris, Plt
↓ NO availability ←
1st sign & Symptom in Pre-eclampsia

http://mbbshelp.com WhatsApp: +1 (402) 235-1397



(51)

fluid ⇒ Edematous patient

Edema & Hb concentration } Not criteria or Predictors; only bindings

if this capillary supply kidney

Cause End-organ damage

1st & M/c organ affected in Pre-eclampsia

Kidney shows "Glomerular Endotheliosis" on HPE.

↑ Serum Uric acid ⇒ also a ~~criteria~~ binding not criteria

* Immune theory :-

- Normally ⇒ ↓ TH_1 ⟶ ↑ TH_2 Response

In pre-eclampsia – this shift doesn't happen

⇓

so; ↑ TH_1

⇓

altered Immune Response to paternally derived Antigen.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

- **Risk factor** :→ i) Primigravida; (b/c 1st time expose to Antigen)
  - ii) Molar pregnancy (Extra paternal chromosome)
    - ↳ can develop Early onset Pre-eclampsia;
  - iii) APLA
  - iv) Multifetal ♀
  - v) Chronic Hypertension
  - vi) Renal disease;
  - vii) Diabetes Mellitus;
  - viii) obesity
  - ix) extremes of age <18; >35 yr age
  - x) Previous H/o Pre-eclampsia

- **Protective factor** :→ i) Smoking
  - ii) ♀t has ⊖ve association ⊂ Placenta previa;
    ♀t has ⊖ve association ⊂ Abruption.

- **Predictors of Pre-eclampsia** :→ i) ↑ sFlt-1
  - ii) ↑ s-eng
  - iii) ↓ PLGF
  - iv) ↓ VEGF
  - v) Uterine Doppler
  - vi) ↓ Urinary Cate excretion,

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Uterine A. Doppler (52)

(N) → Notching — disappear by 22 weeks

Persistent Notching — beyond 22 wk — Predictor for Pre-eclampsia

Prevention of Pre-eclampsia ⇒ • Aspirin
⇓
150 mg — once in a day
— start in 12th wk
↳ continue throughout ♀
↳ only indicated for high Risk patient for Pre-eclampsia

• Ca Supplementation
↳ Prevent Pre-eclampsia only in women who have Ca^{+2} deficient

— Salt Restriction
— Omega 3 Fatty acids
— Vit. C, E
} No Role in prevention.

* Management of Pre-eclampsia !⇒

- **Symptomatic**
  - Anti-hypertensive
  - Anti-seizure
- **Specific**
  - Termination of ♀
    - Stop progression
    - Reverse the damage

Anti hypertensive

i) When do you start Anti-hypertensive
↳ if BP persistently ≥ 150/100 mm of Hg

ii) Which drug — DOC
↳ Labetalol (α+β β-Blocker)

But; in chronic Hypertension
↳ Methyl dopa (safest Antihypertensive in Pre-eclampsia)

DOC for Acute HTN in ♀ (≥ 160/110 mm of Hg)
↳ acc. to ACOG, Any of these we as 1st line drug

① i/v Labetalol > ② i/v hydralazine > ③ Sustained Release Nifidipine

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(53)

iv Labetalol

↓

20 mg i/v

↓ after 10 min

40 mg —after 10 min→ 80 mg ⟶ 80 mg upto total 300mg/24hr.

④ i/v Nitroglycerine ⇒ used in Pulmonary edema

⑤ Last Resort Refractory ⇒ Sodium Nitroprusside
Anti hypertensive drugs cause CN (Cyanide toxicity)

* Methyl dopa is Not given in Acute HTN
↳ b/c

iii) drugs not to be used as Antihypertensive →

i) ACEi ;
ii) ARBs ;
iii) Diuretics ;
iv) β Blockers ;
v) Diazoxide

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

iv) Target Blood Pressure ⇒

Systolic blood pressure = 120–130 mm of Hg

Diastolic blood pressure = 80–90 mm of Hg

TERMINATION OF PREGNANCY

Gestational Hypertension / Mild Pre-eclampsia ; well controlled BP

↳ @ 37 weeks

Severe Pre-eclampsia — well controlled — TOP — @ 34 weeks

* Indication of Termination of ♀ Irrespective of Gestational age

i) Impending Eclampsia;

ii) Eclampsia

iii) HELLP Syndrome;

iv) Abruption / Fetal distress

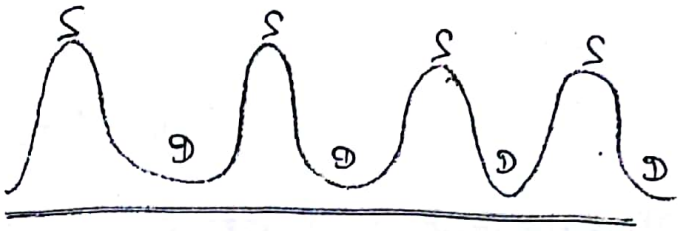
v) Uncontrolled HTN / Rising serum creatinine

vi) REDF – Reversal of End diastolic Flow

↳ doppler of Umbilical Artery.

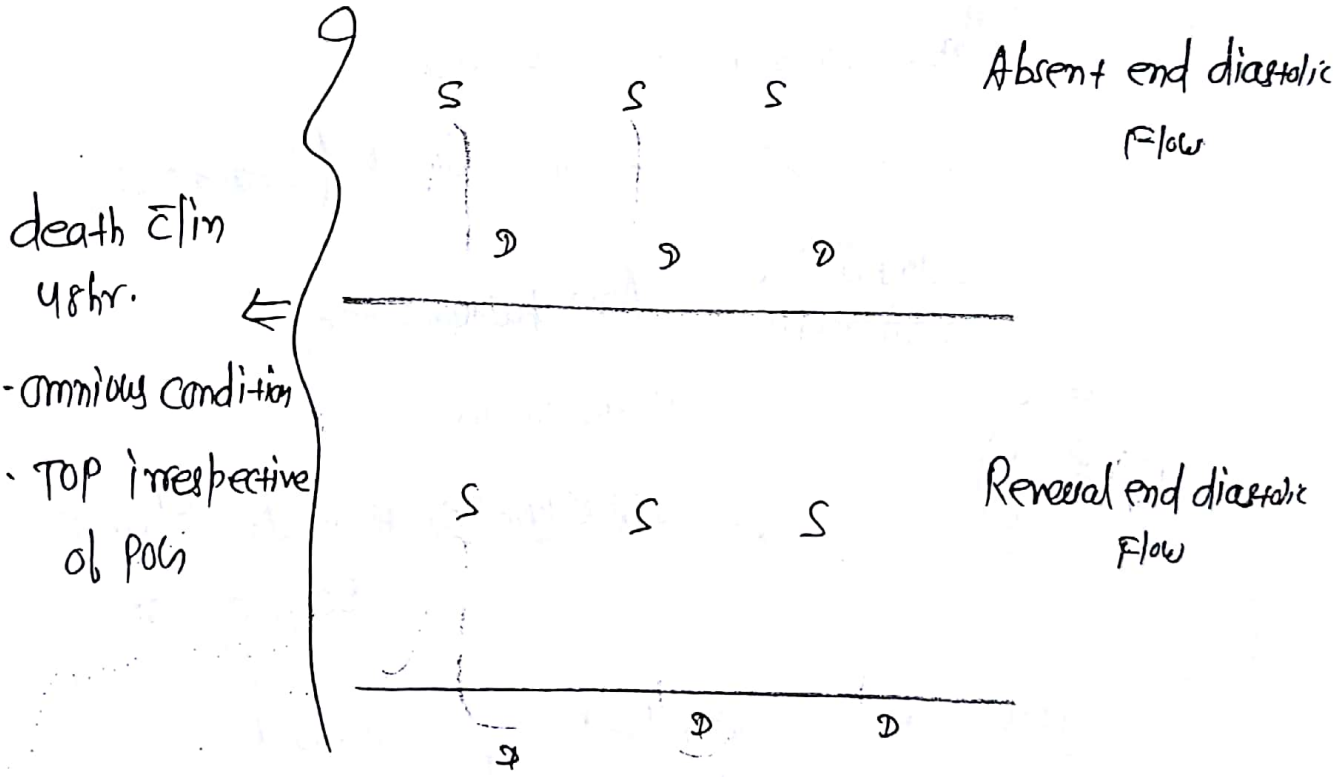
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(N) Umbilical Artery Flow ⇒ $\frac{S}{D}$ Ratio (54)



In (N) Pregnancy ⇒ $\frac{S}{D}$ Ratio ↓es as POA ↑es

In UPI ⇒ $\frac{S}{D}$ Ratio ↑es (≥30 $\frac{S}{D}$ ≥3)



* Whenever Possible do Vaginal delivery >> cesarian section

(High Risk
Anesthetic complication
Blood loss

* In C.S.
  - epidural Anesthesia given
    - if Not given then
      Mask Neuraxial Anesthesia

Never give General Anesthesia

ECLAMPSIA

Preeclampsia + Seizures
- GTCS (Grand mal)

1st Seizure ⇒ Antepartum (M/C)
Intrapartum
Postpartum ⇒ It Means within 48 hrs Seizure comes

Causes ⇒ Cerebral hypoxia + Cerebral edema

Rx ⇒ MgSO4 ⇒ Central Action
- ↙ vasodilatation: does not do any Peripheral
- ↙ NMDA Receptor
- ↘ Cerebral vasodilatation

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Mg^{++} Periphery $MgSO_4$ ⟶ Ca^{++} channels (55)

⇓

So; don't club Ca^{++} channel blockers (for HTN) & $MgSO_4$

⇓

Causes "Neuromuscular Paralysis"

↳ So; $MgSO_4$ gives & Labetalol (as anti HTN)

* 1st ly ... looks for vitals

↓

Stabilize the position (by tie her legs & hands)

↓

Secure Airway — Mouth GAG
Suction
Oxygen by Mask

↓

Inj. $MgSO_4$ + Anti-HTN

↙

Pritchard's Regimen

↙ ↘

Loading dose

↓

4 gm

⇓

4 gm - Slow i/v @ 1 gm/min — Monitor by Heart Rate
& 5 gm - i/m (5 gm in each buttock)

Maintainence dose given every 4 hourly until 24 hr after delivery or 24 hr after last seizure (if

⇓

before giving dose check ⇒ Patellar Reflex ⊕ (if RR > 12/min

⇓

then give 5 gm i/m dose (@ Alternate site) → Urine output > 30 ml/hr
to check abscess formation

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

If Any of the Patellar Reflex ⊖nt / RR > 12/min / Urine output >30ml/hr → any Absent → Omit the dose

⇓

Send serum Mg^{+2}

⇓

Therapeutic Level = 4-7meq

@ 9-12 meq

- @ 10meq = Patellar Reflex Absent
- @ 12meq = Respiratory distress

Warmth, diaphoresis, Slurring of speech

Antidote for $MgSO_4$ ⇒ 10ml of 10% I/v Ca gluconate

* Indication of Prophylatic $MgSO_4$ ⇒ In Impending Eclampsia
In HELLP syndrome;
In Severe Preeclampsia

* oliguria is Not a toxicity symptom of $MgSO_4$.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

QQ Primigravida 34 weeks gestation; Casuality ⊂ headache × 4hrs; 2 episodes of vomiting O/E BP=160/110 mm of Hg; FHR-(N); Most appropriate step of Mx (56)
Fundal height = 34 weeks; Urine output Protein (2+).

(Firstly) Inj MgSO4 + Anti HTN + TOP

(≡) → then (÷) → then

* Eclampsia is indication for TOP

⇓

Vaginal delivery > C.S.

delivered ⊂ 24 hour

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

DIABETES in PREGNANCY

MELLITUS

- Overt
  - Pregestational
    - Known case of "Diabetes Mellitus"
- Gestational
  - 1st time deranged sugar case in Pregnancy diagnosed
    - Most common

Single Step

- both Screening & diagnostic
- 2hr OGTT

- National guideline DIPSI criteria
  - done @ 24-28 weeks
  - glucose load 75 gm (oral)
  - ± Fasting

after 2hrs	Blood sample
75 gm oral glucose	> 140 – GDM
	≥ 200 – overt GDM
	120-140 = Impaired glucose tolerance of Pregnancy

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* All ◎ Women Must Undergo 2 hour OGTT

↳ Universal Screening (57)

* Early testing — 1st Antenatal visit

① if she gives H/o baby ≥ 4kg

② if she gives H/o Still birth

③ if she gives H/o Macrosomic baby

④ if she gives H/o Diabetes — 1st degree

⑤ if she is obese

~~FBS~~

FBS
or
HbA1c

Fasting ≥ 126 ⇒ overt diabetes.

* Diabetes ⇒ High Risk

For Foetus

↑ Risk of Gross congenital Anomaly by four fold in compare to (N) ♀

⇓

dt hyperglycemia (keto-toxic)

⇓

Free Radical Injury

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Risk of GCA Tes In overt b/c Gestational Tes after 24-28 weeks.

* M/c GCA ⇒ CVS > NTD

* Most Specific ⇒ Caudal Regression Syndrome (Sacral Agenesis)

* M/c CVS Anomaly In fetus of diabetic Mother ⇒ VSD

* M/c Specific Anomaly In fetus of diabetic Mother ⇒ TGA

* M/c finding In fetus of diabetic Mother ⇒ HOCM

Anencephaly

Frog eye sign | Mickey Mouse sign on USG

Anencephay — Earliest ⇒ 10 weeks
\ diagnosed ⇒ 14 weeks

* Screening/ diagnosis ⇒ USG

* Recurrence Risk = 4% In Previous 1 anencephaly baby ; Recurrence Risk = 10% In Previous 2 anencephaly baby

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(58)

* Maxm complication seen In female foetus excep ⇒

Macrosomia
Respiratory complication } In Male

* Anencephaly seen In Polyhydramnios ♀

↳ Post term Labour > Pre term Labour
(Initiation of Parturition ⇒ CRH)

↳ Mainly Face Maldevelopment seen.

* Banana sign
Lemon sign } seen in Spinal bilida & Arnold-chiari syndrome.

- Test – for Risk of Anomalies

HbA1C ⇒ @ 6.5 ⇒ Risk ↑es by 3%.
@ 7.5 ⇒ Risk ↑es by 4%
@ 8.5 ⇒ Risk ↑es by 8%.
> 9 ⇒ Risk ↑es by 15%.

* USG ⇒ for Anomalies diagnosis → Target imaging for fetal Anomalies
↳@ 18-20 weeks ↳ Level–II (TIFFA)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Level-II USG do for all Preg. women

Prevention of Anomaly :→

- If we know that pt. is overt diabetes — Pregnancy — give Insulin
  ⇊
  Tight glucose control

- give Folic Acid Supplementation

Prophylaxis of NTD	IFA
0.4 mg	0.5 mg (RDA)

overt diabetic
previous H/o NTD
Antiepileptics
→ 4mg

- When to start :⇒ as soon as they present preconceptionally
  Folic acid

* Minm Requirement :→ 1 month before to 3 month after

2. Macrosomia

Hyperglycemia —cross placenta→ Hyperglycemia in ~~fetus~~ foetus

↓

Stimulates Fetal Pancreas → Hyper Insulinemia

↓ Fat deposition — Shoulders, Abdomen

↓

Pedersen's hypothesis

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(59)

Diagnostic for Macrosomia

⇓

EBW ≥ 4Kg

⇓

On USG

↳ Single - Fetal growth

⇓

Abdominal circumference (Macrosomia / IUGR)

* USG also uses to calculate Gestational age

Best In 1st Trimester for Gestational age = CROWN-RUMP Length

2nd " = Bipariental diameter

3rd " = Femur Length

Best for Gestational Age = CRL

* Best for Gestational Age :-

(a) CRL for 16 weeks

(b) BPD @ 16 weeks

(c) Femur Length 30 weeks

(d) Abdominal circumference 30 weeks

* Macrosomia Patient presents ⊂ Shoulder dystocia

⇓

> 1min delay in the delivery of Shoulders after delivery of head

⇓

TURTLE SIGN

↳ Sudden Pulling back of head towards Maternal Perineum

* Mx of Shoulder dystocia ⇒

H — Call for Help

E — empty bladder [episiotomy do

L — 1St — Legs — Mc Robert's Maneuver
↳ Sudden flexion & Abduction of Maternal thigh on the Maternal Abdomen
↳ ↑ ↑ space in A-P diameter
⇓
we Injured Lateral Cutaneous Nerve of thigh
⇓
Meralgia Paresthetica

P — Suprapubic pressure
Not fundus pressure

E — Enter — Wood's screw Maneuver
cork

R — Removal of Posterior Arm

R — Roll over on 4 limbs

⇓

Gaskin all fours

Last Maneuver ⇒ Zavanelli Maneuver
↳ Push head back & do C.S. into mother

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Theoretically – destructive procedure – Symphysiotomy
– Cleidotomy (60)
– Iatrogenic # clavicle

* M/c fetal Injury In shoulder dystocia ⇒ Brachial plexus

* M/c Maternal complication In shoulder dystocia ⇒ PPH

3) IUGR ⇒ Rare (common)

↳ In Diabetic vasculopathy } Utero placental Insufficiency
Pre-eclampsia

↳ Expected birth weight < 10th Percentile

(4) Still birth ⇒ Seen In Macrosomic baby, Male baby
(↑ O2 Requirement)

↓

Hypoxic episode

↳ Sustained – Still birth

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

⑤ Pre Maturity → Iatrogenic

Spontaneous → Poly hydramnios

→ Infections

M/c Neonatal Mortality

⑥ Lung Maturation is delayed

↳ Phosphatidyl glycerol ⟹

Not L/S Ratio

⑦ operative delivery

↳ ↑ Risk of Respiratory Problem

⑧ Immediately after delivery :- i) Hypoglycemia

ii) Polycythemia

iii) Hyperbilirubinemia

iv) Hypocalcemia } Prematurity

v) Hypomagnesemia }

vi) RDS

vii) HOCM

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Maternal complication of Diabetic Mother :→

(61)

i) Abortion ⇒ Uncontrolled diabetes

ii) Polyhydramnios — Causes → GICA
→ ↑ glucose in Amniotic fluid
→ Hyperglycemia in fetus (Polyuria)

iii) oligohydramnios (Uncommon)

Seen in → Diabetic vasculopathy } in Utero-placental
Pre-eclampsia } Insufficiency

iv) Pre eclampsia ⇒ 15% Risk Tes

v) Infections — UTI
— Candidiasis

vi) Complication of diabetes — Vasculopathy
— Retinopathy
— Nephropathy
→ Pre existing = worsen in Pregnancy

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

vii) Operative deliveries

Vaginal — C.S.

viii) PPH (over distension)

ix) Pt. can develop later overt diabetes (in 50% cases)

follow up → 6 week (Post partum visit) | 12 wk

by OGTT test

* Management of Diabetes Mellitus in ♀

Maternal Monitoring

- Blood Sugar Level

Overt diabetes → Pregnancy → Insulin

GDM → only diabetes diet

40% = Carbohydrate

40% = Fats

20% = Proteins

↓ after 72 hr

do Sugar profile

Fetal Monitoring

- Staff to Monitor at - 32 wk

DFMC (daily fetal Movement Count);

NST

BPP (Biophysical Profile)

USG ; Doppler Never use

only in IUGR — UTI

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(62)

Sugar Profile

Fasting ≥ 95 or

1 hr PP ≥ 140 or

2 hr PP ≥ 120

↓

Drug Rx

- DOC → Insulin
  - It doesn't cross placenta.
- OHA → Metformin, Glyburide

M/c Insulin use ⇒ Regular Insulin

Total dose

- 1/3 → Regular Insulin → (Immediate Post Meal Hyperglycemia)
- 2/3 → Long acting insulin → Lente / Aspart / NPH (Maintain Basal level)

1–12 wk = 0.7 U/kg

12–28 wk = 0.8 U/kg

28–34 wk = 0.9 U/kg

≥ 35 wk = 1 U/kg

Target Levels

F < 95

1 hr PP < 140

2 hr PP < 120

Avg. glucose = 100

HbA1c ≤ 6.5%

* TOP = Gestational diabetes on diet alone = EDD = 40 weeks

Overt / GDM on Insulin = 39 weeks

* Diabetes (Alone) is Not an Indication for C.S
* Expected birth weight ≥ 4.5 kg in a diabetic pregnancy
  ⇓
  Cesarean section

* In Non diabetic pregnancy ≥ 5kg

* Insulin Requirement in Labour :→ ↓es
  ⇓
  Stop Insulin in Labour
  & do Intensive Monitoring @ 2hrly.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

ECTOPIC PREGNANCY

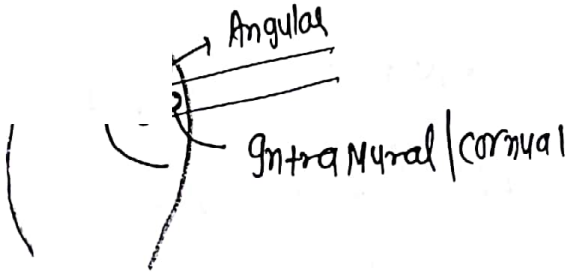
- Any Pregnancy is Implanted outside the Uterine Cavity. (63)

- Cornual Pregnancy → ectopic ♀

  Intramural part of Fallopian tube

- Angular Pregnancy → Intrauterine ♀

  ↳ (gle of Uterus



* Round Ligament is attached Lateral to the growth of Uterus

↳ Angular ♀

* Round Ligament is Medial to growth of Uterus

↳ Cornual ♀

* Heterotopic ♀ ⇒ 2 Pregnancy simultaneously @ different sites of Implantation.

Most common ⇒ Intrauterine + Intrafallopian tube (diff qrt ran,

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

- Risk factors —

i) Highest Risk of ectopic — H/o Previous Ectopic

1 Previous History ↑ Risk by → 15%

2 Previous History " → 30%

ii) 2nd highest Risk — H/o Tubal Surgery

iii) M/c Risk factor — PID

iv) cervicitis

v) Infertility

vi) ART (IVF)

vii) Smoking

viii) Previous C.S

ix) Contraception & Ectopic

↳ all contraceptive ↓ Absolute Risk of ectopic;
Certain ↑ Relative Risk of ectopic

↳ Tubal Ligation > IUD > POP

(Intrauterine Device; POP ↳ Progesterone only pills)

doesn't Inhibit ovulation
so; More Risk of ♀ (ectopic)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Order of GUD in decreasing order of Tes Relative Risk of ectopic ♀ ⇒ Progestasert > Mirena > Cu T (64)

Mirena ⇓

It has GUD & Progesterone both.

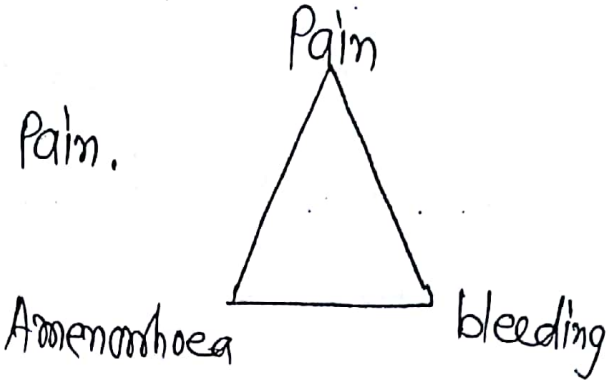
* M/c site of ectopic ⇒ Fallopian tube — M/c site = Ampulla; L/c site = Intramural
* L/c site of ectopic ⇒ C.S. Scar > cervical > Abdominal (I.A.)

* M/c outcome of Ampullary ectopic ♀ = Tubal Abortion
  and M/c outcome of Ampullary ectopic ♀ = Rupture @ 8th week
* M/c outcome of Isthmic ectopic ♀ = Rupture @ 6th week
* M/c time of Interstitial (OR Intramural) ectopic ♀ Rupture = 12th week ⇓ Most Life threatening ⇓ Hemoperitoneum ↑↑

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Triad of ectopic ♀ ⇒ Seen in 50% of Patient

Most common / Most consistent } Pain.



- H/o Nausea; Vomiting
  Shoulder tip pain
  ↳ Hemoperitoneum
  ↳ Diaphragm
  ⇓
  Referred Pain via Phrenic Nerve

- Syncopal Attack

- Per Abdomen examination ⇒ Tenderness in Lower Abdomen
  ↳ Rigidity/ Guarding d/t Peritonitis
  ⇓
  i.e Ruptured ectopic

Per vaginal examination ⇒ Uterus – enlarged; less Period of gestation.
Cx Motion tenderness Salpingitis
⇓
differentiate by Pain ⇐ PID ⇒ close D/D for ectopic.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Adnexal tenderness
Adnexal Mass QQ

(65)

Investigation ⇒ UPT ⊕ve @ 99% times

Investigation of choice ⇒ Trans vaginal Ultrasound

⇓

1st finding ; which Raises Suspicion

↳ empty Uterus

finding ; which Raises Suspicion Agains

Not diagnostic of ectopic

↳ complex Adnexal Mass.

↳ Ring of fire sign on Doppler study

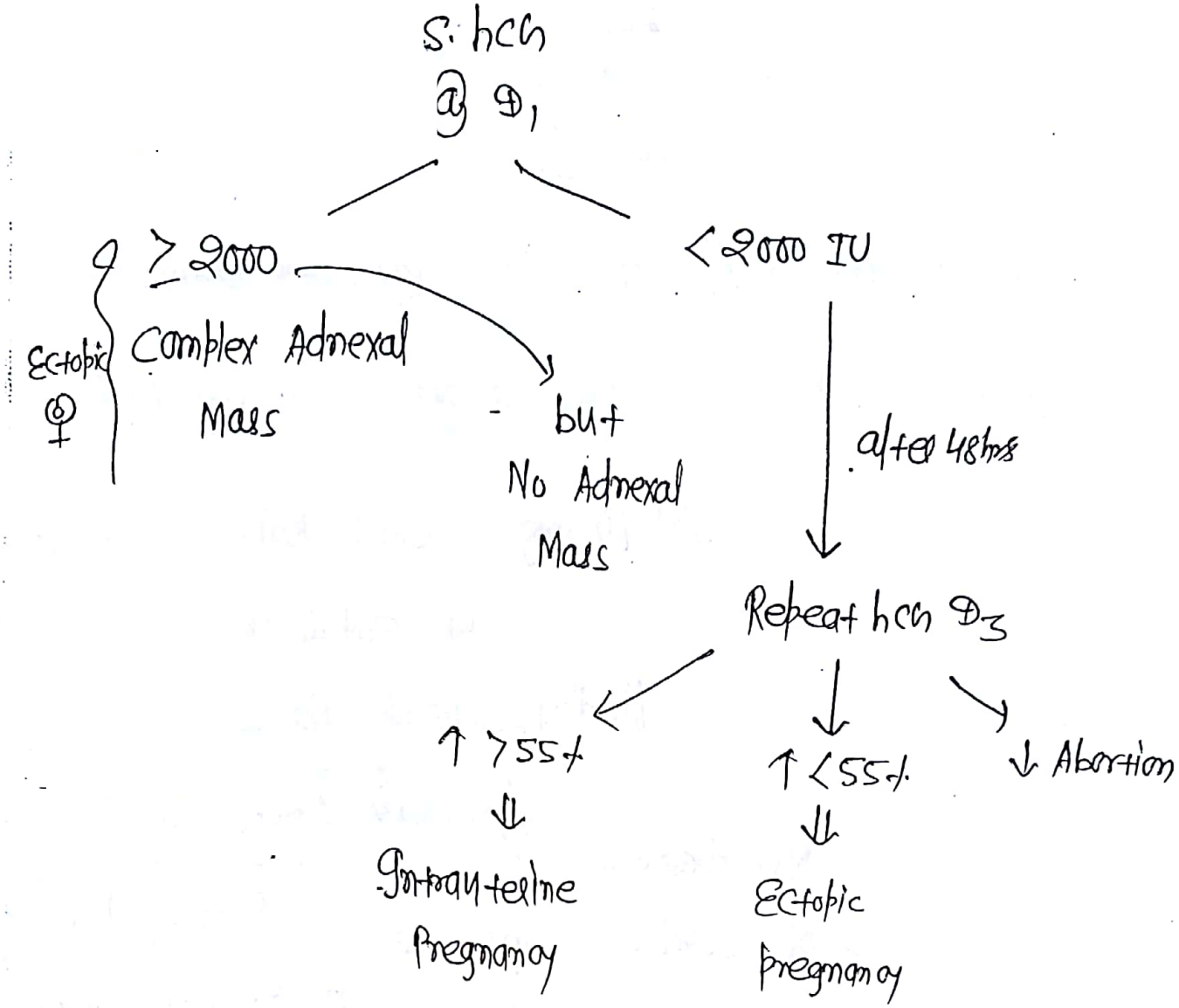
diagnosis finding in ectopic ♀ = Extra uterine gestation Sac + cardiac activity.

QQ No Intra Uterine Gestation Sac ; B/L Adnexa (N); Please Corelate clinically.

⇓

Pregnancy of Unknown origin ; check S. hCG on ③,

http://mbbshelp.com WhatsApp: +1 (402) 235-1397



* Repeat hCG till it crosses the critical value
* goC = TVS + Serial β hCG
(≡) (=)
* Gold Standard test = Diagnostic Laproscopy
* Serum Progesterone = >25ng — Live Intrauterine ♀
<5ng — Abortion
\ ectopic
* Culdocentesis Ruptured Ectopic → (>100ml ↳ significant)
↳ i> small collection ⇒ Usg; ii> Large collection ⇒ PA, Variable

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(66)

* Which test has No Role In Ectopic ♀ ?

i) Colotomy

ii) HSG

iii) Hysteroscopy

} Clin Up(+)ve patient

iv) all

Management

Medical | Surgical | Expectant

- Pre Requisites for Medical Mx
  - i) Stable
  - ii) hCG < 5000 IU
  - iii) Gestational sac Size
    - < 3.5 cm: ☇ cardiac Activity
    - < 4 cm: ☇ out cardiac activity
  - iv) Preferably absent cardiac Abnormality (Relative Requirement)

Drug ⇒ Inj. Methotrexate (1mg/kg) — D1
or 50mg/m²

Surgical Indications

i) Unstable Patient;
ii) Failed Medical Rx;
iii) criteria for Medical Mx ; Not Met
iv) Ruptured ectopic
v) Family complete

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

D_4 S. hCG

D_7 S. hCG

Management is Successful if S. hCG level fall by 15% from D_4 value

if D_7 value fall but less than 15% from D_4 value

⇓

give Inj. Methotrexate (D_1)

↓

D_4

↓

D_7 (if again less than 15% of D_4 value)

↳ give Inj. Methotrexate

Failed Medical Mx ⇒ Total of 3 Methotrexate Injections

Surgical Mx ⇒ Unstable vitals pt.

Next Most appropriate Step ⇒

a) IV fluids & Medical Mx *

b) Immediate Laparotomy

c) Serial β hCG

d) FAST

if localizing sign ⊕ eg ⇒ Peritonitis — do Immediate Laparotomy

if No localizing sign ⊖ — do FAST

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

i) In general Laparoscopy is preferred over Laparotomy. (67)

↓

but if Unstable vitals ⊕ ⇒ go for Laparotomy.

ii) Salpingostomy - is preferred over Salpingectomy

↓

Small Incision (1cm)

on Anti-Mesentric border

(No closure of Incision)

↳ b/c chance of ectopic

Yes by Suturing ; suturing itself by fibrosis & Fibrosis ↑ chance of ectopic ♀

i) Family complete
ii) Ruptured ectopic
iii) ≥ 5cm
iv) if you can't achieve hemostasis

QQ. 6yr of Marriage — Infertility — Conceived. Ruptured ectopic ?

a) Medical Mx
b) Salpingostomy
~~c~~) Salpingectomy — Partial
d) Expectant Mx

↓

Later date

↳ Tubal Reanastomosis.

* Expectant Management ⇒

Pt. is Stable
βHCG < 200 IU & falling trend
No visible gestational Sac
Monitor serial β-hCG

* Heterotopic Ectopic :→

Risk factor = ART (IVF)
Missed on USG
⇓
Late Diagnosed ⇒ by 16 weeks
↳ Big size Sac
↳ Impending Rupture / Ruptured

TOC: Medical Mx is C/I;
Sx ⇒ Laproscopic salpingectomy

If we want to give drug in clinical trials ⇒ Inj. KCl
under USG guidance ← cardiotoxic
give to Ectopic child & kill.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(68)

* Cervical ectopic
  - ↳ Painless bleeding
  - ↳ Medical Mx (as long as Pt. is stable)
  - ↳ criteria for Dx of cervical ectopic
    - ↳ Paalmans (Rubins criteria)

* Abdominal ectopic ⇒ Pain ; No Bleeding
  - Studdiford criteria
  - Late - 3rd trimester (Abd. ♀)
  - 32 week Abd. ♀
    - ↓
    - Immediate Laprotomy
      - ↳ deliver the baby + Placenta in situ
        - ↳ Leads to Autolytic digestion

* Ovarian ectopic ⇒ Speigelberg criteria
  - ↳ Surgical Mx

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

ABORTION **

· Weight of baby @ 20 weeks ≥ 300 gms

< 20 weeks

≤ 500 gms (WHO)

Spontaneous Abortion (Sporadic)

→ means spontaneous

Most common cause of Abortion

↓

Chromosomal

↓

Also in 1st & 2nd Trimester Most common.

Recurrent Abortion (Habitual)

≥ 3 consecutive Preg. losses < 20 wk.

New guidelines ≥ 2 loses documented ∴ ↓ confirmed ♀. Start evaluation)

* 50% of total abortion in 1st Trimester } Chromosomal
35% of total abortion in 2nd Trimester }

* Chromosomal

↓ → M/c chromosomal Anomalies cause Abortion

Aneuploidy (alteration in No. of chromosome)

M/c Aneuploidies cause Abortion ↑

↓

Trisomy (13, 16, 18, 21)

↓

Monosomy X – 20% Abortions

↓

Trisomy 16 – 16% Abortions

Single M/c/c

QQ - M/c cause of Abortions ⇒

a) Trisomy 16

b) Monosomy X

c) ~~Aneuploidy~~

d) Tetraploidy

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Most viable Aneuploidy = Trisomy 21

Most Lethal Aneuploidy = Trisomy 16 (69)

* M/c cause of Recurrent ♀ Loss ⇒ Idiopathic (75% cases)
(RPL)

↓

APLA – 16% RPL

↓

Uterine Anomalies — Congenital
\ Acquired

↓

Endocrinopathies

↓

Chromosomal – only 4% cases of RPL

M/C ⇒ Balanced Robertsonian Translocations

* Which of the following doesn't causes RPL?

i) Infections — Sporadic

⇓

TORCH Infections

Can't cause early RPL

Which Infection can cause RPL ⇒ "Syphilis"

⇓

Kassowitz Law

⇓

Every Successive ♀ in Syphilis POG of Loss Keeps Testing

↳ Mainly cause Still birth; Not Abortion

if 1st child Pog / Loss @ → 10th wk

2nd " → " → 24th wk

3rd " → " → 32nd wk

4th " → Live born child (Stigmata syphilis)

Q. G5 A4 @ 12 weeks present c Missed Abortion. all her previous early losses ; all the following investigations for her evaluation except ⇒

① Karyotyping
② LAC
③ AEA
④ ~~VDRL~~

* Karyotyping should be done in patient of RPL

* APLA (Anti Phospholipid Antibody Syndrome) ⇒
  ↳ Single Most common cause of RPL.

Diagnosis of APLA ⇒ 1 clinical + 1 Lab criteria

↳ Any one of the following
  ↳ i) ≥3 ♀ losses of <10 wks
  ii) ≥1 ♀ losses >10 wks of a Morphologically Normal fetus
  iii) Atleast 1 preterm delivery (<34 wk)
    ↳ Secondry to Severe Pre-eclampsia or Uteroplacental insufficiency
  iv) Venous & arterial thrombosis

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Lab criteria ⇒ Antibodies

(70)

i) LAC ⇒ Lupus Anticoagulant
ii) ACA ⇒ Anti: cardiolipin Antibodies
} ⇒ M/c

iii) Anti β_2 GP$_1$ Antibodies ⇒ Most specific
↳ current disease activity

test to look for LAC ⇒ Russel viper venom test.

IgM & IgG ACA ⊕ve in Medium to high titres on 2 occassions done 12 wks Apart.

* if the pt. is K/c/o APLA syndrome & ♀ also

- Heparin
  - Low Mw Heparin (Unfractionated can be used)
    - ↓↓
    - Started when Intrauterine ♀ confirmed
- Aspirin
  - Low dose Aspirin
    - ↓
    - Started when UPT ⊕ve

Continued throughout ♀

- Heparin stopped @ onset of Labour
- Aspirin stopped 7-10 days before Labour

2nd line ⇒ should be used when only 1st Line Rx fails.

⇒ Plasmapheresis

IvIg

Doc for APLA ⇒ Warfarin (Not given in ♀)

↳ (Cause embryopathy)

Doc for APLA in ♀ ⇒ · Low Mw Heparin.

* Routine test Antibodies for APLA — In women c RPL
* Most characteristics trimester for APLA — 2nd trimester

* UTERINE STRUCTURAL ANOMALIES CAUSES ABORTION

Congenital

- Septate Uterus
  ↓
  It can even cause 1st trimester abortions

Most characteristically cause 2nd Trimester Abortion

Acquired

- Cervical incompetence → M/c Acquired cause abortion
- Fibroid (Submucosal)
- Polyp
- Adhesion

Diagnosis of cervical incompetence

USG based diagnosis

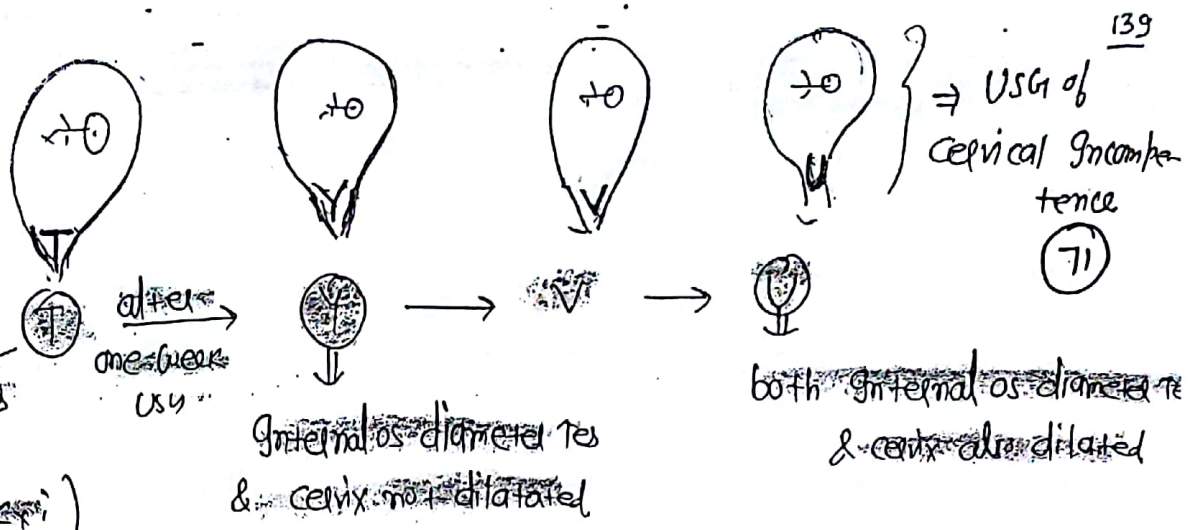
i) do in 2nd trimester & see cervical Length ⇒ if it is < 25mm;
& internal diameter > 2cm

History based diagnosis

i) causes 2nd Trimester abortions (Not causes 1st Trimester abortion)
in RPL
ii) Painless dilatation of cervix

obstetrics in subhilic ↳ in every question Presume the pt. at less Risk version

http://mbbshelp.com WhatsApp: +1 (402) 235-1397



* Diagnosis of cervical Incompetence in Non pregnancy State :-

i) Passage of No 8 Hagger's dilator through the Internal os ~~c/out~~ Resistance

↳ done in Pre-Menstrual Period

ii) No 16 foley catheter ⟶ fill the ballon ~~c~~ 2cc Normal Saline

⇓

Pull it out ~~c/out~~ Resistance from the Internal os

⇓

- Cervical Incompetence (+)

* Screening for Uterine Anomalies (Mullerian Anomalies)

HSG

Sonohysterography

⇓

do MRI / Hysteroscopy / Laparoscopy

↳ for diagnosis

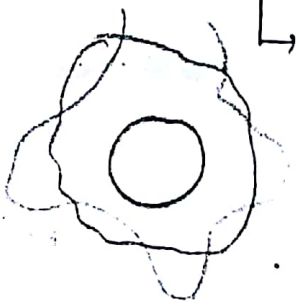
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

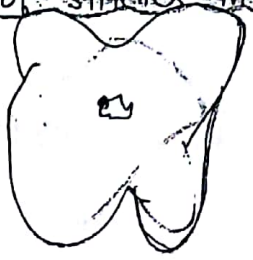
If Pt. has Cx incompetence ??

∴ do cerclage (cervical stitch)

↳ Mcdonald Procedure (Mc done)

↳ Placement of stitches in the cervix to hold it closed





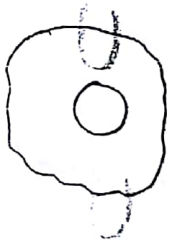
Purse string suture

⇓

Passes through all the walls of Cx.

Shirodkar cerclage ⇒ use Mersilene tape

↳ only pass through A-P walls



Cervix Index = Final Length / 1+endocervical Length

↳ 0.32 (N)

> 0.52 ⇒ cervical insufficiency

↳ done when Mcdonald's fail.

* Ideal time to do ⇒ 12-14 weeks (14 weeks)

Upto what time we put the cerclage ⇒ upto 24 weeks

At what level we put the cerclage ⇒ as close to internal os

Contraindication of cerclage ⇒ i) GTCA

ii) Current pelvic infection

iii) Ruptured Membrane

iv) placenta previa

Removal of Suture ⇒ @ 37 weeks

So↓ if any of the following develop ⇒ Raptured Membrane

↳ Necessary

Chorioamnionitis

Onset in labour

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Gn - Non-♀ State ⇒ [redacted] Lash & Lash Surgery (72)
  Rx of cervical incompetence

QQ Should we do Sonohysterography/HSG in Recurrent Preg nancy loss

⇓

Yes (Should be done as a Routine in Non-♀

⇓

Gn ♀ ⇒ do USG

ENDOCRINOPATHIES CAUSES RPL

* Thyroid ↓ – Hypothyroidism

⇓

do TSH → as Routine Screening for RPL

↳ Subclinical Hypothyroidism → Abortions

* Diabetes → Uncontrolled diabetes

↳ Blood sugar is Not a Routine procedure

↳ do when pt. is Symptomatic / Significant Family History

* Prolactin → Hyperprolactinemia

S. Prolactin → Not a Routine test

Mc presentation in ♀ ⇒ Amenorrhea & Infertility

* L.P.D (Luteal Phase defect) → corpus Luteum is formed by secretion of Less Progesterone
  - ↳ Not a established cause of RPL
  - ↳ only : when S. Progesterone < 15 ng/ml.
    - ↳ Not a Routine test

* only ↳ established cause of RPL
  - ↳ APLA
  - Uterine Anomalies
  - Chromosomal
  - Hypothyroidism

* How does women c Abortion presents ⇒

Spontaneous Abortion

Missed — all presents c

Threatened — Amenorrhea + Pain + Bleeding

Inevitable

* P/s examination
  - ↳ Os closed — os closed — os open
* Size of Uterus
  - POG = POG = POG

* In UGS examination Cardiac activity is absent (missing) = Cardiac activity is present

Q. Lady is 6 week Amenorrhoic; Pain + Spotting;
USG = Intrauterine gestation Sac ± embryo; ± No cardiac activity.

* if CRL ≥ 7mm & absent cardiac activity (73)
↳ Missed Abortion. ↳ Non viable Pregnancy.

but if CRL 5mm & absent cardiac activity
↳ Repeat USG after Some times (Min^m 1 week)

Non-viable ♀ ∴ ○ – Mean Sac diameter ≥ 25mm & No Yolk/embryo inside
↙
Blighted ovum (No yolk inside b/c of Avascular villi)
(empty sac)

Q. Missed Abortion is Missed b/c Symptoms presented after later date of Abortion; so; we missed to diagnosis.

Mx ∴ Induce Abortion (to open the os)
↳ In Missed Abortion

9. Empirical Rx (Bed Rest; Progesterone Supplements, i/m – weekly injection, Micronised oral tab)
avoid Intercourse
avoid Lifting heavy weight
→ In Threatened abortion ⇒ abort d/t chromosomal Abnormality
No Specific Rx ⇒ In Inevitable Abortion.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

** Complete Abortion

** Incomplete Abortion

Amenorrhea + Pain + Bleeding + H/o expulsion of POC's

P/S examination

↳ OS closed

⇓

Symptoms improve after expulsion

USG

⇓

For confirmation

⇓

Uterine cavity empty

No Retained Product of conception (RPOC)

OS open

↳ Period of conception (POCs) can be seen in the cervical canal

Uterine size ↓ POCs

Bleed a Lot

↳ Unstable Vitals (Patient May present c Shock)

Mx → Symptomatic Rx

Mx → Specific

Complete the process

⇓

do Suction & evacuation (Digital evacuation could be life saving)

* Induced Abortion ⇒ MTP Act

⇓

Upto 20 weeks

Pt. Asked for Abortion for ⇒ Rape ⇒ Humanitarian

Contraceptive Failure ⇒ Social

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

MTP → Eugenic

Medical/Surgical disease → Theraputic (74)

Who do Abortions ⇒ RMPs (Registered Medical Practitioner)

i) degree/diploma in field of OBG;

ii) 6 months of house surgeonship in department of OBG;

iii) assisted in 25 procedure of abortion in govt. hospital (out of 5 done independent)

<12 week ⇒ 1 RMP

12-20 week ⇒ 2 RMP

1st Trimester → WHO ⇒ 9 weeks

- Upto 7 weeks — Outpatient Medical Abortion

On D_1 ⇒ Mifepristone (Tab 200 mg oral)

D_3 ⇒ Tab Misoprostol (Tab 400 Mg; Pervaginal; Per oral; Sublingual; Buccal) → acc to WHO 4 800 Mg

Usually bleed after Misoprostol (so; observe 2-3 hr & send home)

D_{15} ⇒ History/Examination of Abortion;

* USG, before/After ∨ Not Mandatory

⇓

Only in Special circumstance

2nd Trimester

Medical

M/cly done

Adv:- No Anesthesia/Sx complication

Disadv:- Retained Products May prt.

Rx

* Prostaglandin

↳ M/c :- Misoprostol PVE,

2nd M/c ⇒ Carboprost PVF2α

Surgical

Adv ⇒ one time Procedure

Disadv ⇒ Anesthetic/surgical complication

Rx

* D/E

⇓

Dilatation & Evacuation

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

- Beyond 7 weeks & upto 12 weeks
  - ↳ do" Suction & evacuation"
    - ⇓
    - Hegar's dilator ⇒ graduated blunt devices (if we perforate ⇓ it heals itself, wait & watch ⇓ Monitor the vitals
    - Karman's cannula ⇒ 600 mm of Hg pressure generated
      - ↳ white plastic devia
      - ↳ on P/V examination
        - ↳ Size of cannula = size of uterus on P/V examination
        - ↳ usually 1 less than POG's
      - ↳ if we perforate by karman's cannula ⇒ Immediate Laparoscopy ⇓ to check Avascular Necrosis of bowel loop

Medical Rx
Extra amniotic
Ethamidene
Intra amniotic hyperosmolar saline
oxytocin

- End point of Suction & evacuation
  - ⇒ i) ↓ bleeding
    ii) Air bubbles in cannula
    iii) Gripping sensation on canula

- Check curettage ⇒ Sharp devices
  - ↳ give grating sensations

In village; alternative to Suction & evacuation ⇒ MVA ⇒ Manual vacuum Aspiration
- ↳ Who is Eligible to do
  - Cannula from 3 or 4 of sprinkle (sterile)
  - Syringe = 60 cc
  - Pressure 600 mm of Hg = 600 mm of Hg

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Dilatation & Evacuation

(75)

↳ ~~Ovum Forceps~~ ⇒ Spoon shaped forceps

No Locks ⊕

Piecemeal the products

* MOBIUS SYNDROME ⇒ ~~dt + Misoprostol~~

↳ Paralysis of Facial Muscle

(~~Facial Nerve affected~~)

* if Cx is Not open after giving Misoprostol & all drugs in Under 20 weeks

⇓

~~Opening of Uterus~~ — In early Gestation

⇓

~~Hysterotomy~~

(So; it gives Classical Scar; b/c @ 20 weeks we don't different ate the Lower Uterine segment; so; after it always do cessarian Section in Next ♀)

LABOUR

Initiation of Labour ⇒ Functional fetus Hypothalamic – Pituitary Axis

⇓

Release CRH

⇓

Cortisol

⇓

Placental CRH → M/c hormone for Initiation of Labour

→ down Regulation of Progesterone on uterus

→ Causes upregulation of Estrogen Receptors on uterus

→ Causes upregulation of oxytocin Receptors on uterus

→ Prostaglandin

→ Causes Release of Oxytocin

* Levels of the hormone don't change significantly

Oxytocin works via ⇒ Ca^{+2} influx

PhF2α from the decidua

↳ Max^m oxytocin Receptors ⊕ @ 2nd stage of Labour

Expected date of delivery = 40 weeks (Naegeles formula)

↳ on EDD ⇒ 4% delivery occur

FDD + 1 week ⇒ 50% delivery occur

EDD + 2 week ⇒ 80% delivery occur

(76)

* Preterm Labour ⇒ before 37 weeks

Term ⇒ ~~Early term~~ ⇒ 37 - 38+6

Term ⇒ 39 - 40+6

~~Late term~~ ⇒ 41 - 41+6

~~Post term~~ ⇒ ≥ 42 weeks

* Non-Medically Indicated C.S. ⇒ don't do ~~before 39 weeks~~

* ~~Gravida~~ ⇒ No. of times the women has been ♀.

Parity ⇒ beyond period of viability.

* G - T - P - A - L → currently Living children.
  - G → gravida
  - T → term (≥ 37 weeks)
  - P → Preterm (20-36 wk)
  - A → Abortion (< 20 weeks)

Q. In twin ♀ None of the Parameters change; except ⇓ Currently Living children

Q. 2nd Pregnancy; 1st was twins 34 wk delivery; Both alive

$G_2 T_0 P_1 A_0 L_2$

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Patient comes c Uterine contraction

check

False Labour

- Uterine contraction ⇒ No↑ in frequency, intensity, duration
- No Passage of blood mixed cervical Mucus
- No Progressive Cx dilatation & effacement
- No Rupture of Membrane
- Sedatives ⇒ Uterine contraction will subside

True Labour

- Uterine contraction ⇒ ↑ in frequency, intensity, duration
- g+ shows ⇒ Passage of blood mixed cervical Mucus
- Progressive Cx dilatation & effacement
  - ↓ in.
  - ↳ gn (cm)
  - ↳ Fully dilatated ↳ 10 cm
- gn Primigravida → effacement → dilatation
- gn Multigravida → both all simultaneously
- Rupture of Membrane
- Sedatives → Pain perception ↓es, Labour will Progress

Best Sign ⇒ Progressive Cx dilatation > Rupture of Membrane

↳ ble of PROM ⇒ Rupture of Membrane before onset of Labour

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

~~Rupture of Membrane~~ PROM ⇒ Per speculum examination (77)

⇓

- Leaking of Fluid from the OS.
- pH :→ Nitrazine Paper test
- OSC :→ Oligohydraminos
- dye test.
- FFN (Fetal fibronectin)
  - ↳ Marker of Pre-term Labour also.

PPROM :→ Rupture of Membrane before 37 weeks

⇓

Preterm PreMature Rupture of Membrane

Mx :→ PROM

⇓

> 34 weeks

Induce Labour

(Risk factor of chorioamniotis)

+

Prophylactic Antibiotics

< 34 weeks

Antibiotics steroids

⇓

once >34 weeks

⇓

Induce Labour

Threatened PretermLab

< 34 weeks

Steroids + Tocolytics

⇓

No Role of Antibiotics

> 34 wee

⇓

Wait & wat

* Most Imp. R/F for Pre-term Labour

↳ Previous H/o of Pre-term Labour

// Infection

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Prophylaxis in high Risk previous pre-term Labour Patients
↳ Progesterone

* if patient is in True Labour; we know about :-

1st Stage

Onset of True Labour Pain to full dilatation of cervix

- Latent Phase
- Active Phase

	cervical dilatation
0-5 cm	(Acog) ≥ 6 cm
0-3 cm	(WHO) ≥ 4 cm

↓ duration of Latent Phase

	Normal	Prolonged
Primi	24 hrs	20 hrs
Multi	8 hr	14 hr

↓ Rate of Cx dilatation
- in Primigravida (1.2 cm/hr)
- in Multigravida (1.5 cm/hr)

Rate of descent of head
- Primigravida: 1 cm/hr
- Multigravida: 2 cm/hr

(N) Progress = 1 cm/hr

2nd Stage

From full dilatation to expulsion of fetus

3rd Stage of Labour ⇒ From the birth of child to complete expulsion of placenta

4th Stage of Labour ⇒ Duration of observation of Mother : 1 hr

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

PARTOGRAM

153 B,B,B ⇒ Blood stained
M,M = Meconium stained
C,C,C,C,C,C. → Clear Amniotic fluid

Top Most part ⇒ tells about fetus

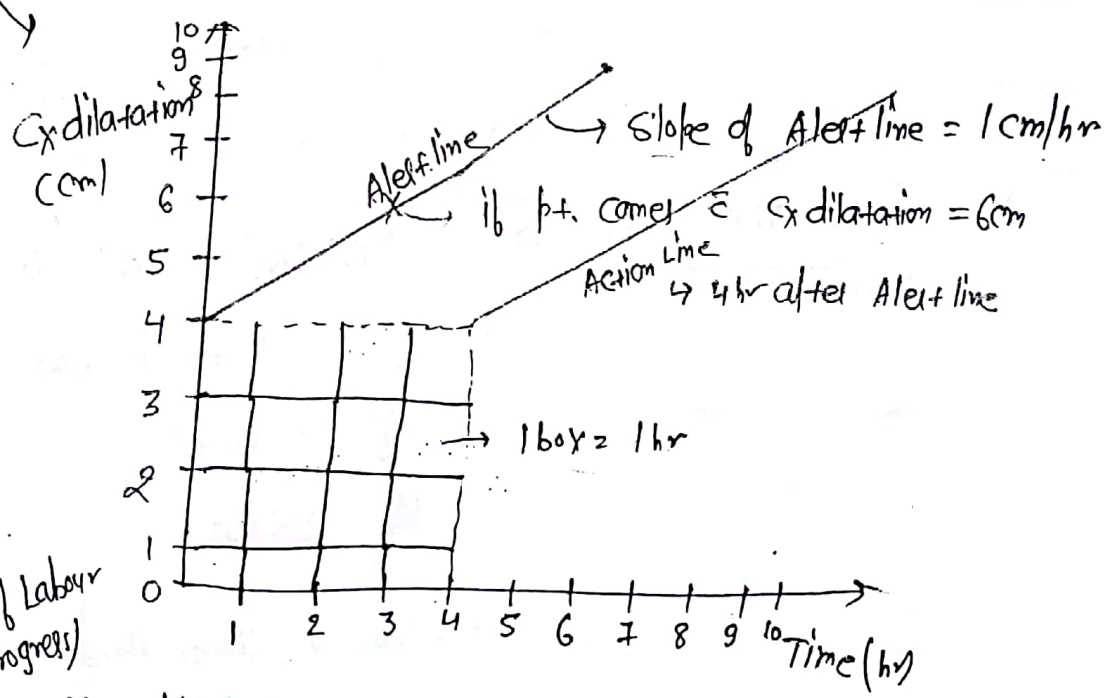
Middle part ⇒ Progress of Labour (Cx dilatation) (78)

Lower part ⇒ tell about Mother

tells about Moulding

- Grade 1 ⇒ Parietal bone touch each other
- Grade 2 ⇒ overlap; can be separated
- Grade 3 ⇒ overlap; can't be separated

Plotting always done on Alert Line



Dystocia of Labour (Abn Progress)

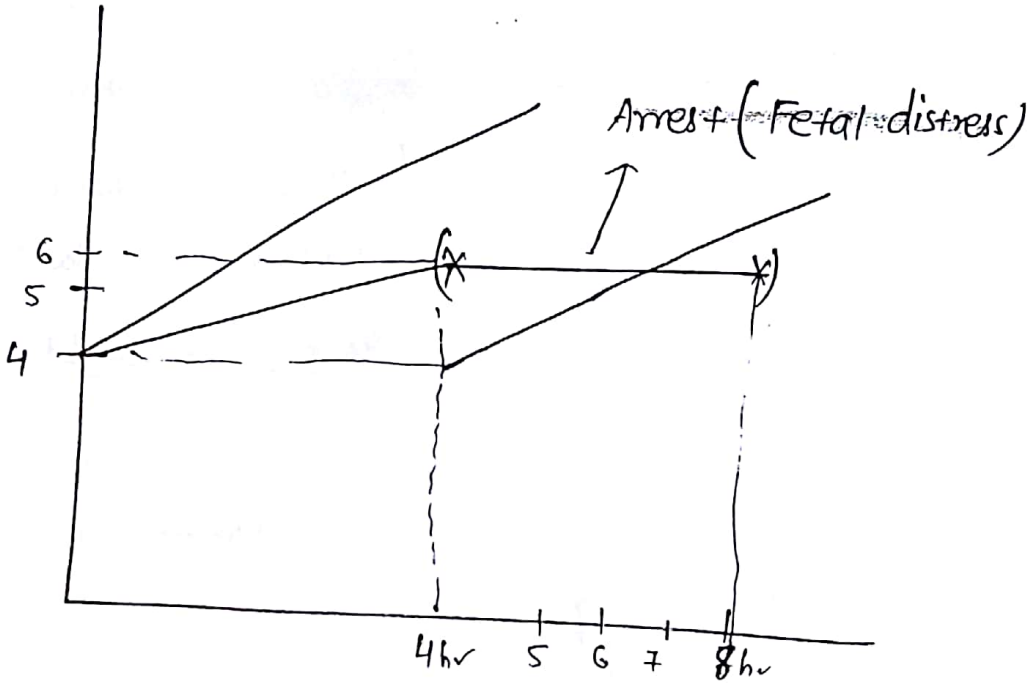
Not plot Latent phase in Partogram (Plot after ≥ 4cm)

- if Partogram is Right to Alert Line ⇒ Referral to higher center
- if Partogram goes to Right to Action Line ⇒ Intervention

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Arrest of Active Phase ⇒ No change in Cx dilatation even after 4 hrs of Adequate Uterine contraction → only if FHR ⇒ (N)

Intervention → Ceasarean Section



* Lower Most Part ⇒ Maternal cond^{n} (Uterine contraction)

- <20 sec in one contraction
- 20-40 sec
- >40 sec

→ also tells about ⇒ Heart Rate
BP
temp
Urine output
drugs to be given

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

2nd stage of Labour ⇒ Avg. duration (79)

↳ 1 hr = Primigravida

30 min = Multigravida

Arrest of 2nd stage

↳ No descent of head in the presence of Adequate uterine contraction

for 3 hrs → Primigravida

2 hrs → Multigravida

do C.S.

• Arrest of 2nd stage ∈ epidural Analgesia

4 hr ⇒ Primigravida

3 hr ⇒ Multigravida

* Progress of Labour → P/A → contractions — duration / frequency

examination → descent of head

Ruled Five

Numerator ↓ Parts Palpable

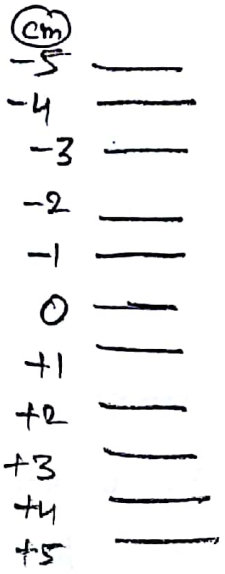
5/5	A ⇒	entire head above Pelvic brim
4/5	B ⇒	Sinciput high; occiput easily felt
3/5	C ⇒	Sinciput easily felt; occiput felt
2/5	D ⇒	Sinciput felt; occiput just felt
1/5	E ⇒	Sinciput felt; occiput Not felt
0/5	F ⇒	None of head Palpable

P/V examination → Cx dilatation

→ Descent of head

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Descent of head in P/V examination ⇒



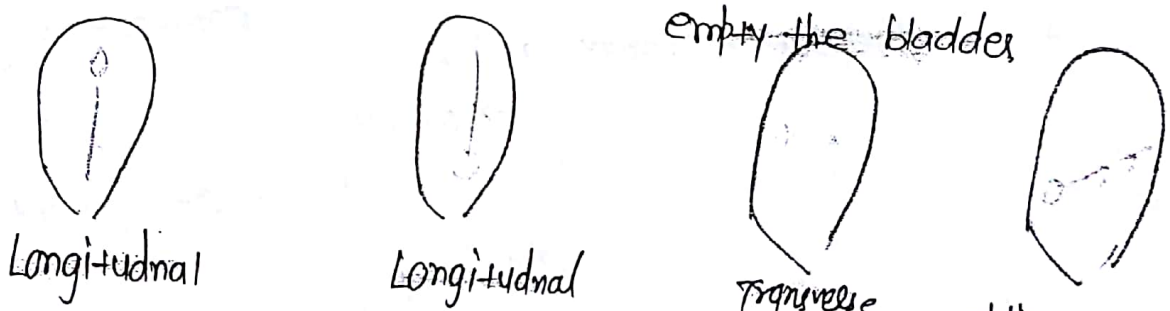
Station −2 ⇒ baby's head 2 cm above Ischial spine

Station +3 ⇒ baby's head 3 cm below Ischial spine

* LIE ⇒ Relationship of Fetus & Long axis of Uterus

⇓

firstly correct the detrotation & empty the bladder



M/cly lyndal location of placenta Ant.

⇓

Keeps changing even after 37 weeks

M/c/c ⇒ Idiopathic (→50%)

2nd M/c/c ⇒ Placenta previa

Polyhydramnios

Oligohydramnios Never cause Unstable lie

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Presentation ⇒ Part of fetus which is foremost in the birth canal. (89)

Breech Cephalic Shoulder

Leopold Maneuver ⇒ Soft, broad part ⇒ buttock
Smooth curve ⇒ Back
Limbs ⇒ Knobby feel

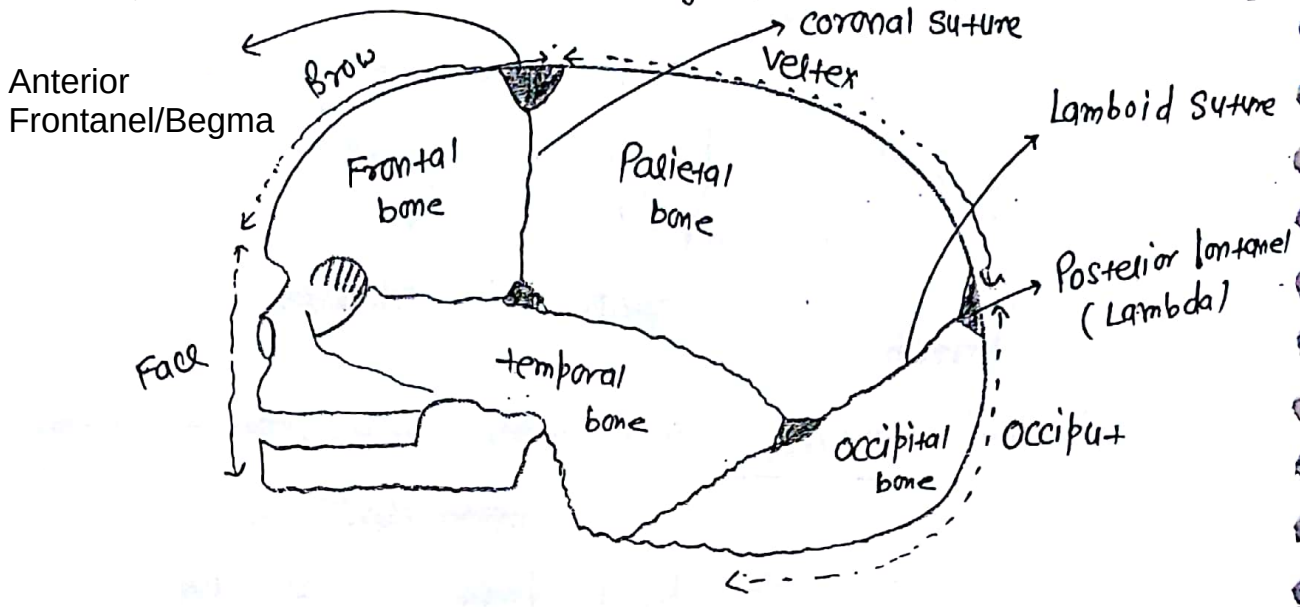
(A) Fundal grip (1st Leopold)
(B) Lateral grip (2nd Leopold) → is with single hand we do
(C) Pawlik's grip (3rd Leopold) → 2nd Pelvic grip
(D) Pelvic/deep pelvic grip (4th Leopold) → 1st Pelvic grip
↳ Both hand we use

* if head is in Complete flexion ⇒ Vertex presentation
Partial flexion ⇒ Sinciput presentation
Partial extension ⇒ Brow presentation
Complete extension ⇒ Face presentation

* Anterior fontanel ⇒ Bregma
Posterior fontanel ⇒ Lambda
Posterior boundary of Brow ⇒ Anterior boundary of vertex

* Anterior fontanel ⇒ diamond in shape

Posterior fontanel ⇒ Triangular in shape



Engagement ⇒ When the Largest diameter of the presentation crosses the Pelvic brim.

Largest Transverse diameter ⇒ ~~Biparietal diameter~~ 9.5cm

engaging dm in different presentation :-

Engaging diameter (AP)
↳ Antero-Posterior

Vertex
Suboccipito bregmatic (9.5cm)

Sinciput (Partial flexion/deflexed)
- Occipito frontal (occiput to anterior end of Anterior fontanel) 11.5 cm
- Sub-occipito frontal (10.5 cm)

complete extension/ Face
- Submento-bregmatic (9.5cm)

Brow
- Mento vertical (14 cm)

↓
Largest dm of fetal head

(81)

* In Most of the Primigravida
  ↳ engagement @ 37 weeks

* free floating head @ 37 weeks in Primigravida
  ↳ d/t deflexed head; CPD; Placenta previa; Polyhydramnios.

* Engagement Rule out cephalo pelvic disproportion at the inlet. (CPD)

* when the head is Engaged; station = 0.
  ↳ on P/A exam; 2/5 is Palpable

* DENOMINATOR - Bony point on the presentation used to describe the position of head

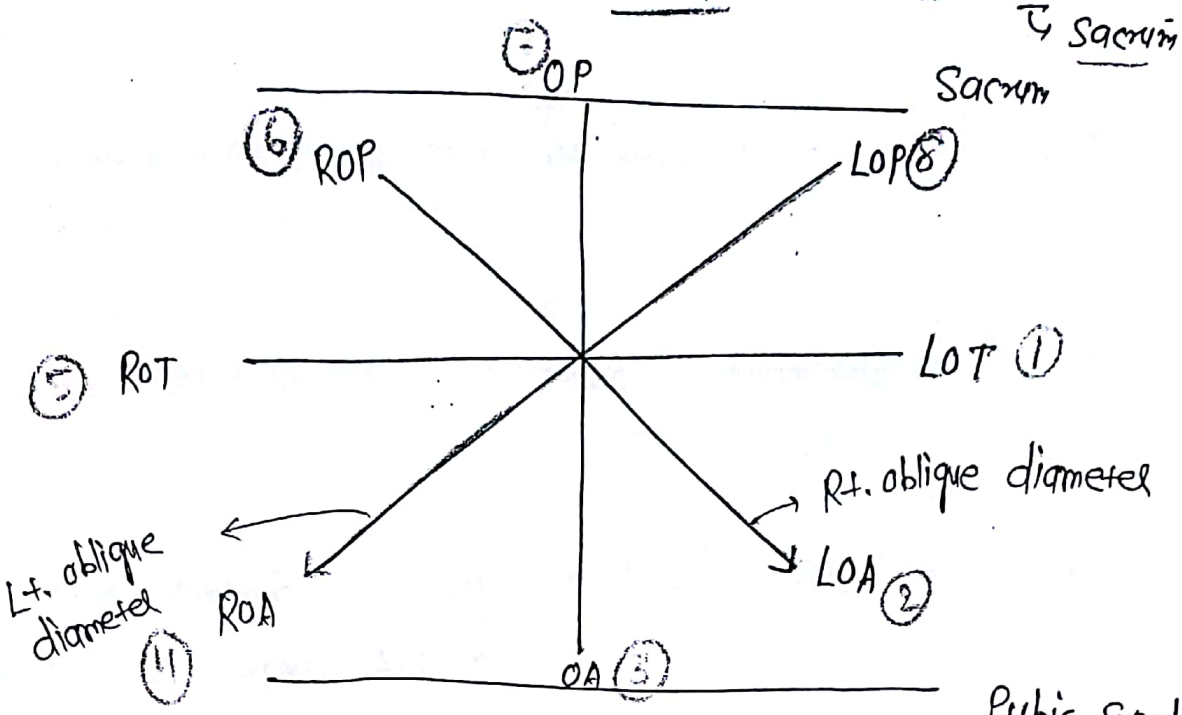
Presentation		Denominator
Vertex	→	Occiput
Breech	→	Sacrum
Brow	→	Frontal bone
Face	→	Mentum
Shoulder	→	Acromion process (Scapula)

JAIN STATIONARY ★ Deals in Medical Book & Notes ★ 9654691327 9811982449

Maternal Pelvis ⇒ occiput ⇒ for vertex presentation

if breach prt. ⇒ write "S" in blaced "O"

↳ Sacrum

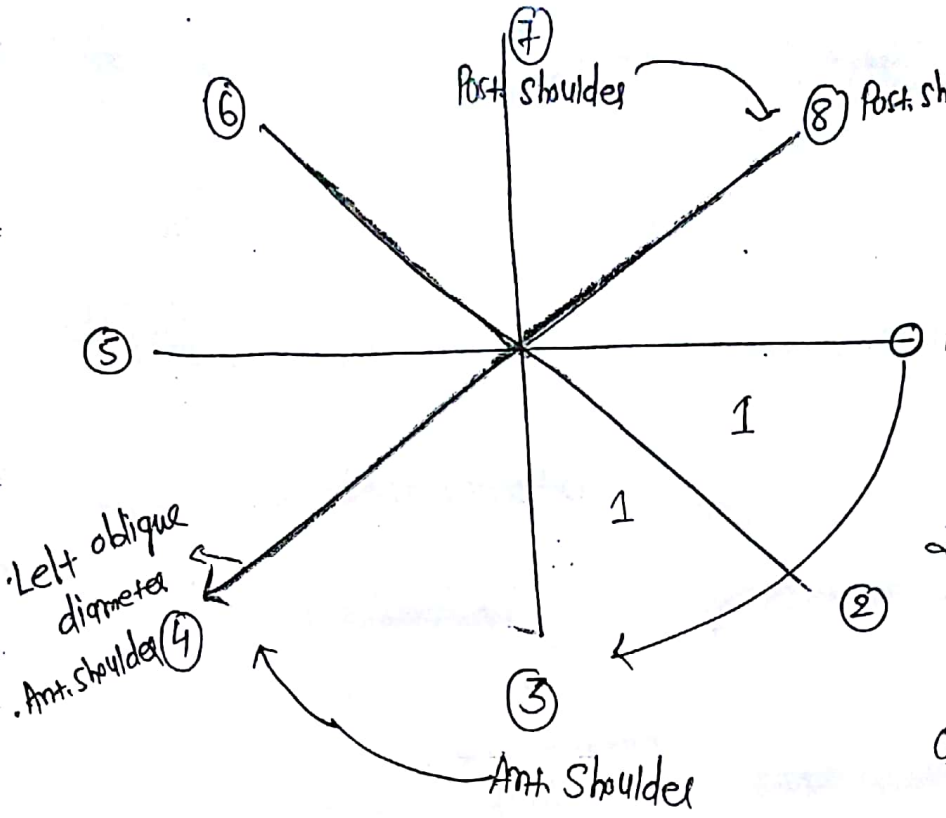


* In Routine exam^{n}; Plv exam^{n} done in active Labour 4 hourly.

* M/c position of (N) Labour ⇒ LOT**

Cardinal steps of (N) Labour

1. Engagement
2. descent
3. flexion
4. Internal Rotation
5. Extension ⇒ delivery of head (occiput → vertex → Forehead → Glabella → Nose → Mouth → chin
6. External Rotation

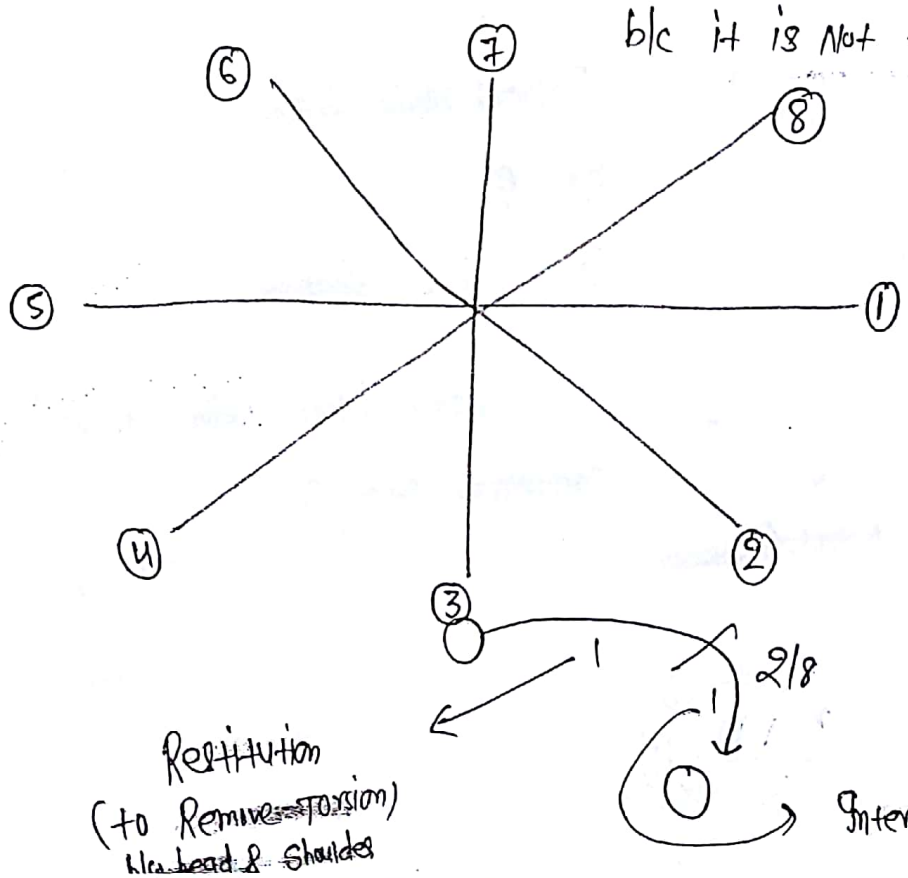


2/8th Rotation (Internal Rotation) ⇓ occurs @ the Level of Pelvic floor

but Shoulder Rotate only by 1/8

* Relation of Internal Rotation to External Rotation 4 opposite direction.
* Relation of Restitution to External Rotation 4 same direction

* External Rotation :- Restitution is Not a cardinal Movement b/c it is Not the separate Movement



after external Rotation head goes back to original Position (LOT)

3 "P"s Require for (N) labour :→ Passage

Push

Passengers

Passage ⇒ Maternal Pelvis ⇒ by Caldwell & Malloy

⇊

on the basis of inlet

M/c Pelvis in ♀ = Gynecoid Pelvis (circular Pelvis)

4 in 50% ♀

Transverse Diameter ≥ AP Diameter

2nd M/c Pelvis in ♀ = Anthropoid Pelvis

⇊

Antero-posteriorly oval Pelvis

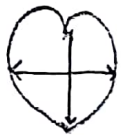
in 25% ♀

AP Diameter > Transverse Diameter

Other = Android Pelvis

⇊

Typical Male Pelvis



Transverse Diameter > AP Diameter

20% ♀

Inlet = Heart shaped

Least common Pelvis in ♀ = 5% cases (Platypelloid Pelvis)

⇊

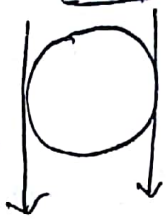
Transversly Oval Inlet

Flat Gynaecoid

Transverse Diameter >>>> AP Diameter

83

Gynecoid



Sidewall ⇒ Parallel

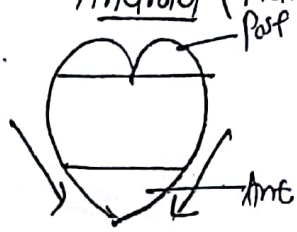
Gschial spine ⇒ Blunt

• DTA Not Seen

Subpubic Angle ⇒ obtuse
(90-100°)

Shallow Pelvis

Android (Male Pelvis)

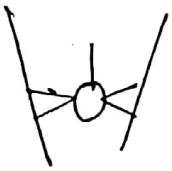


Convergent Side wall

M/cc of occipito Posterior ⇒ Android Position

(Posterior space is More than Anterior) Pelvis

Sharp



Deep transverse Arrest (DTA)
↳ M/c in Android

Acute
(85°)

Delp Pelvis

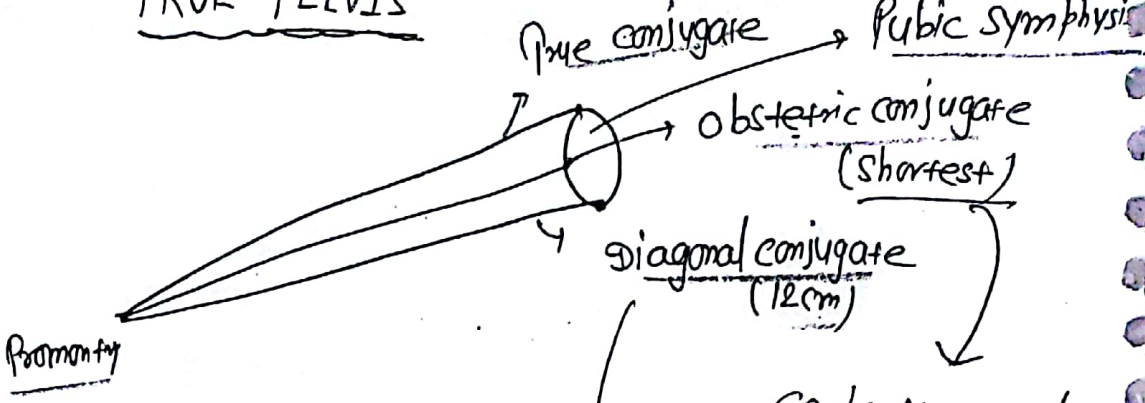
(*Deepest Pelvis ⇒ Anthropoid)

occipito posterior ⇒ Android

Persistant occipito posterior / Direct occipito posterior ⇒ Anthropoid

TRUE PELVIS

INLET :→



Can't Measured clinically

Can be Measured

↓

10.5cm

~~DC — 13 = obstetric conjugate~~

~~DC — 10 = True conjugate~~

↳ 11cm

Cavity: → distance b/w ischial spine

~~Inter ischial spine diameter (IID)~~

↳ 10.5cm

↳ we shouldn't able to touch the both ischial spine simultaneously Normally

~~Contracted cavity~~ : IID < 8cm

OUTLET → ~~Intertuberous diameter~~ = 11cm

(~~ischial tuberosity~~)

↳ "~~Four knuckle test~~" is done to Measure it,

Contracted Pelvis ⇒ Any 1 or More of the Previously Studied diameter are contracted (84)

↳ Inlet ⇒ <10cm (for diagonal conjugate it is less than 11.5)

Cavity ⇒ <8cm

outlet ⇒ <8cm

↳ do C.S.

to know about the contracted Pelvis; we will do "Pelvic Assessment"

⇓

In Primigravida; it do @ 37 weeks

In Multigravida; it do; when she goes in Labour

Q. $G_2 P_1 L_1$; Previous 1 C.S; done for contracted Pelvis; comes @ 37 week ANC ⇒ Recurrent Indication for C.S. (Never do VBAC)

* Cephalo Pelvic Disproportion (C.P.D) ⇒

↳ Best way to know ⇒ Trial of Labour

↓

MRI

↓

CT Scan

↓

X-Ray Pelvimetry

↓

Pelvic assessment

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Q $G_2P_1L_1$; Previous 1 C.S. done for C.P.D; She presents C Labour & Pain 37 wk ; OS 1 cm dilate ; 70% effaced Vertex at $\Rightarrow -3$; What is $M_X = ?$

do VBAC

↓

Trial for VBAC

CPD is Non-Recurrent Indication for C.S

* Plane of Least Pelvic dimensions = obstetric outlet (Forms Roof of obs. outlet)
= Ischial spine
(Passes Laterally to Ischial spine)
* Anatomic outlet = Ischial tuberosities
(Passes Laterally to Ischial tuberosity)
* Plane of Greatest Pelvic dimensions = Disc space b/w S_2–S_3

II. PUSH

Uterine contraction ; Pacemaker ⇒ Rt. cornu

Strongest ⇒ Fundus

Rate of speed ⇒ 2 cm/sec ; depolarise entire uterus in 15 sec

At what Intrauterine Pressure Contraction became Palpable ⇒ 10 mm Hg

At what Grip contraction became Painful ⇒ 15 mm Hg

↳ Min Pressure Required to Initiate Cx dilatation

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Fundus can't be Extended ⇒ Moderate contraction
  ⇓
  40 mm Hg (85)

* end of 1st Stage ⇒ 50 mm Hg
  2nd Stage ⇒ 80 mm Hg

* Adequate Uterine contraction ⇒

i) 3 contraction in a span of 10 min & each is lasting for 45 sec;

ii) If contraction generates Pressure of 200-250 Montevideo Units.

Montevideo Units ⇒ No of contraction in 10 min × P generated

Tachysystole ⇒ > 5 contractions / 10 min
↳ UPI → Fetal distress

good or Bad?
↓
Bad

Tachysystole + Fetal distress — Hyperstimulation

↳ b/c Most of blood supply goes to baby in diastole

Rx
- 1st ly Stop the Infusion
- Left Lateral Posture
- O_2 by Mask
- I/V fluids
- Tocolysis (Stop the contraction)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* On Augmentation of Labour

- Oxytocin given
- Misoprostol avoid
  - ↳ May cause hyperstimulation
    Rupture uterus

Managment of ⇒ LABOUR

- FALSE
  - No change in Cx dilatation
  - ⇓
  - Mx ⇒ Rest & Sedation
- TRUE
  - Progressive Cx dilatation
  - What stage
    - Latent Phase
      - 0-5 cm
      - (0-3) WHO
      - Amount of Cx dilatation ⇒
      - ⇓
      - Rest & Sedation
      - ↓
      - wait & watch
    - Active Phase
      - 7-6 cm
      - ↓
      - Is the Labour slow?
        - Yes (< 1cm/hr)
          - ⇓
          - Contractions are Adequate or Not
            - Yes
              - Inadequate Labour
              - ⇓
              - Mx ⇒ Augmentation
              - ↓
              - ARM (Release Prostaglandin)
              - ↓ after 4hrs of 3rd stage Oxytocin
            - No (Adequate Labour)
              - ⇓
              - d/t CPD of Position
              - ⇓
              - do Caesarean
              - Moulding
              - Caput (Swelling of scalp)
              - ⇓
              - On slow labour
              - ↳ Marked CPD.
        - No (1 cm/hr)

Q. Pt comes @ 2PM. 6cm dilated Cx ; Tot effaced ; Vertex @ -1 ; Membrane absent, Liquor Clear, contracting 220 mv (Montevideo Units) (Ruptured) (86)

↓

@ 6PM ; 7cm 80% effaced ; Vx @ -1 ; caput (+) ; Moulding (++)

↓ do Trial of Labour

@ 10 PM ; Finding absolutely Same

↳ i.e Arrest of Labour

↳ do C.S.

OBSTRUCTED LABOUR

On General Physical examination ⇒ Exhausted
dehydrated
Tachycardia
Tachypnea
Acidotic breath

On P/A examination ⇒ Upper segment ⇒ Tonically Contracted
Lower Uterine segment = Stretched / Thinned out
B/w U.S & L.U.S = depression (Ring)
Bandl's Ring / Pathological Retraction Ring
Suprapubic bulge (Bladder)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

FHR = Severe distress

Absent

P/v examination ⇒ Bleeding per vagina

Caput & Moulding

Hematuria

* If we put Folay's we can not be able to enter as it is Compressed by head we can Only able to put feeding tube 8 can see hematuria

Doesn't pass Urine is the earliest Marker of obstructed Labour

* obstruction is the absolute Indication for cs ; even if the fetus is dead

* Destructive Procedures → Not in Modern obstetrics

↳ do craniotomy

Symphysiotomy

If Not done cs ⇒ Rupture Uterus

* if Patient present C Not passing urine and told us about Bladder injury then we prove it as Not Bladder injury by

↳ VVF (vesicovaginal Fistula) in developing countries

↳ of obstructed Labour

In developed countries

↳ Gynecological surgeries (Malignancy ...)

III. Passenger

Fetus convert (N) into (AbN) Labour (87)

- Vertex ⇓ (N)
- CPD
- Non vertex (AbN) Labour

Malpresentation ⇓ M/c ⇒ Breech

R/F ⇒ i) Multiparity;
ii) (AbN) Pelvis;
iii) PreMaturity;
iv) Poly/oligohydramnios
v) GICA
vi) Placenta previa

* M/c Malposition
  ↳ Occipito posterior

BREECH

M/c Cause ⇒ PreMaturity

POG	Breech
28 wk	→ 25%
30 wk	→ 7–11%
Team	→ 3%

M/c type of breech ⇒ Frank breech (extended breech)
⇓ Hip joint = flexed; knee joint = extended
Heel near

Complete breech (Flexed breech) ⇒ Least common type of breech.
⇓ Both knee & Hip are flexed; P/V ⇒ Ischial tuberosity; Anal opening; Heel pad;

* Primigravida ⇒ Flank breach

Multigravida ⇒ complete breach

* Footling breach ⇒ Incomplete breach

↳ baby May have cord prolapse

Q P/V ⇒ can see foot of baby

Cord Prolapse ⇒ Exposed to temp. ⇓

↳ Intense cord vasoconstriction Higher Risk in Footling breach

↳ death of baby. Least Risk in Frank breach

* Indication of C.S in breach :-

Absolute Indication ⇒ ① Footling breach;

② Staligael breach;

↳ Hyperextended head

Relative Indication of C.S.

↳ Vaginal is Not C/I; but C.S is preferred over vaginal delivery.

① Primigravida & Breach;

② Previous C.S & Breach;

③ Macrosomia & Breach;

④ Hydrocephalus

↳ do ventriculo Peritoneal Shunt by Pediatric Surgeons.

⑤ PreMaturity

Q. Primigravida ; 37 week ; ANC checkup; O/E = Breech presentation; FHR (N); Liq (N); Placental fundal ; Pelvis adequate; Mx = ∅ (88)

do ECV (External Cephalic Version)

↙ can be done In Latent Phase of Labour.

↳ for all Non-Cephalic presentation.

if Requirements Met.

⇓

done for ⓐ Single term ♀ ;

ⓑ ≥ 37 wk / 36 wk baby ;

ⓒ Liquor Adequate ;

ⓓ Membrane should be Intact ;

ⓔ FHR (N)

ⓕ No C/I for vaginal delivery,

Relative C/I for ECV ⇒ Risk More than Benefit

↳ avoid ECV ⇒ ⓐ Previous C-S

ⓑ GUGR

ⓒ Pre-eclampsia

* ECV is always done under continous fetal Monitoring ;
* GA is done under tocolysis (terbutaline inj^n) ;
* during ECV → if fetal distress ⊕

⇓

Revert baby to original Position

↳ do C-S.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Q. $G_2P_1L_1$ 39 weeks Breach presentation

⇓

first try ECV

⇓

but if any c/I of ECV ⊕ → Primigravida ⇒ C-S

→ Multigravida ⇒ Vaginal delivery

⇓

(Assisted) Breach vaginal delivery

↳ if fetus has extended Arms ⇒ Lovset Maneuver

extended Legs ⇒ Pinard's Maneuver

After coming head ⇒ Burn-Mauthall Maneuver

⇓

In this delivery of head by "Flexion", Not by extension.

Grab foot & goes 180° towards Pelvis of Mom; after head comes out by

Spine of fetus is Anterior & towards the obstetricians

After coming head ⇒ Mauriceau Smellie viet (MSV)

⇓

do Mallet bone flexion & Shoulder traction & delivery of head by "flexion"

* Burn Mauthall & MSV

⇓

only when baby is DorsoAnterior

In Dorso-posterior breach ; after coming head ⇒ Praques Maneuver

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Duhrssen's Incision ↳ 2 Small Incision on Cx

↳ done in preterm after coming head
↳ if most of the part of baby is delivered & only head is inside

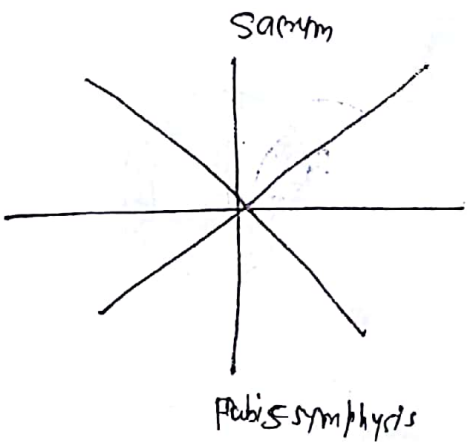
* Forceps delivery ⇒ Pipers Maneuver

* Last Resort ⇒ Zavanelli Maneuver

* M/c cause of Fetal death ⇒ Cerebral Hemorrage (ICH) in breech

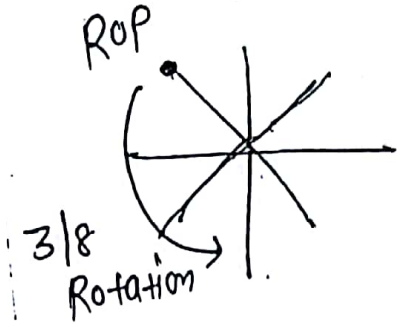
* O.P. (occipito Posterior) ⇒ Not Malpresentation ; Malposition
↳ M/c cause ⇒ Android Pelvis
2nd M/c cause ⇒ Deflexed head
⇓
Engaged diameter ⇒ occipito frontal
↳ 10.5

M/c in Primigravida
M/c Position — R.O.P.



http://mbbshelp.com WhatsApp: +1 (402) 235-1397

1st outcome ⇒ all favourable — Push
— Passenger
— Passage



↳ so take much time; slow progress of Labour

⇓

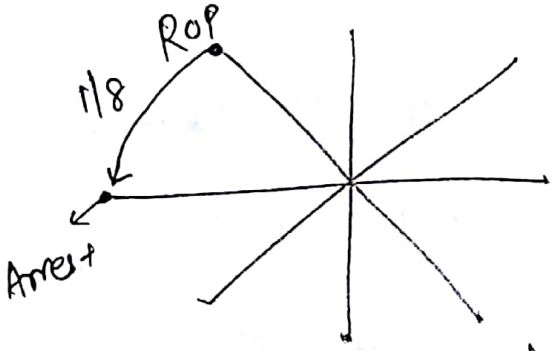
Rx :- Wait & watch ; when baby is Anterior then delives

2nd outcome ⇒ Deep transverse arrest

↳ d/t android Pelvis

⇓

do the C.S.



but if Pelvis is (N) ; then

i) if Inadequate contraction seen

↳ give oxytocin

ii) if Contraction is Adequate

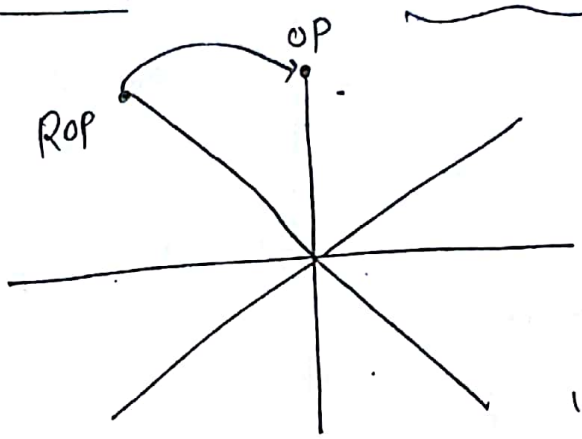
↳ Manual Rotation

Forceps Rotation

Vacuum device extraction

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

3rd outcome :- Persistant OP / Direct OP



↳ seen in Anthropoid Pelvis (90)

⇓

Mechn of Labours

⇓

"Face to Pubes" delivery

* In case spontaneous delivery (Not happening)

Forceps < C.S.

⇓

In Posterior Position ⇒ Incidence of Maternal Injuries & severity ↑es

* % of babies are in O.P. at onset of Labour = 20%

at the end of Labour = 5%

FACE / BROW PRESENTATION

*

M/c cause of Face presentation ⇒ Anencephaly;

Pelvis type; which favour it ⇒ Platypelloid

Anything that prevents flexion of head ⇒ Risk Factors (> 1 Loop of cord around Neck; tight loops /

* Mentum → Posterior
  - No Mechanism of vaginal delivery
  - C.S.
  ↓
  Anterior
  ⇓
  vaginal delivery
  - Face → delivery by flexion

* Mentoposterior in Labour ⇒ C.S.
  Mentoposterior in early Labour ⇒ wait & watch
  - to Rotate gives time

* Brow presentation
  - engaging Diameter ⇒ Mentovertical = 14cm
  - No Mechanism of Labour
  - Brow in Labour → C.S.
  - Brow in early Labour → wait & watch

TRANSVERSE LIE

M/C cause ⇒ Pre Maturity

M/C cause at term ⇒ Placenta previa

- Most Commonly Seen ≅ "Platypelloid" Pelvis.
- Highest Risk of cord prolapse

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Transverse Lie — In Labour — do C.S.

↳ Tries ECV (91)

↳ if Requirement Mets.

* Neglected Shoulder

↳ Upper segment ⇒ Tonically contracted

Lower Segment ⇒ Stretch

Bendl's Ring ⊕ in b/w US & LUS

⇓

Case of obstructed Labour

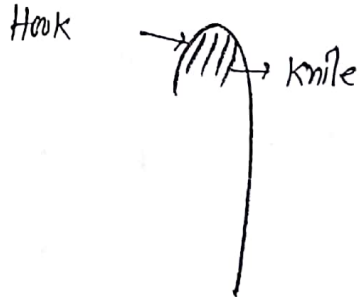
↳ FHR Absent

↳ do C.S.

Destructive procedure ⇒ i) Evisceration;

ii) Decapitation;

⇓



Q. Lady prt. ē Neglected Shoulder presentation ē dead baby. all the following can be done except ⇒

a) C.S.

b) Evisceration

c) Craniotomy (b/c for it vertex presentation Require & her transverse lie prt

d) Decapitation

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Q. Confusion of Breech presentation on P/V examination :→

Face presentation

↳ Frank breech Most commonly confuse.

↳ In it ~~three~~ two bony prominence & one opening (Mouth) Makes a triangle;

while in breech it forms straight line

INSTRUMENTAL DELIVERY

- do when we cut short 2nd stage of Labour
- Pre-Requisites :→

F → Fully dilated Cx

O → No Obstruction In the path

R → Ruptured Membrane

C → Good Uterine Contraction

E → Engaged head / Emkty bladder / episiotomy

P → Favourable presentation

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Forceps delivery	Vacuum delivery
→ difficult	→ easier Application (92)
→ Maternal Exhaustion	→ Needs Maternal effort
→ we in heart disease	→ also we in heart disease; Not C/I

→ In Fetal distress (Forceps > vacuum delivery)

* In general Forceps prefer over vacuum

→ In preterm — if POG < 34 weeks; vacuum is absolutely C/I

→ Face presentation (MentoAnterior Position) — In Face presentation ↳ C/I.

→ After coming head of breech (Piper's Forceps)

→ More Maternal Injuries — More fetal Injuries

Q Which fetal injuries are M/c c Forceps delivery??

- IVH
- Facial Nerve Injuries
- Brachial Plexus Injuries
- Cornea of the eye

Q Injuries which see c vacuum Not c Forceps delivery??

- 6th Nerve Injuries
- Cephalhematoma
- Retina Injuries

* **Classification of Forceps delivery :-**

Outlet ≥ +3

Low +2

Mid cavity – b/w 0 & +2 } Not in Modern days

High – above 0

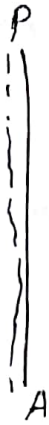
* Criteria for application of outlet forceps ⇒

① Scalp visible at introitus

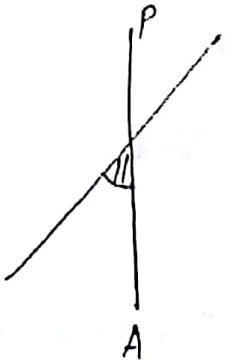
② head on Pelvic floor } ≥ +3

③ Skull on Perineum

④ Saggital Suture should be preferably in A-P Position



⑤



Rotational defect <45°

↳ apply outlet forceps

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

How to know that Forceps is correctly applied ?

(93)

⇓

Blades have to be equidistant from saggital suture

along which fetal diameter we apply Forceps blade

↳ occipitoMental (13.5 cm)

* Left blade of Forceps ⇒ Introduced first

↳ M/c Position = Left,

* M/c outlet forceps used ⇒ Wrigley's outlet forceps

↱ Not used in After coming head; b/c of short Nature

⇓

for both outlet & Low position,

short forceps & have English Lock

* Kelland's forceps ⇒ for Rotational defect

↳ Long forceps

* Piper's forceps ⇒ for after coming head

↳ Pelineal curve ⊕ (Baby body Rest here)

very long forceps

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

VACUUM DEVICES

- Use only plastic cup

  - Bell shaped
  - diameter = 5–7 cm
  - Silastic
  - Pressure = 0.8 kg/cm² generated
  - Centre of the cup @ Flexion Point
    - 3 cm Anterior to Posterior fontanel
    - OR
    - 6 cm Posterior to Anterior fontanel
    - @ saggital suture

- The Margin of cup touches the Posterior fontanelle

Failed Vacuum ⇒ 3 Pulls – No descent of head
3 Pop offs.

* if one device fails we goes for C.S.

C/I of Instrumental delivery ⇒ a) Contracted Pelvis
b) CPD.
c) HIV ⊕ve Patient
d) K/c/o Coagulation defect } in baby
e) osteogenesis Imperfecta

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

ANTEPARTUM HEMORRHAGE (APH) (94)

* Bleeding from or into the genital tract beyond the period of viability
  ↳ In India ≃ 28 weeks

* Causes of APH ⇒ Abruption
  Placenta Previa
  ↳ Placenta Lying in the LUS

→ Premature separation of a Normally Located placenta (from Underlying decidua)

ABRUPTION

Previous history upto 15%
(Relative Risk)

Pre-eclampsia ; Thrombophilia
Trauma Folic acid deficiency
Polyhydraminos Fibroid
PROM
Long standing oligohydraminos

Advanced Maternal Age
Smoking
Multiparity
Highest Risk

High Risk

Early ♀ USG
↳ In Subsequent Scan ⇒ Placenta ⇒ Upper segment
dt differential growth of uterus
Placenta migrates

In Previous C.S.
↓
Migration abt
↳ So; RIF for Placenta previa

PLACENTA PREVIA

Previous history (5%)

Previous L.S.C.S.
(More the Number higher Risk)

Placenta May be Low Lying

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

- Endometrities
- Mullerian Anomalies

CLASSIFICATION

Placenta PREVIA

↳ type-I ⇒ Low Lying

⇓

Lower segment of placenta is ≤ 2cm of Internal os

Anterior (A) ← Anterior wall

Posterior ← (B) Posterior wall

type-II → Marginal

type-III ⇒ Partial (Partially covering the Internal os)

type-IV ⇒ complete/central (completly covering the Internal os)

Other classification ⇒

Minor Placenta previa ⇒ Type 1A ; 1B ; 2A → Mode of delivery ⇒ Vaginal

Major " ⇒ Type 2B ; 3 ; 4

↳ Mode of delivery ⇒ C-S

* Dangerous Placenta previa ⇒ 2B ⇒ Fetal distress

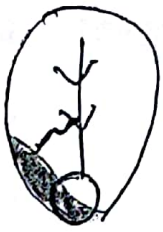
↳ Stallworthy sign ⇒ Pushing down of head produces a dip in FHR.

← On type 2B

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Type I

Type II


Type III

Type IV

(95)

Classification of Abruption

- **Revealed** ⇓ → Blood → expelled out
- **Concealed** ⇓ → Blood collects behind placenta (Retroplacental clot)
- **Mixed** → M/C

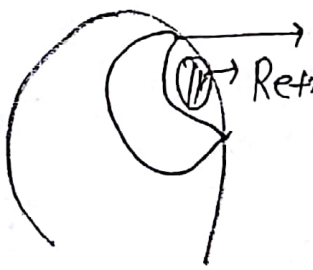
* **PAGE's classification of Abruption ⇒**

Type 0 ⇒ Retrospective diagnosis,

Type 1 ⇒ bleeding & Pain (FHR ⇒ (N))

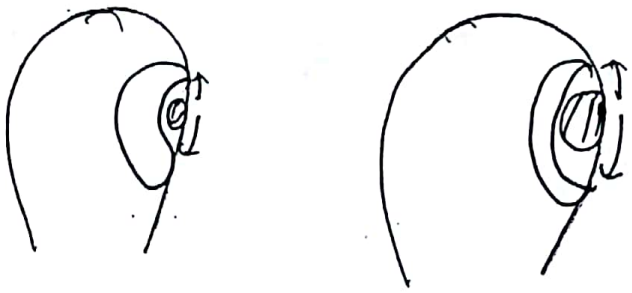
Type 2 ⇒ Bleeding + Pain + Fetal distress

Type 3 ⇒ Bleeding + Pain + GUD + Shock (Maternal) ± DIC



⇒ tissue thromboplastin ⇓ Potent Uterotonic (Pain)

* Abruption is self propagating



Risk of DIC is dependent on how long Abruption to delivery time taken

* Termination of Pregnancy
  ↳ only Mx of Abruption
  ⇓
  No Role of conservative Mx.

*Pt. comes ☹ APH; how to tells about P.P & Abruption?

P.P.	M/c Presentation	ABruption
Bleeding		Bleeding
↳ Painless		↳ Painful
Bright Red (Fresh bleeding)		→ Altered (dark coloured)
Causeless		→ Preceeding event
		↳ Pre-eclampsia
		Trauma
Hypotension M/c	⇐ General Physical examination ⇒	Hypotension is Not common (b/c bcoz BP is high)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

P.P.	P/A examination	Abruption
Uterus Relaxed		Uterus tense tender (96)
Non-tense Non-tender		
Fundal height = POG <POG (Sometimes)		Fundal height > P.O.G.
Less common	Fetal Distress	More Common
Most Common (Fundal height < POG) Transverse Lie	Malpresentation	Less common
H/O Warning hemorrhages		No warning hemorrhage (Acute event)
Should not be done in APH Until you Rule out Placenta previa.	P/S And P/V examn	
Transabdominal USG	IOC	

* TVS is Not C/I; but it is More Sensitive for Posteriorly Located Placenta.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Qq Pt. comes c APH

↳ Pt. Not Low Lying (Fundal)

No RPC

ans: Still a case of Abruption

↳ P/v examination

↳ ARM

Confirm → Blood stained Liquor

Induce Labour

* Placenta previa

↳ Mx ⇒ Are there any indications for TOP

⇓

Yes (If is in order to do TOP)

⇓

i) P.P. + Unstable vitals; (Mc indication for TOP) → ⇓ do it Right Now

ii) P.P. + Fetal distress;

iii) P.P. + > 37 weeks.

iv) P.P. + Continous Bleeding Per vagina

v) P.P. + Women goes into Active Labour

vi) P.P + GUD

vii) P.P. + GCA (Incompatible for Life)

Q. $G_3P_2L_2$; 34 weeks APH (Bleeding P/V; Painless); on examination Fundal height = 34 weeks; Relaxed Non-tende Non-tense; Relaxed uterus; RR = 100/m; BP = 114/76. (97)

Usg = type 4 PP.

Mx ⇒ Conservative Mx.

* Indication of CS in APH :- i) Unstable Vitals;
ii) Fetal distress;
iii) Major degree of Placenta previa;
iv) Far from term (< 32 wk)

* Conservative Mx in Placenta previa
↳ Macaffee Regimen
i) Bed Rest
ii) Maternal Monitoring : Vitals;
FH (Fundal height)
AC (Abdominal circumference)
BPV-(Bleeding Per vagina)
Baseline Ix
Uterine contraction

(only bleeding is Not Indication of blood translusion; Anemia also a Indication)

iii) Fetal Monitoring : FHR
iv) if patient < 34 weeks ⇒ steroids for Fetal Lung Maturity
↙
Dexamethasone (National guideline) ⇒ Dose
↓
6 mg IM x 4 doses x 12 hr apart

Betamethasone – 12 mg × 1/2 m × 2 doses 24 hrs apart.

∀ < 34 wk + Uterine irritable (Mild contraction)

↳ give Tocolytics (to buy time for steroids cover)

↳ also for ECV

Hyperstimulation

- Doc (Tocolytics) ⇒ Nifedipine
- Safest Tocolytic ⇒ "
- Doc of Tocolytics in heart dz ⇒ Atosiban (oxytocin Receptor Antagonist)
- Initially β-Agonists used as Tocolytics

↳ cause ⇒ Hyperglycemia AIIMS May 18

Hypokalemia

Tremors

Tachycardia

Arrythmia

Cardiac arrest

Pulmonary edema

only β-Agonist used as Tocolytic

Now a days

↓

Terbutaline

- Indomethacin

↳ Not given >32 week ← Premature closure of ductus arteriosus

- Halothane
- Alcohol
- Diazoxide
- $MgSO_4$ (acts as tocolytic @ 9-10 meq.)

↳ given 4-7 meq

↳ it has Neuroprotective action (prevent cerebral Palsy) ↳ for preterm babies

↳ toxic dose for Mother ↓ So Not given as a tocolytic agent.

(98)

End point of conservative Mx

↳ 37 wks @ or any other Indication of TOP

ABRUPTION ⇒ No Conservative Mx

↳ Indication for TOP

↳ No Role of Tocolysis

↳ Vaginal delivery is preferred 2°

⇓

ble she has high Risked DIC

&

Progress very quickly in Labour

(tissue thromboplastin)

Precipitate Labour (entire process of Labour c/in 3hr)

↳ do CS: when ⇒ Unstable vitals

Fetal distress

Fal from term

If Intraoperatively we see Red Uterus

⇓

COUVELAIRE UTERUS

(Bleeding c/in Myometrium)

Seen in Uteroplacental Apoplexy / Abruption.

⇓

- It is Not an Indication of Hysterectomy
- It is R/F for PPH.

Q. 34 week ♀; Bleeding P/v ± Pain; O/E uterus 36 wk; tense, tender; FHR = 100 bpm; on Evaluation BT/CR/INR = deranged

Mx ⇒ pt is the case of DIC

Transfuse FFP and try for vaginal delivery.

in ceaserean section; Pt. Bleed Profusely from all the sites & dies on table.

Mc cause of DIC in obstetrynal ⇒ Abruption.

* Placenta previa → term

⇓

Mx ⇒ USG

OR

do " Double set up examination "

P/v in O.T

1 table

⇓

Ready for emergency C.S.

2nd table

⇓

on P/v ⇒ Fornices boggines (≥ 2 fornices)

⇓

we are done for Major placenta previa

if we don't get any fornices boggines

↓

goes upto the level of Internal os

⇓

If bleeding ⊕ or Placental tissue ⊕ Near Internal os.

⇓

do emergency C.S

⇓

If No placental tissue Near the Internal os (Minor)

⇓

ARM → Labour Room

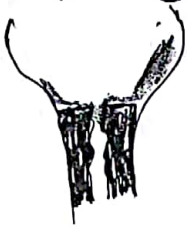
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

ADHERENT PLACENTA

(99)

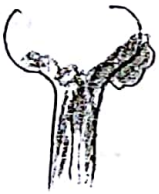
(N) Placenta is attached to Decidua; but here Placenta is attached to Myometrium & intervening decidua is absent

- Types ⇒ (1) Accreta ⇒ Attached to Myometrium
  - Most common
  - "Large intraplacental Lacunae" ⇒ Sonological findin



(2) Increta ⇒ Invades into the Myometrium

(3) Percreta ⇒ Penetrates through & through the Myometrium. It comes out in the serosal surface.
  - Least common



- Highest R/F ⇒ Previous L.S.C.S. + Placenta previa (current)

QQ Highest R/F for Adherent Placenta :-

(a) Previous L.S.C.S.

(b) Previous P.P.

Other R/F ⇒ Curettage
Scar
Multiparity
Increasing Age

IOC ⇒ USG + Doppler

- Heterogenous Placenta
- Intraplacental Lakes (Blood tissue in placental tissue)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

if we have Any doubt / OR we want to know about depth

⇓

do MRI

(N) prt. b/w placenta & decidua

On MRI ⇒ Absent / Incompletely developed Nitabuch's Membrane (Layer)

⇓

It is fibrinoid degeneration b/w trophoblast & decidua

Mx ⇒ · K/c/o Adherent placenta

↳ Elective cs (classical) **

\+

Hysterectomy

↳ if we incise on Lus, Myometrium cuts & we damage placental tissue

· presentation in Undiagnosed case ⇒

deliver

↳ No Sign of placental separation

↓

if we try to Manual Removal

⇓

Pt. bleeds

↳ Refractory PPH (Pt. prt. with Refractory PPH)

⇓

do hysterectomy

* if Patient denies hysterectomy

↳ deliver vaginally

↳ cut the cord short as possible as close to placental end

leave the placenta ← It will go autolytic digestion c/m 6 Months

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(100)

MOLAR PREGNANCY

GTD ⇒ Gestational Trophoblastic disease

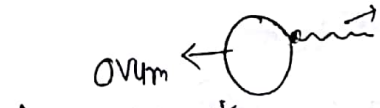
- Molar ♀
  - Partial
  - Complete
- GT Neoplasia
  - Invasive Mole
  - Choriocarcinoma
  - PSTT (Placental site trophoblastic tumor)
  - ETT (Epitheloid Trophoblastic tumor)

PARTIAL MOLE

- Chromosmal make up of Molar ♀
  - ↳ Triploid (9at.)
    - ↳ 69 XXY
  - 10% Tetraploid
  - Extra set — Paternal
  - Dispermic

COMPLETE MOLE

- Diploid (46XX) — 9at
  - ↳ 10% 46XY (Dispermic)
  - Monospermic
- all genetic Material is Paternal



Bleeding (2nd Trimester ♀)

O/E ⇒ Fundal height ≤ POG

Mis diagnosed USG
↳ Missed Abortion

Mic presentation

IOC

Bleeding (Grapes Like vesicle) (2nd Trimester ♀)

O/E ⇒ Fundal height > POG

USG
↳ Snow storm appearance

PARTIAL MOLE	COMPLETE MOLE
• Fetus Seen ↳ dies d/t Multiple Anomalies	• No Fetus on USG Seen • ovaries → Theca-lutein cyst in it. ↳ in 25-30% cases
*If we can see focal hydropic in Placenta	
Gestation → Transverse diameter > AP diameter	
Molar ⊕ Most commonly diagnose in 1st Trimester (USG in 1st trimester)	
- HCG > than expected (but Not Markedly high)	HCG - Markedly Raised (>10^5)
HPE — Gold Standard Investigation (Confirmation of diagnosis) i) Less Marked trophoblastic Proliferation ii) Focal hydropic degeneration of villi iii) Fetus ⊕ iv) Vascular	HPE i) extensive trophoblastic Proliferation; ii) complete hydropic degeneration of villi iii) No Fetus iv) Avascular
- Trophoblastic Scalloping ⊕ ↓ Stromal Inclusion	⊖
Medical complication X X X X	i) Thyroid Storm → d/t high hCG ii) Pulmonary embolism iii) Early onset Pre-eclampsia ↳ d/t Paternally exposed Ag, iv) Hyperemesis Gravidarum ↳ d/t hCG

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Partial	Complete
Partial Mole → GTN (3-5%)	Complete Mole → GTN (15-20%)
Partial Mole → chorio.ca (<1%)	Complete Mole → chorio.ca (4%)

Mx ⇒ Suction & evacuation (do if Fundal height ≤ 12wks)

⇓

if pt is ≥ 40yrs + complete Mole ⊕

↳ do Hysterectomy (↓ Risk of chorio-ca)

SIE ⇒ Pulmonary Embolism

Thyroid storm

to prevent Embolism ⇒ Start suctioning first then followed by oxytocin.

Check curettage ⇒ Sharp

* Send sample for HPE

↓

then follow up ē HCG

Weekly S. HCG ⇒ until 3 (N) values

⇓

Monthly HCG

Total surveillance ⇒ upto 6 months

* Avg time to β-hCG to become (N) ⇒ 9 weeks

Avg time to β-hCG to become (N) in Partial Mole ⇒ 7 weeks

* Say patient Not to conceive

↳ Contraceptive of choice ⇒ OCP

Barrier can be used

gud Avoid ↳ bleed bleeding

* CRITERIA FOR Diagnosis of GTN (Any 1) :→

① 4 consecutive HCG values shall shows of Plateau (Less than ± 10% values)

② 3 consecutive HCG value that shows a Rise (>10%)

③ HCG Remains elevated even after 6 months of Suction & evacuation

④ HPE → GTN

* clinical presentation of GTN :→

i> Bleeding Per vagina — Persistent

ii> Shock

iii> Persistant Theca Lutein cyst

↓

(N) Theca Lutein cyst shows Spontaneous Resolution within 2-4 months of Suction & evacuation.

iv Uterine Subinvolution

↳ Uterus doesn't go to (N) Non-P state after Suction & evacuation

v Metastasis

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(102)

* High Risk for Conversion of GTN ⇒

i) ≥ 40 yr (Maternal Age)

ii) Fundal height > POG

iii) HCG > 10^5

iv) B/L Large (> 6cm) theca Lutein cyst

} Should Receive Prophylactically Chemotherapy ⇓ Actinomycin D OR Methotrexate

* M/c GTN ⇒ Invasive Mole

4c GTN ⇒ ETT

M/c GTN to develop after Full term ♀ ⇒ Choriocarcinoma

* Choriocarcinoma M/c develop after which type of ♀ ⇒ Complete Mole

Malignant ⇓

Metastasis seen (Cannon ball Metastasis on CXR)

↳ M/c site ⇒ Lung > vagina > Liver > Brain

2nd M/c finding on Choriocarcinoma on CXR Lung ⇒ "Snow Storm Appearance" ⇓ also seen in USG of complete Mole

* In vagina

↳ Bluish Suburethral Nodules ⊕

↳ don't take biopsy bc very vascular

* How to differentiate Invasive Mole from choriocarcinoma ?

(HPE) ↳ Presence of villi ⇒ Invasive Mole

Absent villi ⇒ Chorio carcinoma

Choriocarcinoma	PSTT
• M/c	Rare
• M/c after complete Mole	M/c after FTP (↳ Full term ♀)
Tumor Marker ⇒ HCG	HPL > PLAP (↳ Placental alkaline Phosphate; HPL ↳ Human Placental Lactogen)
Malignant	Benign
Dimorphic cells (Cyto/Syncytiotrophoblast)	Mononuclear Monomorphic cells (No Syncytial ones)
• Hemorrhage/Necrosis +	↓
• Chemo sensitive	Chemo Resistant
• TOC ⇒ Chemotherapy	Hysterectomy

* STAGING OF GTN ⇒

Stage I ⇒ Tumor is confined to uterus

Stage II ⇒ - Outside uterus but clin Pelvis (Metastasis ... vagina)

Stage III ⇒ Metastasis to Lungs (good Prognosis)

Stage IV ⇒ Metastasis elsewhere except → vagina

PNEI

Modified Ueda Scoring ↳

	Low Score (good Prognosis)	High Score (bad Prognosis)
i) Age	≤ 39 yr	≥ 40 yr
ii) HCG (≥ 40,000 ... ↓)	≤ 10^3	≥ 10^5

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(103)

iii)	Type of Antecedent ♀	Molar	FTP (Full term Pregnancy)
iv)	Duration from Antecedent Pregnancy	< 4 month	> 12 month
v)	Site of Metastasis	Lungs	Liver, Brain
vi)	No. of Metastasis	< 4	> 8
vii)	Tumor size	< 3 cm	> 5 cm
viii)	H/o Previous Chemotherapy	Single Agent	Multi Agent

if Total WHO Score ≤ 6

↳ Low Risk GTN

⇓

Single agent chemotherapy

⇓

Methotrexate

↓ if Pt. Resistant

Actinomycin D

also in stage I →

≥ 7

High Risk GTN

⇓

Multi Agent chemotherapy

E → Etoposide — D_1

M → Methotrexate — D_2

A → Actinomycin D — D_3

C → cyclophosphamide — D_4

O → oncovin (vincristine) — D_5

↓ if Resistant

E → D_1

M → D_2

A → D_3

E → etoposide

P → cisplatin

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Follow up ⇒ Weekly hCG — till 3 Ⓝ value

End point of chemo. ⇒ 1st Ⓝ value — 3 More cycles of chemotherapy

After 3 Ⓝ value ⇒ Monthly follow up

Period of Surveillance for Low Risk GTN — 12 Month

" for high " " → 24 Month

Advice ⇓ Not to conceive & contraception of choice is Same as Molar ♀ ↳ Combined ocp's

Previous C.S.

Elective Repeat C.S.

Absolute C/I

↳ i) Classical C.S.
(Repeat C.S. but Not an Indication for Repeat classical)

ii) H/o Rupture Uterus

iii) ≥ 3 Previous L.S.C.S.

iv) ⊕ of C.P.D in current pregnancy

v) H/o Sx → Hysterotomy
Sometimes Myomectomy (when Uterine cavity is opened)

Trial for VBAC ⇓

Anything other than elective Repeat C.S.

* Gmp. Prognostic Marker Success of VBAC ⇒ H/o Previous vaginal delivery.

- Successful
- emergency C.S ⇓ do in impending
- emergency Laprotomy ⇓ do in Rupture

Q. $G_2P_1L_1$ c previous L.S.Cs.; done for C.P.D. 40wk; Head is free floating Cx os closed & Unellaced Mx (104)

⇓

C.S. (b/c C.P.D ⊕ in current ♀)

vii) Where vaginal delivery is c/I (Contracted Pelvis / Major degree of Placenta previa)

* Relative Indication for Repeat C.S. (C.S. > V.D) :-

i) Previous L.S.C.S. — c Breech in current ♀

ii) " — c Macrosomia

iii) " — c Post-term

* Sign & Symptom of Impending Rupture :-

i) Non Reassuring FHR

↳ 1st FHR changages ⇒ Tachycardia

M/c FHR changages ⇒ Bradycardia

ii) evidence of Maternal Tachycardia;

iii) evidence of Scar tenderness (Pain);

become only significant if Non-Reassuring FHR ⊕.

⇓

If Intraoperatively; at the Scar site — all Layer of Myometrium have given way but overlying Serosa intact

⇓

Very imp. for Next ♀ ← "Scar Dehiscence"

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Sign & Symptoms of Rupture of Uterus :→

i) Maternal Tachycardia;
ii) ± Hypotension;
iii) Severe fetal distress / FHR absent;
iv) Fetal parts all superficially felt; (as the fetus is expelled into Abdominal cavity)
v) Uterine contour is Lost.
vi) Sudden stoppage of Uterine contraction;
vii) fresh bleeding per vagina;
viii) Catheterise → Gross hematuria
ix) Loss of station (Most characteristic feature of Rupture Uterus)

x ⇒ emergency Laprotomy (Tries to Repair)

* Can we do Induction in Labour (IOL) in previous C.S
↳ Not C/I
⇓
Spontaneous Labour > IOL
⇓
Doc ⇒ Oxytocin
Not be given ⇒ Misoprostol

* Can we do Augmentation of Labour
↳ Not C/I
↳ Continous fetal Monitoring (to identify 1st sign of impending Rupture)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Can we do ECV in Previous C.S.
  - ↳ Yes (Not CI) (105)
  - ↳ Relative CI for ECV

* Internal Podalic version (IPV) in Previous CS
  - ↳ Absolutely CI in Previous C.S.

* Induction of Labour is CI in :→ Contracted Pelvis
  - ⇓
  - it Means we can't delivey vaginally.
    - Classical C.S.
    - H/o Rupture uterus;
    - Transverse lie;
    - Major degree of Placenta previa;
    - Category 3 FHR tracing
      - ↳ Ominous to baby
        - ↳ Immediate delivery

* Pre-Induction Score :→ to Induce Labour
  (Bishop's Score)

Cervix	Score 0	1	2	3
Position (Least imp.)	Posterior	Mid-position	Anterior	
Consistency	Firm	Medium	Soft	
Effacement	0-30%	30-50%	60-70%	> 80%
Dilatation (Most. Imp.)	closed	1-2cm	3-4cm	>5cm
Baby's station	-3	-2	-1, 0	+1, +2

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Qn Modified Bishop ⇒ Cx effacement is Replaced by Cx Length

Qn Simplified Bishop ⇒ dilatation
effacement
station

* All Scores ≥ 9 (>8) ⇒ Favourable → Initiate Uterine contraction.

≤ 5 (<6) ⇒ Unfavourable

Total Score – 13

↳ firstly do cervical Ripening

Medical Methods

- Cervidil gel (Dinoprostone) PGE_2
  - 0.5 mg
  - Ideal → Intracervical
  - Acceptable → Posterior fornix
  - Put 6 hrly Max^m 3 doses in 24 hrs
  - Mc used
  - ↓t do only Ripening; so; after Ripening; give oxytocin +o Uterine contraction (after 6 hr.)

- Misoprostol (PGE_1)
  - ↓
  - 25 µg per vaginally
  - Put every 4 hrly
  - Max^m 6 doses/24 hrs.
  - Better (do Ripening + Uterine contraction)
  - after 4 hrs we give oxytocin; if Uterine contraction is Not

Mechanical Methods

- Laminaria Tents (osmotic dilators)
- Bulb of Foley catheters

TWINS PREGNANCY

* M/c type ⇒ Dizygotic (70%); klas "Fraternal twins"
  Monozygotic (30%); klas "Identical twins"

* In ART procedures ⇒ M/c type ⇒ Dizygotic twins

* Incidence of Dizygotic twins
  ↓ Varies
  depend on ⇒ Race
  ethnicity
  Family History
  ART

  Incidence of Monozygotic twins
  Constant
  M/c type of Monozygotic twins
  ↳ MCDA

* Dizygotic ⇒ Dichorionic
  Diamniotic
  M/c type ↑

  - depend on time of cell division
  C/in 72 hrs of Fertilization ⇒ DCDA
  C/in 4th-8th day " ⇒ MCDA
  C/in 8-12th day " ⇒ MCMA
  C/in >12th day " ⇒ Conjoined twins (Siamese)

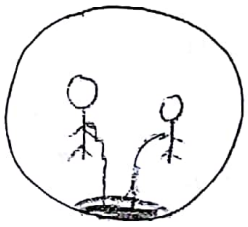
* Monochorionic twins has higher Risk as compared to Dichorionic

* Marker of Dichorionicity (to know chorionicity we do USG in 1st Trimester (<7wk))
  ↳ i) 2 separate Placenta on USG
  ii) Opposite sex twins;
  iii) Twin Peak sign (Lambda sign
  (Seen in 10-14 week) ↳ b/c chorion enters into

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

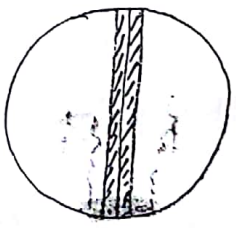
* In Monochorionic twins
  - Inverted "T" sign seen on USG
iv) 4 Layers in dividing Membrane
  2 Amnion 2 chorion
v) Thickness of dividing Membrane
  ⇓
  ≥ 2mm thick ⇒ Dichorionic
  if < 2mm thick ⇒ Monochorionic

* Monochorionic Monoamniotic twins



* M/c type of conjoint twins ⇒ Thoracopagus (to joint)

* Monochorionic Diamniotic twins



* M/c Risk to fetus in twin ♀ :- Preterm Labour
  also ⇒ GICA ↑
  GUGR
  } compalion to singleton ♀

(107)

* 2 things not Seen in Multifetal ♀
  - Post dated ♀
  - Macrosomia

* Fetal Reduction :⇒
  - Ideal time to do ⇒ 10-13 week
  - Under USG guided Inject KCl into thorax
  - Converted into 2 fetus (Not less than twins)

* Monochorionic twin (Specific) Complication ⇒
  - TTTS
  - TRAP (Twin Reversed Arterial Perfusion)
    - Also "Acardiac twinning"
  - TAPS (twin Anemia Polycythemia Sequence)
  - Selective IUGR
  - ↑↑ Risk of GCA

TTTS (Twin twin transfusion Syndrome)

- It is Seen in Monochorinic Diamniotic
  - Reason for TTTS
    - Vascular Anastomosis

Deep Artery of one baby anastomoses with Deep vein of other baby

* 9m Monochorionic Monoamniotic twins

↳ Plenty of Superficial Artery - Artery anastomosis ⊕ ; so ; TTTS not seen in it

Diagnosis ⇒ USG

Simultaneously → Polyhydramnios (by DVP Method we see Amniotic fluid)
→ oligohydramnios

Deep Artery ⟶ Deep vein

Donor
⇓
Oligouria
⇓ oligohydramnios
Heart failure

Recepient
⇓ ↑ blood volume
Polyuria
⇓ Polyhydramnios
CHF
↳ d/t Cardiac overload

* QUINTERO STAGING ⇒ Staging of TTTS

Stage 1 → Poly/oligo + Bladder of oligo twin is visible + Doppler (N)

Stage 2 → Poly/oligo + Bladder of ~~oligo~~ twin is Not visible + Doppler (N)

Stage 3 → Poly/oligo + bladder Not visible + Doppler (ABN)

Stage 4 → Either/both hydrops fetalis

Stage 5 → Either/both IUD.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Tt ⇒ Feto Scopic Laser Ablation of the vascular Anastomosis. (108)

Stuck twin ⇒ alive; only stuck
Oligo twin of twin twin transfusion Sx.
↳ can't Move; so; Looks like Stuck

Vanishing Twin ⇒ Spontaneous abortion of one of the twin.

Fetus Papyraceus ⇒ One twin dies & is compressed by other twins.

Impending death
↓
do TOP
↓
take out both the babies; as other baby May goes to hypoxic injury

if one twin – already die
↳ gud
↓
Continues Pregnancy + Monitors the other twin
⇓
Baby May go hypoxic injury & coagulation defect both

Superfetation ⇒ different cycle (Menstrual)

Superfecundation ⇒ Same cycle

OUTCOME OF TWINS ⇒ Lie of 1st Twin

1st Twin — Longitudinal — vaginal delivery
Non-Longitudinal — C.S.

* M/c combination In Labour ⇒ Vertex – Vertex
1st twin 2nd twin

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Vertex – breech

QQ $M_X = ??$; if 1st twin = Breech; 2nd = vertex

Vaginal delivery is Not c/I

C.S. > vaginal delivery

Complication ⇒ twin gnterlocking

QQ. $M_X = ??$ if 1st vertex deliver ; 2nd breech

⇓

Assissted Breech vaginal delivery

QQ. $M_X = ??$ if 1st vertex deliver ; 2nd Transverse lie

⇓

do Gnternal Podalic version (GPV)

∈ Breech extraction

gives under GA (General Anesthesia);

Mother have no effect to push the baby; so; do Breech extraction

↳ i.e No efforts by Mother at all

* The lie of 2nd baby is Not deaided until 1st baby is delivered

QQ M/c complication of Monoamniotic twins are

↳ Cord Entanglement

↳ delivered by GS:

⇓

by 32-34 weeks

Rh ⊖ve PREGNANCY

(109)

♀ Husband ⊕ve ⇐ both Require for complication

↳ Feto maternal hemorrhage (FMH)

⇓

occur in 1st ♀ @ delivery

Sensitization of the Mother

0.1 ml blood is Required to sensitization

⇒ 1st Ab produced by Mother after sensitization

↳ IgM (doesn't cross the placenta & Not cause affect in baby in 1st ♀)

Later she produce IgG (cross placenta)

⇒ Significant titre Require to damage fetus

↳ ≥ 1:16

GCT done

⊕ve Sensitized ⊖ve Non-Sensitized

* Anti-D prevents Sensitization.

⇓

dose: FMH < 12 wks → 50 Mgm

FMH > 12 wks → 300 Mgm

↳ Significant Anemia in fetus

↳ MCA doppler tells about it

↳ Peak systolic velocity

↳ PSV ≥ 1.5 Mom

Multiple of Median

Cause heart failure

Hydrops

↳ death of Foetus

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* 300 Mgm of Anti-D Neutralize
  - fetal blood - 30mL
  - fetal RBC - 15mL

* if we suspect FMH more than usual then to calculate dose of Anti-D — Kb test (Kleihauer Batke)

Case I :-

Rh ⊖ve
↓
Husband ⊕ve
↓
@ 12 week GCT ⊖ve
(Not sensitized)
⇓
GCT (28wk)
↳ ⊖ve
⇓
Anti-D 300 Mgm → Prophylactically
↳ this works for 12 wks ; so, she delivers after safely.
⇓
if Baby blood group ⊕ve
⇓
Anti-D 300 Mgm i/m. (ideally c/in 72hrs ; can be given upto 28 days)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(110)

Case 2 :→

Rh ⊖ve

⇓

Husband Rh ⊕ve

⇓

@ 12 weeks gCT ⊕ve (< 1:16)

(Anti-D has No Role in gCT⊕ve Patient ; it Means Sensitization already takes place)

↓

Repeat gCT X 4 weekly

if Rising trend ; Repeat 2 weekly

↓

deliver at term

Case 3 :→

Rh ⊖ve

↓

Husband Rh ⊕ve

⇓

@ 24 weeks gCT ⊕ve (> 1:16)

↓ followed up for Severe Anemia

PSV - MCA doppler

- ≥ 1.5 Mom ⇓
  - P.O.G. ≥ 34 wk ↓ deliver
  - P.O.G < 34 weeks ↓ do cordocentesis ↓ Intrauterine transfusion ← Hb < 8 gm%
- < 1.5 Mom ↳ Repeat MCA doppler

if Hb level < 5 gm% of fetus ⇓ Hydrops fetalis

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Hydrops fetalis ⇒ Most common cause (Non-Immune Mediated)

↳ CVS — abnormalities

↳ M/c/c

↳ Immune Mediated

Infection that can cause hydrops fetalis ⇒ Parvovirus B-19

USG diagnosis ⇒ Any ≥ 2 of the following

i) Pleural effusion
ii) Pericardial effusion
iii) Ascites
iv) Subcutaneous edema

} Criteria

Scalp edema ⇒ Buddha sign.

Findings in hydrops fetalis ⇒ Placentomegaly
Polyhydramnios

* Gene for Rh factor Located on ⇒ Short Arm of chr. 1

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

HEART DISEASE IN PREGNANCY

(III)

Symptoms

- Orthopnea
- Paroxysmal Nocturnal dyspnea
- exertional dyspnea (Progressive)
  ↓
  It is Physiological; but progressive exertional dyspnea is Pathological

Signs

- Cyanosis / clubbing
- Diastolic Murmur
- Systolic Murmur > grade 2
- Cardiomegaly
- Atrial fibrillation / (AbN) Rhythm
- CHF
- Persistently distended Neck veins
- Pulmonary Artery HTN
  ↳ Loud P_2
- Wide Split S_2

* M/c heart disease in ♀ ⇒ Mitral Stenosis

M/c congenital heart ds in ♀ ⇒ ASD

M/c congenital valvular heart disease ⇒ Mitral valve Prolapse

* High Mortality Rate (> 50%) in ♀ :-

i) Marfan's Sx c Aortic Root Involvement
ii) Coarctation of Aorta c Aortic valve Involvement
iii) Eisenmenger Syndrome

→ TOP (Abortion)
in Severe MS (< 1.5 cm^2 ← valve Area)

v) NYHA Grade 3/4

vi) Ejection fraction < 45%

* **Good outcome**
  - ASD — Corrected TOF
  - VSD — Mitral valve Prolapse
  - PDA — Ebstein Anomaly

* if a patient has Severe MS
  - → High Mortality Rate ≥ 30%
  - ideally goes to — Valve Replacement
    - Sx preconceptionally
      - Not be done during ♀
  - if she wants to continue ♀
    - do Ballon valvotomy
      - ideal time
        - 18–20 weeks

* if she has valve Replacement
  - Prosthetic heart valve → Pt. is on Anti-coagulation
    - if she wants to Conceive
      - 1–12 weeks → Heparin
        - Antidote for heparin → Protamine sulphate
      - 12–36 weeks → Warfarin → causes embryopathy in 1st Trimester → Chondrodysplasia Punctata (Stippled femoral epiphysis) also
        - (More Potent)
        - Warfarin has No Antidote
      - 36– Onset → Heparin
        - On close to Labour; if Warfarin given; PPH happen

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* During Labour → Stop Anticoagulant (112)

However Restart the Anticoagulant In vaginal delivery ⇒ After 6hr
In C.S. ⇒ After 24hr

⇓

Restart ≈ Heparin + Warfarin

⇓

Withdraw Heparin ; Corre-d INR ; As Warfarin has delayed onset of Action

* GENERAL PRINCIPLES :-

i) Maxm Rise of CHF :-

Immediate Post partum > 2nd stage > 32 weeks

ii) Vaginal delivery is preferred ;
C.S. is Reserved for obstetric Indication

iii) ≤ Heart disease Indication of C.S. ⇒

1) Marfan's Sx ≈ Aortic Root Involvement
2) Coarction of aorta ≈ aortic valve Involvement
3) Aortic dissection
4) Severe As

In all Ejection fraction is affected

* In Eisenmenger's Sx ⇒ Vaginal delivery the

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Induction of Labour (IoL) is not contraindicated in heart disease

↳ it is safe

however; Spontaneous Labour over IoL

Qq 38 wks – Heart failure; k/c/o Heart disease;

⇓

Mx ⇒ Stabillze the patient

⇓

wait for Spontaneously Labour

iv) Propped up | Left Lateral Posture | O2 by Mask – Readily available

v) Restrict iv fluids @ 75 mL/hr

A.S ⇒ wet side

vi) Restrict the Pv exams

vii) ARM — Can be done

Memb. Rupture — Prophylactic Antibiotics

(AHA guidelines) ⇓

⇓ Ampicillin + Gentamicin

Vaginal delivery safe

viii) Pain Management ⇒ Epidural Analgesia (Neuraxial)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(113)

ix) Cut short the 2nd stage of Labour

⇓

Forceps delivery > Vacuum delivery

x) Immediately after delivery → given Inj. Lasix (to ↓ Preload)

→ Avoid Methargin

Hang down the patient leg from delivery table (to ↑ Venous Return)

xi) C.S. ⇒ Anesthesia → SIE ⇒ Hypotension

↳ Epidural Anesthesia; but if Ejection fraction is low; give General Anesthesia

Severe A.R / Severe AS / Cyanotic H.D. } ⇒ Low Ejection fraction

* In Aortic dissection (emergency condn) do emergency C.S. under G.A.

PERIPARTUM CARDIOMYOPATHY

- Development of heart failure Around Labour in a women ∈ No underlying Heart Disease
  ↳ 1 Month before delivery to 5 Month after delivery
- Ejection fraction – Low.
- Left ventricle May or Maynt be dilated
- Mainly in Pre-eclampsia patient; also in Multi-fetal ♀; advanced Maternal age
- Prolactin has some role to develop
- Mx = Same as Heart failure

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Fetal Monitoring

Fetal Movements :→ Quickening (1st Fetal Movement)

↳ 16 weeks — Primigravida
18 weeks — Multigravida

↳ (N) ≥ 10 fetal Movement in a 2 hr Period of Rest
OR
≥ 10 fetal Movement in a 12 hr Period in Routine activity.

↳ Maxm fetal Movement ⇒ @ 32 weeks
Perceived by women

- easiest time for gus in Absense Fetal Movement = 12 hrs
Maxm time for gus in Absense Fetal Movement = 48 hrs

- **Modified Biophysical Profile (BPP)** :→ ↓es Fetal Movement beyond 32 weeks

also klas "cardio-tocography"

NST >> AF ⇒ Amniotic fluid

NST ⇓ gn Acute gnjury

AF ↳ gn Chronic gnjury (UPI)

(N) Heart Rate = 110–160 beats/min.

Beat to beat variability = 5–25 beats/min

Acceleration ⇒ ↑ Heart Rate by 15 beats/min above baseline for 15 sec

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(114)

Deceleration

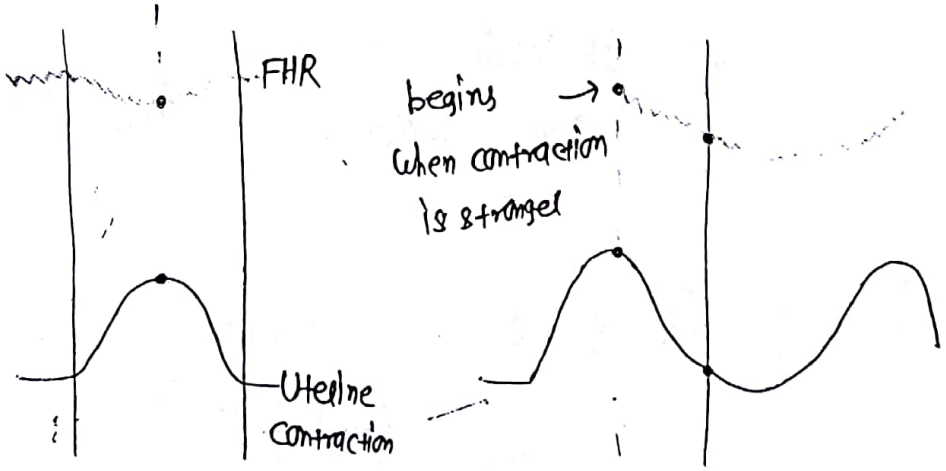
(3 types)

- Early ⇒ dip in heart Rate (d/t head compression)
- Late ⇒ dip persisting after the uterine contraction ends (d/t Uteroplacental insufficiency)
  - gradual dip in heart Rate
- Variable ⇒ Abrupt dip in heart Rate (d/t cord compression)
  - it is also bad outcome
- Sinusoidal Pattern ⇒ Marker of Severe fetal Anemia, Severe fetal hypoxia
  - ↳ Most ominous type of Pattern (worst outcome)

When variable deceleration is significant

↳ i) if HR < 70 beats/min × 1min

ii) Persistant Around ≥ 50% of uterine contraction



Early Deceleration

Late Deceleration

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Reactive NST ⇒ two or More than two acceleration in a span of 20min.

Non-Reactive NST ⇒ < 2 acceleration in a span of 40 mins

↳ Physiologically if baby is sleeping

* Category 1

Beat-Beat variability (N)

Category 2 ↓

- Further assessment
- LLP (Left Lateral Posture)
- O2 by Mask.
- Stop oxytocin
- i/v fluids
- give tocolytics

Category 3 ← ominous ← Immediate delivery → C.S.

Absent c

Any one of the following ⇓

Bradycardia

Late deceleration

Persistant variable deceleration

Sinusoidal

NST in high Risk ♀ ⇒ twice a week (once in 72 hrs)

* BPP (Biophysical Profile) ⇒ Manning Score

↳ Report card of Fetus

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(15)

→ USG for 30 min

↳ we a Score of +2 or Zero

- It has 5 components

⇓

Breathing Movement	⇒	At least one Movement Lasting 30sec	+2
Gross Body Movement	⇒	3 Movements	+2
Tone	⇒	Flexion – Extension – Flexion	+2
Amniotic fluid	⇒	Atleast 1 Pocket of 2 cm	+2
NST	⇒	Reactive	+2

; if Score is $\frac{8,10}{10}$ ⇒ (N)

$\frac{6}{10}$ ⇒ (N) Liquor = Equivocal = Repeat testing on the same day

$\leq \frac{4}{10}$ = Immediate delivery

* (AbN) In Acute hypoxic

⇓

Loss of Acceleration ⟶ Breathing Movement → Gross body Movement → Tone

⇓

1st to become (AbN)

* How frequently to be done in high Risk ♀

↳ once in week.

DOPPLER ⇒ • M/C 1st vessel ⇒ Uterine A

↳ sign of UPI

• S/D Ratio

↳ Ⓝ ♀ S/D ↓ing

• UPI ⇒ S/D ↑es

⇓ ↓

> 28-30 wk ≥ 3 ← UPI

REDF → TOP

• AEDF – TOP ≥ 34 weeks

↳ @ 34 weeks – gives steroid + further Monitoring.

or less than 34 weeks

* **MCA Doppler** ⇒ Not best for UPI

↳ Ⓝ; blc in UPI ; foetus sends blood to vitals organs

⇓

Early Stage MCA doppler ⇒ Ⓝ

⇓

Brain sparing effect

•http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(116)

* REDF — Umbilical Artery
  - ↳ Steroids – 2days
    - ↓
      - Reversal in Venous Doppler ← Last vessel to shows REDF
        - ⇓
          - Indicates Impending death.

* MCA doppler is best studied for fetal Anemia

* Best for Fetal Monitoring
  - ↳ Fetal Scalp blood PH
    - (N) ⇒ 7.25 – 7.35
    - 7.20 – 7.25 = Borderline → Repeat test after 30min
    - < 7.20 = Acidosis
      - ↳ Immediate delivery

* VAST (vibroacoustic Stimulation test) :-
  - High Intensity Sound waves
  - Released from Artificial larynx → on Maternal Abdomen for 1sec (to 2sec)
  - (N) Response ⇒ Yes from baseline by 15 bpm ↑ in 15 sec of stimulus

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* M/c Method for Intrapartum Monitoring :→

∴ Intermittent - Heart Rate Auscultation.

	1st stage	2nd stage
In Low Risk ♀	– every 30min	every 15min
In High Risk ♀	– every 15min	- every 5min

*Time to Heart Rate listen ⇒ Immediatly after contraction & Listen for 1 minutes (Not 15 sec x 4)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(117)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

GYNAECOLOGY ⇒ Base of Gynae

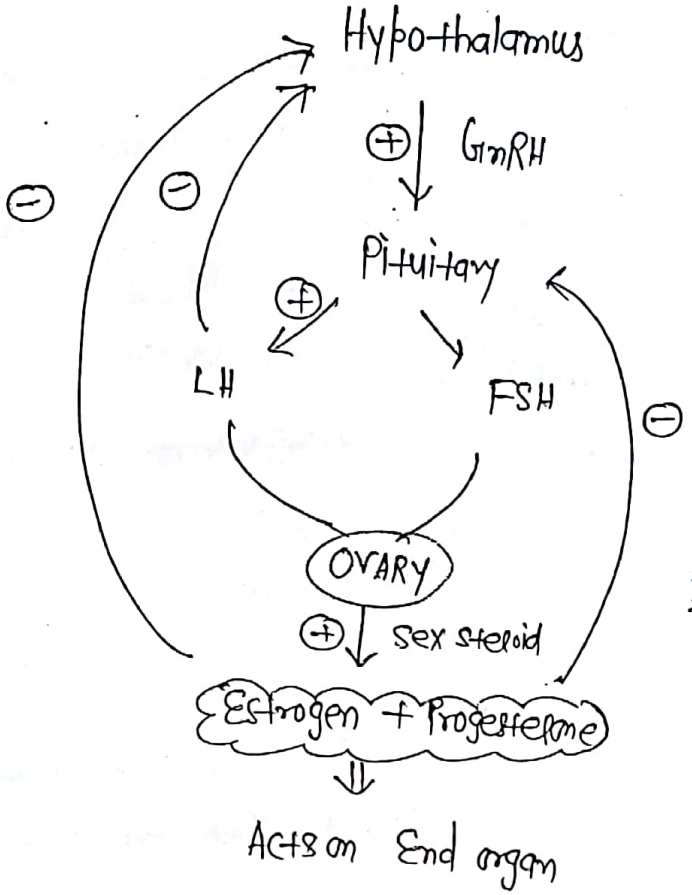
↳ Hormones (118)

* Hypothalamic- Pituitaric- ovarian Axis (HPO axis) :-

↳ Not develop before Puberty.

Sensitive Around = 8-12yr

Fully established by = 13-14yr



* Gn obese ♀ / Pubertal change occur early, d/t ↑es Level of Leptin

↳ Hormone Made by Adipose cells that gnhibit hunger.

* Estrogen

* C_{18} steroids

Types ⇒ E_1 - Estrone - Predominant Estrogen in Post Menopausal

E_2 - Estradiol ↳ in Reproductive Life

E_3 - Estriol ↳ gn Pregnancy

Most Potent (Natural) ⇒ $E_2 > E_1 > E_3$

* Most Potent (Synthetic)

↳ Ethinyl Estradiol (EE)

↳ Used in Combined ocp's

Progesterone

C_{21} steroids

Progesterone (Natural)

Progestin (Synthetic) ⇓ C_{19} steroids (Androgens) derived

↳ ocp's contain it

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Classification of OCP's on the basis of Amount of Ethinyl Estradiol ⇒

High dose ≥ 50 Mgm

Low dose 30-35 Mgm

Very low dose ≤ 20 Mgm.

Lowest dose 10 Mgm (LoLoestrin)

* Classification of OCP's on the basis of Synthetic Progestin :-

1st generation ⇒ Norethindrone

2nd generation ⇒ Levonorgestrel (LNG)

3rd generation ⇒ Desogestrel (M/C used)

Used in Malan, Mala D

Used in Novelon Pills

↓

Least Androgenic

M/C OCP Pills

Gestodene

Norgestimate.

4th generation ⇒ Anti Androgenic

- Spironolactone derivative (Drospirenone)
- Dienogest

as generation ↑es Lipid profile side effect ↓es & Androgenic side effect also ↓es

* Sources

E_1 ⇒ Post Menopausal

↓

Peripheral conversion

Androstenedione $\xrightarrow{\text{Adipose tissue (Aromatase)}}$ E_1

E_2 ⇒ Reproductive Age

↓

- comes from granulosa cells of ovary ↓↓ dependent on Theca cells } 2 cell 2 gonadotropin Theory.
- Corpus luteum

* Sources

- Ovary
  - ↳ Corpus luteum

↓

Formed by Luteinization of Granulosa cells.

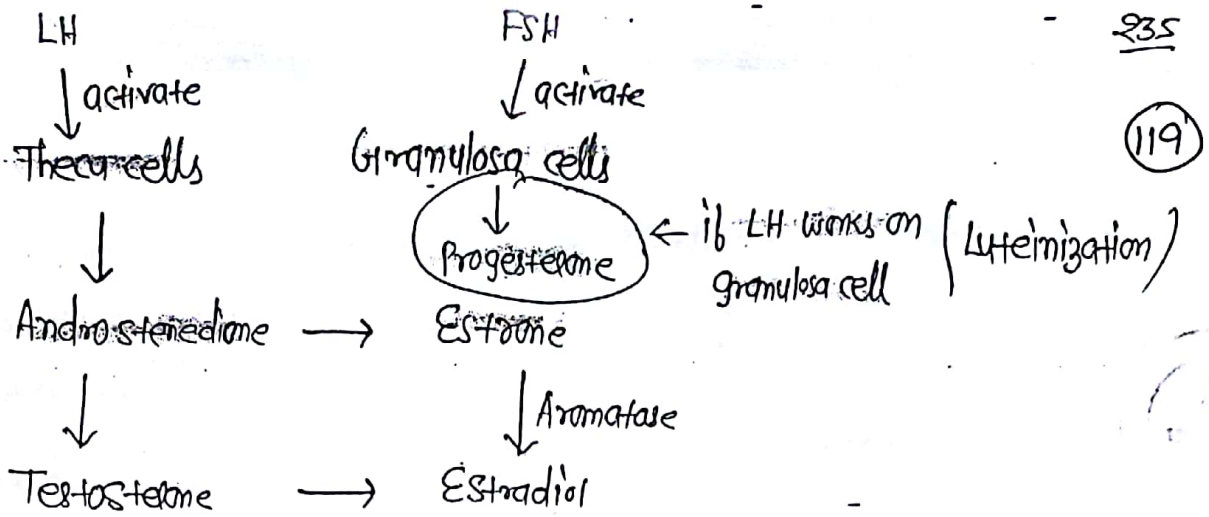
- gn ♀ ⇒ Produced by Placenta

↓

Precursor (Maternal LDL Cholesterol)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(119)



* Theca cell don't have Aromatase enzyme.

* Granulosa cells don't have 17-OHlase enzyme ; so; can't make Androgen

* Placenta — E_3 (Fetal DHEA)
(Pregnancy) L E_2

* Most of estrogen → is in bound form (99%)
If in free form ↓
Mainly bound ē
SHBG
also ē Albumin → sex hormone binding Globulin

* Bound; 2% free
L Mainly Albumin
(cortisol binding ← CBG globulin) Not with SHBG

End product
L Pregnanediol

Estrogen —⊕ve→ SHBG synthesis (Liver)

End products ⇒ Glycuronides
(sulphonides)

* Receptor ?: Location
L Intracellular
Intracytoplasmic

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Uterus

Non-Pregnant	(E)	(P)
	Endometrial Proliferation	Protective Stops Proliferation ↳ do secretory changes ⇓ decidualisation
	Growth of uterus	Growth of Uterus ⇓ Relaxation of Uterine Smooth Muscle

Cervical Mucous ⇒	Thin	Thick
	Copious (Large Amount)	Scanty
	Watery	highly viscous
Elastic can be stretched b/w fingers ←	Spinn barkeit (↕)	No Spinn barkeit ↑
	Ferning → Fern like pattern on Microscopic exam ↳ earliest (a) Dg disappear by Dig ↳ Klas "Arborization".	(X) Tack phenomenon (X) (No ferning)
high amounts of Nacl Required ∈ estrogen to see if		Cx Mucous breaks on stretching

* Periovulatory Cx Mucous is (E) type ⇒ highly fertile.
  ↳ test of ovulation
* Mechanism of POP's (Minipills)
  ↳ to Make the Cx Mucous thick
  (Alteration of Cx Mucous)
* Cx Mucus ⇒ Natural Method of contraception
  ↳ "Billing's Method of Contraception"

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

QQ Which Natural Method is best (least failure Rate)

(120)

Symptothermal

↓ Cx Mucus

↓ Basal body temp. (Progesterone ↑ by 0.5°F)

→ Cx Mucus is also impermeable to Micro-organism

↓ (P) type

↓ Natural defense Mechanism

→ Mirena will ↓ the Risk of Pelvic inflammatory disease

	(E)	(P)
Fallopian Tube	↑ Motility of Fallopian tube ↓ secretion	↑ Secretion ↓ Motility POP → R/F for ectopic ⊙

Vaginal Cytology ⇒

Superficial cells → Big cell, Nuclei become small; Pyknotic & lades → Pink in colour
- Cytoplasm May contain the vacuoles
- High karyopyknotic index (Small Nucleus)

In Intermediate cells

In Post-Menopausal ⇒ Parabasal/Basal cells → Small cell, Big Nucleus

tells about Hormonal Status ↑

Parabasal cell : Intermediate cell : Superficial cell

Maturation Index

0 : 90 → 10 ⇒ ♀

0 : 30 : 70 ⇒ Perovulatory ♀

100 : 0 : 0 ⇒ Post Menopausal
Post partum.

	(E)	(P)
effect on Salt & water	Retention	Excretion
Cholesterol	↑ HDL ↓ LDL ↑ Triglyceride (Total cholesterol ↓es) ⇓ Cardioprotective	↓ HDL ↑ LDL
Bones	Causes Mineralization of bone - epiphyseal closure [Post Menopausal → osteoporosis Precocious Puberty → ↓ growth]	No effect on bone
S. Ca++ Level	⇓	
Urinary excretion	⇓	

(E) Coagulation Profile — Hypercoagulable state ↑ Inhibits Fibrinolysis ** 2, 7, 8, 10

(P) • No effect, so, can be used

H/o Venous Thrombo embolism
Stroke
CAD
} all absolute C/I of OCP.

(121)

Estrogen → Causes Upregulation of Progesterone Receptors on the Endometrium

Progesterone → Down Regulation of Estrogen Receptors on the Endometrium

Progesterone acts only on Estrogen primed Endometrium

Estrogen affects to higher centre ⇒

(E) ⊖ve → FSH

(E) In Low Amount → LH
⊖ve

In High Amount → LH
⊕ve

Neuroendocrine phenomenon

High Amount of Estrogen — Initiation → LH Surge

(P) Low Amount ⊕ve → LH/FSH

High Amount ⊖ve → LH/FSH

E|P $\xrightarrow{\ominus ve}$ GnRH

GONADOTROPINS

- Released by Anterior pituitary;
- Basophils cells secrete
- Pulsatile
- Protein hormone

(R) ⟶ Trans Membrane (GPCR)
(R)

FSH $t_{1/2}$ = 3-4 hr

LH $t_{1/2}$ – 20 min

FSH (R) — gn females → Granulosa cells

gn Males → Sertoli cells (Spermatogenesis)

LH (R) — gn Females – Theca cells

Granulosa cells – appear only in Late Proliferative Phase

gn Males — Leydig cells

↳ Produce Testosterone

FSH ⇒ i) do Selection of cohort of Follicle every Month

(○○○
(○○○)

ii) Selection & growth of dominant follicle.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(iii) Ovulation → Final Release of ovum by collagen breakdown is brought about by FSH

(122)

LH → Function

(i) Ovulation
(ii) Formation & Maintainence of Corpus Luteum
(iii) Final growth of Follicle

LH Surge —(36 hrs (24-36 hrs))→ Ovulation

LH Peak —(12 hrs)→ Ovulation

* LH Surge ⇒ Initiation by high level of Estrogen. (200 pg x 48 hrs)
↳ Amount of estrogen to cause LH surge

Maintainence of LH Surge ⇒ E + P

* When does Progesterone Synthesis begins
↳ Before ovulation (36 hrs) → Low in Amount
LH → Surge → Luteinization of Granulosa cells

Q. Just before ovulation; which is true ??
(a) ↑ LH ; ↓ FSH
(b) ↑ FSH ; ↓ LH
(c) Both ↑ (LH Peak >> FSH Peak) → Small amount of Progesterone gives ⊕ feedback.
(d) Both ↓

CORPUS LUTEUM ⇒ every Month ⇒ die

↳ Life span 14days (Constant Luteal phase)

QQ ib 36 day Menstrual cycle ; ovulation day ??

⇓

on 22nd day

QQ Which hormones Maintain the corpus Luteum

↳ (LH)

QQ Which hormones Maintain the corpus Luteum in ♀

↳ (HCG)

Rescue the corpus luteum from LuteoLysis

Corpus Luteum

↳ Progesterone

Estradiol

Relaxin

Inhibin A

Inhibin B → Secreted by Granulosa cell of the follicle

Inhibit the Release of FSH

- Peak activity of Corpus Luteum ⇒ 8th day Post ovulation

↓

Maxm Progesterone production

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(123)

HYPOTHALAMUS → Release GnRH

GnRH — Arcuate Nucleus Released if (in Medial hypothalamus)

- decapeptide
- $t_{1/2}$ = 3-4min

- Neurons (GnRH) derived → "Olfactory Placode"
  - olfactory N. ← Migration
  - ⇓
  - Arcuate N.
  - Absent Migration
    - "KALL MANN'S Sx" (M/c Inheritance ⇓ X-linked Recessive)
      - Boys >> Girls
      - No GnRH
      - Anosmia
      - No LH & FSH
      - M/c gene involved → KAL-1 gene

- GnRH Secretion in fetus ↳
  - At 12 weeks → LH/FSH → Initially Tes upto 20 weeks
    - ↓ After
    - Suppressed
    - ↓ child born
    - withdrawal of E/P
      - May have bleeding P/V; enlargement of breast
      - Sudden GnRH Tes
      - LH/FSH (elevated May; about 3-6 Months after delivery)
      - After this GnRH suppressed
      - Until Puberty

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Activation of HP axis @ Puberty ⇒ ~~d/t Neurotransmitter~~

↓ GABA
↓ NPY (Neuropeptide-Y)
↑ Leptin
↑ glutamate
↑ kisspeptin

It keeps GnRH dormant before Puberty

↓

Pulsatile Release of GnRH → Night time

↓

Release of LH → @ Night time

↓

LH/FSH ⟹ (@ Night/day)

← Initial cycle May be Anovulatory b/c FSH Not Release ; so ; Mature Follicle Not Release

* GnRH Agonist ⇒ M/c used

↓

Not effective orally.

↳ Leuprolide (Goserelin, Nafarelin, Buserelin)

give in two Manner

Continous

↓

1st Response ⇒ ↑ LH/FSH (Flare Response)

↳ Persistently high (Inhibition H-P-O)

Pulsatile (i/v Infusion pump)

↓

Given ⇒ Delayed puberty

Ovulation Induction

Continous

Endometriosis

Fibroid Uterus

Hirsutism

Precocious Puberty

Breast cancer

Prostate cancer

Pulsatile (24)

Kallmann's Syndrome

* GnRH Antagonist → M/c used ⇒ ~~Cetrorelix~~*

↳ No Flare Response (No Initial Tes)

Same ~~Antagonist~~ – orally active

Indication ⇒ Same as continous GnRH Agonist Indication

* GnRH
  - (LH) ⇒ Pulse Frequency is high
  - (FSH) ⇒ Low Pulse Frequency

MENSTRUAL CYCLE

Luteal Phase → Secretory
Follicular Phase → Proliferative
→ Gn Endometrium
Govary

Luteal Phase → Start ⇒ onset of LH Surge

Maintains → Corpus Luteum → Progesterone 8th day Post-ovulation → Peak Level

Ovulation

⊖ → Late Luteal Phase → LH ↓es → CL → Regress → ↓es Progesterone

*** Progesterone withdrawal

Menstrual blood is Mainly Arterial ← Spiral Arterioles ← vasoconstriction ← Endometrium

Corpus Albicans

Avascular ← Necrosis → Sheds off (Menses)

Release PG $F_{2\alpha}$ (vasoconstrictor)

Myometrium → 1° dysmenorrhea (Physiological) → if present then ovulatory cycle ⊕

Anovulatory bleeding ⇒ Painless

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

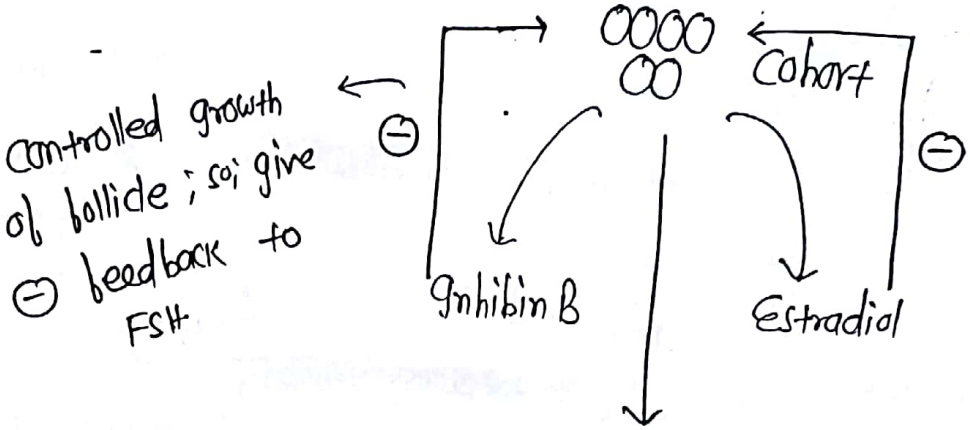
↓ Progesterone → ~~GnRH (Small Tes in Pulse frequ~~ (125)

↓↓

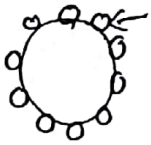
Follicular phase

↓

FSH



Dominant follicle selected on D_8



Middle Proliferative Phase

↓

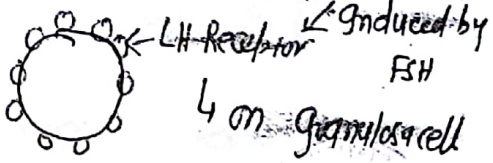
~~Late~~ Proliferative Phase

E_2 Level ↑↑

High (200 pg × 48 hrs)

↙ LH Surge

⊖ FSH



↓ on Granulosa cell

Luteinization of Granulosa cells

Testosterone → Sex Steroids

↓

Intracytoplasmic (R) (In the absense of Ligand) C19

↳ Major Source of testosterone in ♀ ⇒ i) Peripheral Conversion of (50%) Androstenedione

ii) 25% adrenal gland

iii) 25% ovary – theca cells (theca interna)

↓

Androgen

↳ which androgen is in Max^m amount

↓

Androstenedione > DHEA > Testosterone

- Ovary doesn't produce DHT (Dihydro testosterone)
- ovary also doesn't produce DHEAS ↳ sulphate

- Produced by Adrenal gland only.

* Gene for Androgen (R) Located

↳ Long Arm of X-Chromosome

* Testosterone in ♀ ⇒ i) Puberche / Adrenalche ⇒ depend Androgen on

* → Estrogen

ii) Control of Libido

iii) ↓ Intraovarian Testosterone Level ⇒

↓

Arrest follicular growth (Estrogen Rich environment)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Testosterone in ♂ ⇒ Spermatogenesis (126)

⇓

Intra-testicular Level of testosterone is high

⇓

Sertoli cells produces TBP (Testosterone Binding Protein)

* ~~Initiation of Spermatogenesis~~

↳ by ~~FSH~~

* ~~Spermatogenesis Require ⇒ FSH + Testosterone~~

* Sertoli cells produce ⇒ Mullerian Inhibiting Substance

~~TBP (Testosterone binding protein)~~

Relaxin

Inhibin

Estradiol

* Most of Testosterone is in Bound form: Binds to SHBG / Albumin

↳ 1% Testosterone free (Male: 2% free).

* Testosterone —⊖ve→ SHBG Synthesis

↳ takes place in Liver

Qo. Which has higher affinity to bind to SHBG ?

~~Testosterone > Estrogen~~.

* End product of Testosterone ⇒ ~~Oxosteroid~~ (Ketosteroids).

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Q. Which cells form Blood-testis barrier

↳ Junction of Sertoli-Sertoli cells

↳ Physical barrier b/w blood vessels & seminiferous tubules.

2 compartments : ADLUMINAL COMPARTMENT : 1° Spermatocyte 2° Spermatocyte

↙

Apical side of tubules; isolated from blood & Lymph

Basal compartment : Spermatogonia

↳ Outer side of tubules; in contact ~~of~~ blood & Lymph.

* Normal Menstrual cycle

↳ Length = 21–35 days

acc-to FIGO; Length = 24–38 days

Avg. Length ⇒ 28 days

Amount of blood loss ⇒ 80 ml

Average of blood loss (amount) ⇒ 35–50 cc

No. of days = 2–8 days

average No. of days = 4 1/2 – 5 days

* Abnormal Uterine bleeding (AUB) :-

Menorrhagia ⇒ More Amount (>80ml) or More Menstrual day (≥8 day)

Length of cycle = (N)

HypoMenorrhoea ⇒ <2 day or <20ml

Polymenorrhoea ⇒ <21 day (<24) Length of Menstrual cycle

Oligomenorrhoea ⇒ >35 day (>38) Length of Menstrual cycle

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Metrorrhagia ⇒ Irregular bleeding / Intermenstrual

- classification of AUB acc. to FIGO :- (127)

PALM – COEIN System :-

AUB P – d/t Polyp
AUB A – d/t Adenomyosis
AUB L – d/t Leiomyoma
AUB M – d/t Malignancy

AUB C – d/t coagulation defect
AUB O – d/t ovulatory dysfunction
AUB E – d/t endometrial causes
AUB I – d/t Iatrogenic
AUB N – Not yet classified

M_x ⇒ acc. to its cause

AUB ≥ 45 yr → evaluated for Endometrial carcinoma (do Endometrial biopsy to Rule out Endometrial carcinoma)

PUBERTY

- development of Secondry Sexual Chalactel.

	Girls	Boys
(N) Age of Puberty ⇒	$10\frac{1}{2}$ yr	$11\frac{1}{2}$ yr
Precocious Puberty ⇒ (More common in girls)	< 8yr	< 9yr
Delayed Puberty ⇒ (More common in boys)	13yr	14yr

	Girls	Boys
1st sign of Puberty	Growth spurt	Testicular enlargement
1st visible sign of Puberty	Thelarche (Appearance of Breast bud) (Tanner stage - 2)	Testicular enlargement

Q. Growth spurt → Thelarche → Pubarche (Adrenarche) → Peak height velocity → Breast → Tanner stage 3

Peak height velocity ← [↓ Menarche ← Time gap = 6 months

Testicular enlargement → Penile enlargement → Pubarche → Peak height velocity

* M/c Cause of Precocious Puberty in girls ⇒ Idiopathic (90%)

So; girls comes ☹ Precocious Puberty ← Brain tumor (10%)

evaluate ☹ MRI Brain

M/c Brain tumor ⇓ Hamartoma

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Central Precocious Puberty

- Premature activation of HPO axis
- LH/FSH ↑
- Isosexual

Peripheral Precocious Puberty (128)

↓

Peripheral source of sex steroid hormones

⇓

Estrogen / ~~Progesterone~~ Androgen

↳ secreting tumors

⇓

M/c a/w ⇒ McCune Albright Syndrom (Precocious Puberty + Cafe-au Lait + Polyostotic fibrous dysplasia)

↓

♂ May be isosexual or May be heterosexual.

* M/c cause of delayed Puberty in Males ⇒ Constitutional delay

⇓

Other Relatives have Same history of delayed Puberty

* Other problems in adolescent/ Pubertal age group
  - ↳ Irregular bleeding – M/c cause Anovulatory bleeding
    2nd M/c ⇒ Coagulation defects

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

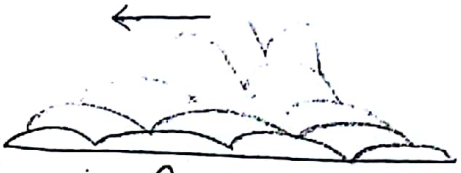
* In Anovulatory cycle → Unopposed estrogen

Superifical Layes ←

⇓

Outgrow the vascular supply

↳ Necrosis → Shed's off (More than (N) bleed)



Break through bleeding (estrogen)

↳ b/c endometrial is thick

* DOC ⇒ OCP

for Adolescent Irregular bleeding

↳ It Regularise the cycle

It also ves blood loss.

Protects from Unwanted Pregnancy

also ves Pelvic Inflammatory disease

also gives - only Progesterone Pills

QQ: 20 days bleeding → Unstable Vitals

↳ So; endometrium is thinned at time of Presentation

⇓

firstly give high dose i/v estrogen

↳ do endometrium Proliferation quickly and stops bleeding by Sealing the breaks

⇓

finally give Progesterone only Pills / combined ocp

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* High dose estrogen only given in unstable vitals; bic in all other cases estrogen also cause closure of epiphyseal plate (stop Growth spurt). (129)

Least effective ⇒ Mefenemic Acid (NSAIDs)

⇓

When hormonal therapy is Not taken by girls.

Tranexamic acid (antifibrinolytic drug)

↳ Stop bleeding

MENOPAUSE

- Cessation of Menses for 12 consecutive Months.
- Avg. Age ⇒ 51 yr

  Avg. Age in India ⇒ 47 yr
- It doesn't Need any investigation; it is history based diagnosis

* Pre Mature MenoPause (Premature ovarian failure, 1° ovarian insufficiency) - ⇒ <40 yr

↳ Confirmed by SFSH Level: if it is ≥ 40 IU on 2 occasion done 1 month apart – diagnosed Premature Menopause

* Delayed Menopause ⇒ doesn't happen by 55 yr of age

⇓

Endometrial Evaluation (Endometrial biopsy)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

FSH ↑

LH ↑

Estradiol → ↓es (<20pg)

Testosterone production from the ovary continues just like before

Gradual Process (Cliametric phase)

↳ Hormonal changes start.

Perimenopausal Phase / early Menopause

M/c Symptom ⇒ Vaso Motor Symptom

↳ Hot flushes

↳ d/t Estrogen withdrawl

↳ coincides ~ LH Surge

Hot Flushes ⇒ Sudden feeling of warmth followed by Diaphresis } Last for 1-5 min.

↳ More @ Night. (so; disturb sleep wake cycle)

↳ Moderate - Severe hot flushes (disturbs daily Routine)

↳ to start HRT (Hormone Replacement Therapy)

Q. If patient has intact uterus ~~post hysterectomy~~

↳ give (E) + P → No Rde in Hot flushes

↳ Systemic therapy (transdermal > oral)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Q: Gn Post-hysterectomy patient

↳ only (E) (1st Line) (130)

↓ if (E) is CI

give SSRI (2nd Line)

3rd Line drugs :- clonidine → Gn pre-Menstrual Syndrome it is 1st Line of drug
Gabapentin
Pregablin

* if patient is Not tolerating oral Progesterone

↳ give Mirena (LNG-IUD)

(E) + Bazedoxifene (SERM+SERD)

↓ protects the Endometrium

→ Good effect on Bones

Other SERMs ⇒ Tamoxifene, Raloxifene, Clomiphene, Ormeloxifene

Mlc side effect ↳ Hot flush ← Not used in Rx of hot flush

Tamoxifene ⇒ given in breast cancer patient
↑ Risk of Endometrial cancer

Raloxifene ⇒ doesn't ↑ Risk of endometrial ca
↳ can be used for Post-Menopausal osteoporosis

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* DOC for Post-Menopausal osteoporosis ⇒ Bisphosphonates

ORMELOXIFENE ⇒ Centchroman (Saheli)

↳ Indian government ⇒ Chhaya

↳ Non-~~Contraceptive~~ Steroidal contraceptive

It Makes endometrium out of phase & prevents implantation.

DUB (Dysfunctional Uterine bleeding)

PERIMENOPAUSAL WOMEN ⇒ Cycle became Anovulatory; So; ⇑

Irregular bleeding starts

(Estrogen break through)

during the phase of active bleeding

43yr ♀ ; ☾ 3 Month Amenorrhoea

Bleeding x ≥20 days

Unstable vitals ⇓ do D&C quickly stop bleeding / In place of high dose estrogen

↳ In Adolescent: NO D&C bc it alters the fertility

Stable vitals ⇓ High dose oral Estrogen ⇒ stop the bleeding in 24 hrs ↳ after that give Ⓟ/OCP

doesn't bleed from ≥ 1/2 A

During phase of Amenorrhoea ⇓ gives OCP / Ⓟ alone

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Any Reproductive age women; comes ☹ H/o Amenorrhoea
Firstly Rule out Pregnancy.

V.V.g. ***

AMENORRHOEA

Primary

- Absense of Menses by 13yr of age in the absense of 2° sexual character
OR
Absense of Menses by 15yr of age in the presence of 2° sexual character

M/c cause ⇒ Gonadal dysgenesis
2nd M/c cause ⇒ Mullerian agenesis

Secondry

- Absense of Menses for 90 days in a previously Menstruating female
(In Irregular cycles ♀ ⇒ 6 Months Absense of Menses)
- M/c cause ⇒ Pregnancy
- M/c Pathological cause ⇒ PCOS

PRIMARY AMENORRHOEA

- Look about Thelarche

Absent
⇓
d/t Gonadal dysgenesis ♀ ⇒ Gonads Abnormal
Kallman's Syndrome } ⇒ Gonads Normal
constitutional delay }

Present

Gonadal dysgenesis (Raised LH; FSH)

- Turner
- Pure gonadal dysgenesis
- Mixed gonadal dysgenesis

	TURNER	PURE GONADAL DYSGENESIS	MIXED GONADAL DYSGENESIS
Karyotype ⇒	XO	46XY / 46XX → Swyer's Sx (Mutation in SRY gene)	MOSAICS 45XO / 46XY
Gonads —	ovary	d/t absense of Y chromosome (Functional (SRY gene) / Non-functional)	
Internal Genitalia —	Female	absense of MIS / testosterone → Estrogen ↓ Growth, Puberty → Absense → Hypoplastic	
External genitalia —	Female	absense of DHT (active form of testosterone)	
Gonads ⇒ absent	Ovary ⇓ Accelerated Atresia ⇓ fibrosis (Fibrotic Streaks)	Fibrotic gonads ⇓ fibrotic ovary	Fibrotic Streaks / Malfunctioning testes

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

	TURNER	PURE GONADAL DYSGENESIS	MIXED GONADAL DYSGENESIS
Uterus ⇒	present (Hypoplastic)	present	Mullerian / wolffian both ducts present; b/c MIS acts on i/L Mullerian duct
External genitalia ⇒	Female Like	Female Like	Ambiguous genitali (Like of both Male & Female
Pubic / Axillary hair ⇒	present (Sparse Scanty)	present	Present
Breast development ⇒	Absent	Absent	Absent

QQ. Most characteristic feature of Turner Syndrome :→
Short Stature

Stature ⇒	Short Stature	N/Tall	N/Tall

45 XO
↓
Absent (X)
↓
Absense of (Shox) gene
↓
Responsible for growth of Long bone

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

TURNER SYNDROME

- Short Stature
- Short Webbed Neck
- Low Posterior hair line
- M/c congenital heart disease ⇒ Bicuspid Aortic valve
- Short 4th Metacarpel
- Cubitus Valgus (elbow deformity)
- Rudimentry ovaries
- No Menstruation

True about Turner's :-

(a) ~~Uterus~~ ⊕ Breast ⊖

(b) Both ⊕

(c) Uterus ⊖ Breast ⊕

(d) Both ⊖

* I.Q. ⇒ (N) in Turner Syndrome

I.Q. ⇒ ~~Ab~~ Sub Normal ⇒ when extra "X" chromosome ⊕

↳ Gn "Klinefilter Sx" (47 XXY)

↳ M/c Sex chromosome Abnormality.

* Life-Span ⇒ Slightly ↓es

* LH/FSH ⇒ ↑es (So; Turner Sx is Klas II "Hypergonadotropic hypogonadism")

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

TURNER's (45XO)	KALLMAN's (46XX)
FSH ↑	FSH ↓ (Hypogonadotropic hypogonadism)
Short Stature	(N) / tall
Streak ovaries	(N) ovaries
Anosmia ⊖	Anosmia ⊕
Uterus ⊕	⊕
Breast development ⊖	⊖
External genitalia Female Like	Female Like
Pubic/Axillary Sparse	Sparse

* Constitutional delay
  - ↳ Diagnosis of exclusion
  - Short (a) Presentation
  - (N) Karyotype

* goc for Primary Amenorrhoea ⇒ Karyotype

* Rx for Gonadal dysgenesis ⇒ give (E)/(P)
  - ↳ She doesn't Needs Surrogate mother. Needs ovum donor

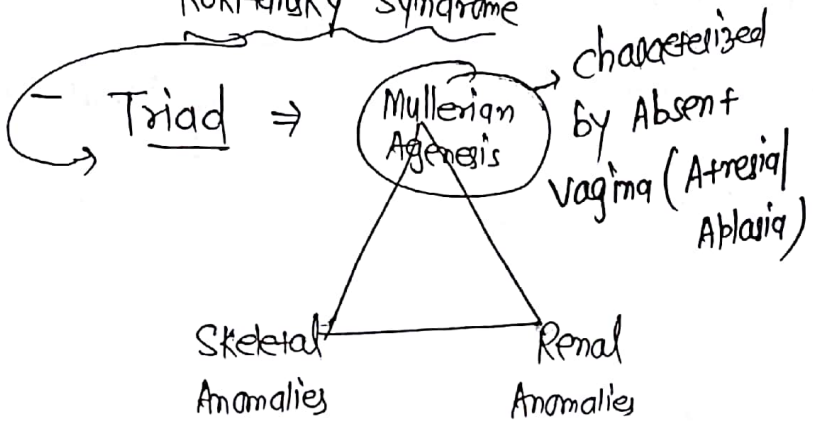
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Primary Amenorrhoea & Secondry sexual characters;

i) Mullerian Agenesis;
ii) AIS (Androgen Insensitivity Syndrome);
iii) Imperforate hymen;
iv) Transverse vaginal septum

Mullerian Agenesis

K/as "MRKH Syndrome"
Rokitansky syndrome



- Absent vagina
- Absent Uterus
- Fallopian tube are absent – Proximally
  Present – Distally
- Gonads – ovary (N)
  Karyotype – 46 XX

AIS

- K/as "Testicular Feminization Syndrome"
- Testis is producing Androgen; but Receptor is completly insensitive
- Blind ending vagina (Small vaginal pouch)
- Uterus Absent (b/c testis produce MIS)
- Testis (+) (functional)
  Karotype ⇒ 46 XY

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

	Mullerian Agenesis	AIS
Breast development	→ Present	Present @ Puberty
external Genitalia	→ Female Like	Female Like

Pt: May have Inguinal hernia & carrying Undescended testis

↳ May cause Malignancy

⇓

do gonadectomy ⇒ after Puberty

⇓

ib done before Puberty:

AIS patient Neither have female Nor Male; so: done after Puberty

Male Pseudohermaphrodite

(M/c cause ⇒ AIS)

↳ genotype Male; Phenotype Female

Female Pseudohermaphrodite

M/c cause ⇒ CAH

↳ deficiency of enzyme 21-Hydroxylase

Female phenotype → Y chromosome

↓

Should undergo gonadectomy ← as Soon as diagnosis is Made

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

	Mullerian Agenesis	AIS
Pubic / Axillary hair	(N)	Absent (Sparse) / Scanty
Pregnancy	Needs Surrogate Mother ∵ Generally – the child is of Mullerian Agenesis patient. (by GVF technique) – also vaginoplasty do	physically Absolutely (N); but they have worst Reproductive outcome ⇓ do vaginoplasty
Best to differentiate ⇒	Karotyping	
S. testosterone Level ⇒	(N) (N female Level)	Elevated (Like of Male Level)

Q: After doing Karyotype in ♀ Amenorrhoea; Nor + testis

USG (=)

USG + FSH (=)

* TRUE HERMAPHRODITE ⇒ Tissue of both ovary & testes (ovo testes)
  - also have Ambiguous Genitalia
  - Mosaic Karyotype
  - ddx of Mixed gonadal dysgenesis ⇒ differentiate by HPE of ovary & testis

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

IMPERFORATE HYMEN

(135)

- Outflow tract obstruction
- everything else — Karyotype – (N)
  Internal genitalia – (N)
  External genitalia – (N)
  development of Puberty – (N)

- H/o ⇒ Primary Amenorrhoea ; cyclical abdominal Pain
  On Local examn ⇒ bluish distended Membrane
- Sometimes prt. c Emergency :⇒ Acute Urinary obstruction
  Hematometra / Hematocolpos } ⇒ Bladder outflow obstruction

TRANSVERSE VAGINAL SEPTUM

M/c site ⇒ Upper 1/3rd of vagina

- H/t = cruciate Incision — Imperforate hymen
  Excision — vaginal Septum (Transverse)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Refeinstein Syndrome ⇒ Partial Androgen Insensitivity Syndrome.

Complete AIS → Clitoris – hypoplastic
Labia Majora – "

Partial AIS → Clitomegaly seen
↳ Both girl looking or Boy looking Person May have Partial AIS (depend on how Much Receptors are Active

* Precocious Menarche ⇒ Menarche starts without 2° sexual character
↳ < 10yr Menarche starts

SECONDRY AMENORRHOEA

- Rule out ♀

GOC: Hormone assessment
always together ⇐ { TSH → both hypo & hyper thyroidism
Prolactin – Hyperprolactinemia
FSH (±LH / ±E2)
done ⇓
bcz TRH is stimulatory to Prolactin.

↳ M/C Cause ☞ Pituitary Microadenoma (<10m)
↳ M/c presentation ↳ Infertility & Amenorrhea

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Prolactin — ⊖ve feedback — GnRH

↳ if < 50 ⇒ Repeat test

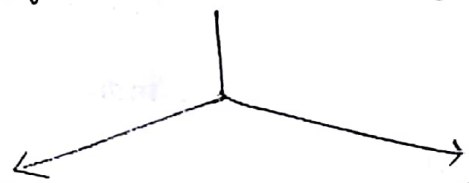
> 50 ⇒ MRI

DOC for Prolactin ⇒ Cabergoline > Bromocriptine

(dopamine Agonists)

↳ Longer t1/2; so give twice a week only.

QQ if TSH & Prolactin ⇒ (N)



FSH ↑

Ovary Problem

⇓

"Premature ovarian failure"

- S. Estradiol ↓es
- PCT (Progesterone challange test)

↳ MPA (Medroxy Progesterone Acetate)

10–20mg X 5 day

⇓

Nor withdrawl bleeding; b/c uterus is Not estrogen Primed

do Karyotype also

FSH Low/Normal

⇓

PCT | SE_2

⇓

PCT ⊕ve (withdrawl)

Serum Estradiol (N)

⇓

Anovulation

↳ "PCOS"

↳ LH ↑

Testosterone ↑

If PCT ⊖ve

⇓

Give E+P challange test (by OCP & withdrawal ↓)

↳ $S.E_2$ = (N) Not bleed

⇓

Endometrium Problem

Asherman Syndrome

Bleed

$S.E_2$ ⇒ Low

⇓

Central causes

↳ do MRI brain

Possibility of trauma; infection & infarction

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

MRI brain

↓

Normal

↳ (Functional hypothalamic Amenorrhoea)

⇓

Diagnosis of exclusion

↳ Seen c Anorexia Nervosa

Stress Induced Amenorrhea

Exercise Induced Amenorrhea

Chronic Malnutrition

Tt of PreMature ovarian failure

↳ HRT

(till the age of Menopause)

ASHERMAN'S SYNDROME

- Intrauterine Adhesions
- M/c cause ⇒ vigorous curettage
- Highest Risk ⇒ PPH (vigrous curettage)
- M/c presentation ⇒ Menstrual Irregularities

↳ Amenorrhea > Hypomenorrhea

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Single M/c Symptom/ Presentation
  ↳ Infertility.

* Screening test ⇒ HSG (Not confirmatory test)
  ⇓
  Adhesion seen as filling defect
  ⇓
  In HSG
  Multiple; Smooth; Irregular Margin; Sma in look.

IOC - Hysteroscopy (confirmatory test)
  ↳ both diagnostic & therapeutic

T/t :→ Hysteroscopic Adhesiolysis
+ Cu-T insertion
  ⇓
  to make distance b/w Uterine wall
+ High dose Estrogen for 1 cycle
  ⇓
  for quickly Proliferation

PCOS (Polycystic ovarian Syndrome)

- K/as "Stein Levinthal Syndrome"
- Primary Pathology lies in the ovary.

Stromal hyperplasia (Theca cells) ← ovary → ↑es Androgen production
→ Anovulation

- ↑es Androgen production ; Not only inside ovary ; but also in Periphery
  - ↳ symptoms (Hirsutism)
  - also cause dyslipidemia
- 50% of girls have obesity (also produces Excess Unopposed Estrogen)
  - ↳ blc in Periphery
  - Androgen $\xrightarrow[\text{cell}]{\text{Adipose}}$ Estrogen
- 75% of girls have Insulin Resistance
  - ↳ causes hyperinsulinemia
    - ↑↑ Tes Androgen production further
    - dyslipidemia

Syndrome X
(Metabolic syndrome)
- ↳ Hyperinsulinemia
  - ↑ Androgen production
  - dyslipidemia

* These patient have Resistance Tes in LH
  - ↳ Tes Androgen production

* HAIR AN → Acanthosis Nigricans ⇒ Cutaneous Marker of Insulin Resistance
  - HAIR → Hyper Androgenism
  - AN → Insulin Resistance
  - ↳ Seen @ Nape of Neck, Axilla, Groin

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(138)

Rotterdam's criteria for diagnosis ⇒

if 2 or more of the following criteria are Met provision diagnosis of PCOS;

i) Amenorrhoea and/or oligomenorrhea
↳ d/t Anovulation

* Menorrhagia ⇒ can be presentation (Mainly in obese pati
↳ Not a criteria of Rotterdam's.

ii) Hyperandrogenemia ⇓ High blood Level ↳ Total S. testosterone ↑ (Mildy elevated)
(N) < 70 ng/dl
∴ PCOS = 70–150 ng/dl
definitely < 200 ng/dl
if > 200 ng/dl (Severe) = Testosterone Secreting Tumor

and/or Hyperandrogenism ⇓ Clinical feature ↓
i) Hirsutism → on chin; chest, Axilla; thick hair growth
Tes terminal hair growth in Male pattern distribution

ii) Acne – Resistant to Usual f/t and Scarring in Nature

iii) Alopecia

* Scoring System to confirm the Hirsutism
↳ Ferriman Gallway score ∑8

i) Virilization (Hyperandrogenism)
↳ Severe testosterone – Seen in Androgen tumor
← Not in PCOS

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Virilization presents c/ :

i) clitoromegaly

ii) ↑ Muscle Mass

iii) Hoarseness of voice

iv) Male pattern balding
(Temporal Recession)

iii) USG criteria of Rotterdam's

a) ≥ 12 follicles in the ovary & each follicle <10 mm in size

And/or

b) Ovary volume ≥ 10 cc

* (N) Female ~~also~~ May have USG pictures of PCOS ;
(20-25+)

PCOS Female may have Normal USG pictures

* if Follicles seem large in USG ⇒ Hyperstimulatory ovary.
(>1cm)

* On USG of PCOS ⇒ Necklace Pattern of ovary
↓
Characteristics to PCOS

Not Rotterdam's criteria

↳ also Stromal hyperplasia
Thick theca

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* If 2 criteria are Met ; then Provisional diagnosis of ⇒

2 P.C.O.S. >> Non-classical CAH (Adult onset CAH) (39)

⇓ ⇓

Very common Rare

to differentiate do ⇒ S. 17 OHP (→ Hydroxy Progesterone) test (Screening test)

ACTH Stimulation test (diagnostic test)

Other dd of PCOS ⇒ Androgen tumor

↳ In it Rapid onset

Rapid progression

Testosterone > 200

Virilization

Cushing syndrome

* Lab Investigation ↳ i) S. testosterone

(DHEAS - May be slightly elevated <700 Mgm)

ii) USG

iii) LH ↑ / FSH (N)

↳ L'H Ration ⇒ Yes (> 2:1)

FSH

iv) T. Estrogen ↑

Total E_1 ↑ / FE_2 = (N) { $\frac{E_2}{E_1}$ Ratio Reverse

Free E_2 ↑

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

v) SHBG ↓ (So; Free E_2 ↑)

↳ b/c testasterone inhibits SHBG Synthesis

↳ d/t Hyperinsulinemia.

vi) Lipid Profile

vii) OGTT (to look for Insulin Resistance)

- Do $\frac{\text{Fasting Glucose}}{\text{Fasting Insulin}} < 4.5$

viii) TSH
ix) Prolactin } (N)

x) 17 Hydroxy progesterone test.

PCOS patients

Short term Problem
- Menstrual irregularities
- Hirsutism
- Infertility

(+co exist)

Long term Problem
- Type 2 DM
- Hypertension
- CAD
- Endometrial cancer
- ovarian cancer
- Non-alcoholic steatohepatitis
- Sleep Apnea syndrome
- Psychiatric disturbances
  - Anxiety
  - depression

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

- Pregnancy Complication
  - Abortion
  - Gestational DM
  - Pre-eclampsia
  - Preterm-Labour
  - Still-birth.

* Management :- Menstrual Irregularities + Hirsutism

Obese PCOS Patient ⟶ Advice weight loss (by 5-10%)

↳ Drug Treatment ⇒ ① OCP (Low dose) → DOC
4th/3rd generation Progesterone

- Correct the Menstrual Irregularity
- Improve hirsutism
- Endometrial Protection.

DOC for PCOS ⇒ OCP

* Only Hirsutism patient ⇒ give Spironolactone derivative
  ↳ Advice Not to conceive b/c it is Teratogenic drug

* Cyproterone Acetate
* Flutamide
* Finasteride
* Ketoconazole
* GnRH Agonist → Insulin sensitizes → weight loss (obese)
* Metformin → Can cause Lactic Acidosis
  do LFT / KFT

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Eflornithine (Topical)

all drugs are given in Hirsutism except → Danazol
(Androgenics S/E)

T/t for Infertility → d/t Anovulatory

Obese pcos ⟶ weight loss
(weight gain is also advice in less weight patient)

Ovulation Induction ⇒ Clomiphene citrate
(SERM) does antigonistic activity

It has. Zu component
En component

MoA ⇒ Central

Estrogen Receptor on pituitary prevents feedback inhibition

↓

FSH ↑ (FSH/LH)

Starting dose 50mg D_2-D_6 / D_5-D_9 of Menstrual cycle

Maxm (Approved) drug ⇒ 100mg.

↳ by FDA

Maxm approved time ⇒ 12 Months.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

% women ovulate after clomiphene ⇒ 80% (141)
% women conceive " ⇒ 40%

Antagonistic effect
- Cx Mucus — Thick (Impermeable)
- Endometrium — Growth is affected

* Poor Response (Not ovulating)

Obese patient (Insulin Resistance) — clomiphene citrate + Metformin / clomiphene citrate (CC) alone

ACOG obese PCOS patient ⇒ DOC for Infertility

↳ Letrozole (Not given for everyone; b/c Not FDA approved)

2.5 mg ⟶ 7.5 mg (Aromatase Inhibitor)

* Clomiphene citrate ⟶ Not teratogenic

M/c side effect of clomiphene citrate ⇒ Hot flushes

2nd M/c " ⇒ ovarian cyst formation

Other side effect " ⇒ Multifetal Pregnancy
↳ (6-8%)
↳ only twins
(Not higher order gestations)

Other " ⇒ OHSS (ovarian hyperstimulation syndrome)
⇊
2-1% (Negligible)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

2nd Line drug for ovulation induction ⇒

- Injection Gonadotropin (preferred) (FSH/LH)

- Laproscopic ovarian drilling ⇒ S/E
  ↳ Premature ovarian failure

- Inj. HMG (Human Menopausal Gonadotropin)
  ↳ taken from Urine of Post-Menopausal women.

- Recombinent Purified preparation → Potent Inj. FSH

Highly expensive

More S/E as well
↳ Multifetal - 30% higher Pregnancy order Gestation
↳ OHSS - 15%

* Step up Protocol

Start ⊂ Low dose
↓
Monitor Response
↳ Tering the dose.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(142)

3rd Line drug for ovulation Induction :-

Doc of ovulation Induction in hypothalamic cause/ Kallmann's Syndrome ⇒ Inj. GnRH ↓ Pulsatile

* Multifetal ♀ Risk ⇒ Gonadotropin > clomiphene citrate > GnRH Agonist

* OHSS Risk ⇒ Gonadotropin > GnRH Agonist > clomiphene citrate > GnRH Antagonist ↓ Prevention of OHSS.

In general :-

Bromocriptine → Anovulation
↳ d/t hyperprolactinemia

Aromatase Inhibitors → Letrozole

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* OVARIAN HYPERSTIMULATION SYNDROME (OHSS)

R|F ⇒
i) Younger Age;
ii) PCOS;
iii) High Serum E_2 Levels (>3500 pg)
iv) Large size of follicle & Large No. of Follicle (>20 Follicles & >10 mm in size)
v) Pregnancy
vi) Gonadotropin

Causes ⇒ Injection hCG (Used as ovulation Trigger);

- Mediator ⇒ VEGF ⇒ Cause Endothelial Injury → Hypercoagulable state
  ↳ Leakage of fluid in 3rd space

Early – c/in 9 days of Inj. hCG
Late – >9 days of Inj. hCG
↳ d/t Pregnancy Late OHSS seen

Prevention ⇒ Delay the hCG Injection.; (called as "coasting")
Cancel the cycle & do cryopreservation of embryo;

GnRH Antagonists
Volume expanders
Bromocriptine

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

INFERTILITY

- Inability to conceive with one year of Unprotected intercourse
- But; if the patient is >35yr ⇒ Inability to conceive c/in 6 Months of Unprotected intercourse

- Female factor — contributes → 40-55%
- Male factor — " → 40%
- Unexplained — " → 10%

- Female Factor ⇒
  - Ovulatory Factor – 30-40%
  - Tubal Factor – 20-30%
  - Uterine Factor – 15%
  - Cervical Factor – 5%
  - Unexplained – 10%

→ ovulatory Factor ⇒ Most Reversible
  - ↳ d/t Anovulation → do → ovulation Induction
  - Premature ovarian failure → do → Donor ovum

- Test of ovulation ⇒
  - i) Cervical Mucus
  - ii) Vaginal cytology → Lateral vaginal fornix (Upper 1/3rd of Lateral wall)
  - iii) Basal body temp. (BBT) (Progesterone
    - ↳ Tes BBT by 0.5-0.8°F

if we plot Biphasic graph – cycle is ovulatory

iv) easiest test ⇒ S. Progesterone

⇓

on D_{21} → ≥ 3ng ⇒ ovulatory cycle

v) Best test — Endometrial Biopsy

⇓

do In Premenstrual phase-

2 days before the expected date of Menstruation.

if endometrium Report ⇒ Secretory Endometrium

↳ ovulatory cycle

Proliferative Endometrium

↳ Anovulatory cycle → Telescopic gland

↳ See Long tubular glands & Pseudostratification

↳ d/t estrogen hormone

While Subnucleal vacuolation → is the evidence of Progesterone secretion on D_{16} on HPE

Cork-screw glands → Seen on D_{20} on HPE (Late Secretory Phase)

Maxm Stromal edema → Seen on D_{22} on HPE

Leucocytic Infiltration of Endometrium → (Premenstrual Phase) on D_{26} on HPE

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

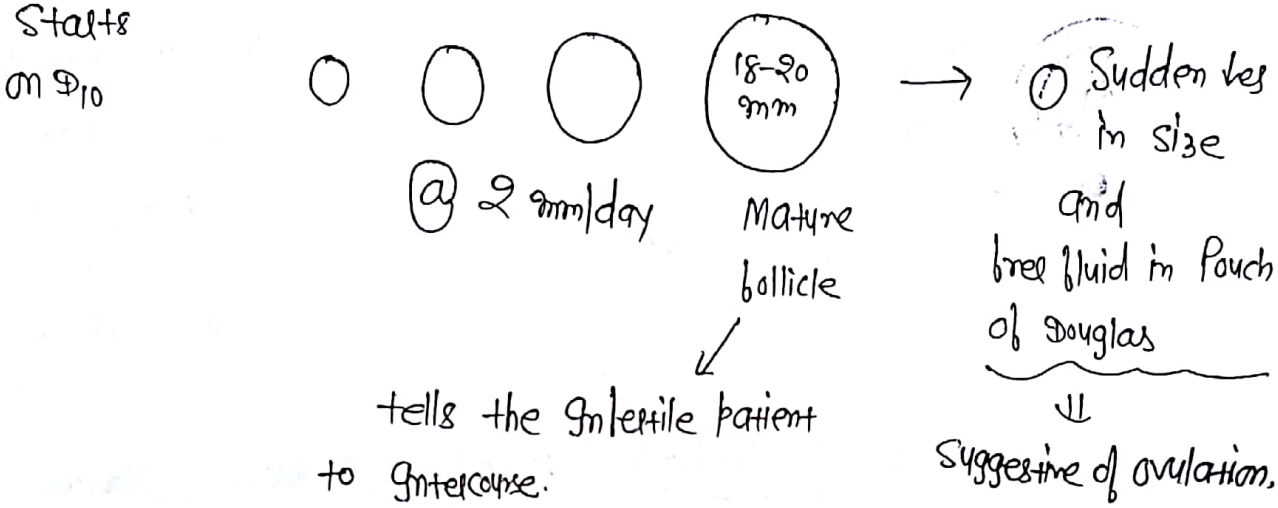
* Endometrial biopsy at least once in evaluation of women infertility to Rule out Genital TB; (144)

Endometrial biopsy

Saline → For TB

Formalin → For HPE

vi) M/c used test of ovulation in infertile Patients TVS for follicular Monitoring ⇒



- also in endometrium on USG ⇒ Trilaminar Endometrium (Tripple Layer Endometrium)

↳ Three hyperechoic Lines seen in Endometrium

↳ Seen in "Periovulatory Phase".

* Single hyperechoic Line ≅ Posterior Enhancement

↳ d/t Secretion from Endometrium

↳ Suggestive of Secretory phase

vii) Urinary LH kits :→

Urinary* LH Surge ⟶ After 24hrs

↳ ovulation takes place

OVARIAN RESERVE

M/c used test for it ⇒ i) S. FSH ⇒ D_2-D_4

↳ on D_3 (Best)

↳ (N) value of S. FSH on D_3

↳ <10IU

10-15 gu ⇒ Borderline Reserve

>15gu = Poor Reserve

>20 gu = Suggestive of Premature ovarian failure

≥40 gu ≥ diagnosis of Premature ovarian failure

ii) S. Inhibin B ⇒ on D_3 — <45 pg — Poor Reserve

iii) AFC (Antral Follicle count) — on D_2-D_4

<10 follicle ⇒ Poor Reserve

iv) Best test ⇒ S. AMH (Anti Mullerian hormone; equivalent to MIS)

Very small amount — Small prenatal follicle

<0.5ng — Poor Reserve

↳ b/c No fluctation in menstrual cycle

(False test - Less)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

VI CCCT (clomiphene citrate challange test)

D_3 - S. FSH.

D_5-D_9 - Clomiphene citrate 100mg

D_{10} → S. FSH

high basal level which Rise further on D_{10} – Poor Reserve

TUBAL FACTOR

Fallopian tube should be patent.

Goc for Patency ⇒ HSG (Screening test)

↓ if abnormal

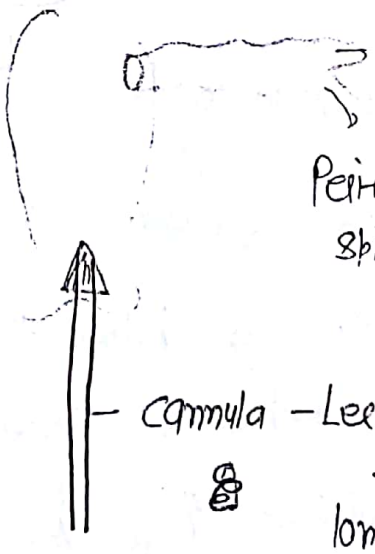
Best → Laparoscopy + Chromopertubation (Diagnostic)

Post-Menstrual Phase ⇒ D_5 - D_{11} day (M/c on D_{10})

↳ dlt Cervix dilation

⊕nt @ this time

and also Pregnancy Ruled out @ this time



* C|I of HSG ⇒ ① Suspected ♀ (UPT → ⊖ve);
② Known case of Genital TB;
(Endometrial biopsy for Aeid fast bacilli ⇒ ⊖ve)
③ Actively bleeding;
④ Current Pelvic Infection;
⑤ K|c|o dye allergy

. HSG as Screening for Uteline Pathologies
- Adhesion
- Polyp
- Submucosal fibroid
- Mullerian Anomalies

. Other Screening Modality ⇒ Sono hysterography
↳ Uses USG & Normal saline

. B|L cornual block (Proximal block)

. B|L Hydrosalpinx ⇒ happen d|t distal block
↳ Represents severe injury

. B|L Proximal block
Mid segment block
Distal block
⇒ Best Prognosis
↳ B|L Proximal block
↳ very less pathologically

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

In Maxm case
B/L Proximal block ⇒ Physiological
- Cornual spasm
- Mucus plug

(146)

↓

Next Step ??

Diagnostic Laparoscopy + Chromopertubation + Hysteroscopy

⇓ OR K/as "Laparohysteroscopy"

⇓ On Same sittings; it works as therapeutic by the process of "Hysteroscopic cannulation"

if it fails ↓

TUBAL PATHOLOGY

Operate ⇐ B/L cornual block Next / Best ↑/t ⇒ Laparohysteroscopy

IVF (preferred over operation; to; avoid ectopic ♀) Last Resort

* if on HSG ; B/L distal block seen

⇓

do Diagnostic Laparoscopy

Mild ⇓ ↑/t by Fibrioplasty Adhesiolysis

Severe (B/L hydrosalpinx) ⇓ do IVF

Fluid ⇒ embryotoxi

· So; before IVF; do ⇒ B/L Salpingectomy & Cornual clipping.

* if on HSG; Proximal & distal block both seen on both of tubes separately (severe)

⇓

do gvf.

* if on HSG ; Mid segment-block seen

⇓

Tubal Ligation ⟶ Tubal Recanalization.

Good Prognostic Marker of conception after Tubal Recanalization ⇒ i) Type of Ligation

Clips > Falope Rings.

⇓

Can be Reversed

Can't be Reversed ; Cautery > Modified Pomeray

ii) Type of Reanastomosis

Best ⇒ Isthmo-isthmic > Isthmo-Ampullary

iii) Total Length after Reanastomosis > 4cm

iv) No other Cause of Infertility

Test done before Anastomosis ⇒ Semen Analysis of husband

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

GENITAL TUBERCULOSIS

(147)

- Secondry Infection;
- M/c Primary - Lungs > Lymph Node
- M/c Route - Hematogenous
  Direct
  Lymphatics
  Ascending Infections
- M/c site ⇒ Fallopian tube > 90%
  Endometrium 50-60%
- M/c Route ⇒ Direct Spread
- L/c Site ⇒ Vagina & vulva - <2%
- Fallopian tube - Acute - Red Inflammed edematous
  Chronic - Thick walled/ Adhesions
- Cobble Stone appearance on HSG
  Tobacco Pouch appearance on HSG
  Lead pipe OR pipe stem appearance on HSG
  Beads on string appearance on HSG
  Golf club appearance on HSG
  B/L Hydrosalpinx on HSG
  ⇒ Genital TB

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* M/c site affected ⇒ Ampulla (1st site to be affected on Genital TB)

L/c site affected ⇒ Intramural

Endometrium → acute – Normal
↳ affects only superficial part
Myometrium – spared
Chronic – Adhesion / Ulcers
(Asherman's Syndrome)

* M/c Presentation ⇒ • Infertility (world over = 10%
India = 17%)
• Pain
• Menstrual Irregularity
↙ ↘
First Menstrual Irregularity → Menorrhagia
More common Menstrual Irregularity → Amenorrhoea > oligo

* M/c Finding In Reproductive Age
↳ (N) Pelvic exam
↳ Tenderness sometime

L/c Finding In Reproductive Age
↳ B/L Adnexal Mass

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

B/L Adnexal Mass ⇒ M/c finding in adolescent girls ∈ Genital TB

Diagnostic ⇒ → Endometrial Biopsy (Best)

→ Menstrual blood PCR Analysis
(1st day sample taken to check superficial layer of endometrium)

Rx ⇒ ATT (Anti-tubercular therapy) X 6 Months

↳ Improve fertility status – Yes.

* In case there is Severe Tubal Pathology (distort Normal Anatomy)

↳ ATT doesn't improve fertility status; go for IVF; but ATT is given for Genital TB

UTERINE FACTORS

Infertility caused by ⇒ i) Fibroid – Submucosal;
ii) Polyp
iii) Endometritis;
iv) DES (Preg. women)
↳ Fetus Female fetus → Uterus (Hypoplasia)
→ Most characteristic T-shaped uterine cavity

DES — In female fetus

↳ @ Vagina → Adenosis (Sq. epithelium Replaced by columnar epithelium)

→ clear cell cancer

@ Fallopian tubes — Para-tubal cyst

No Renal Anomalies

In Male fetus → Hypospadias | Testicular hypoplasia/ cryptorchidism

↳ Renal Anomalies ⊕

V) acutely Retroverted Uterus

Cochleate Uterus ⇒ Acutely Anteverted Uterus

VI) Mullerian Anomalies

↳ M/c cause of Infertility — Septate Uterus

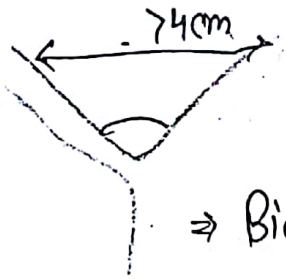
M/c caused Abortion ↙ ↓

M/c Mullerian Anomaly — Worst Reproductive outcome

Best outcome ⇒ Arcuate > Didelphys > Bicornuate

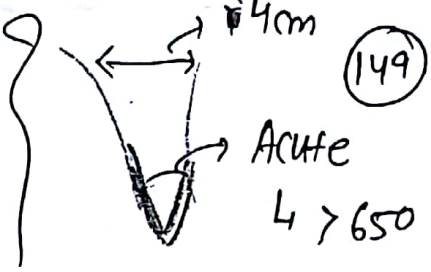
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Screening test ⇒ HSG (Non-diagnostic)

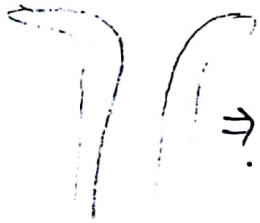


⇒ Bicornuate

Septate Uterus ⇐



(149)



⇒ Didelphius

D/d of Septate Uterus on HSG

↳ Bicornuate Uterus

IOC ⇒ MRI *** ⇒ if showing fundal dip >1cm

⇓

Bicornuate.

Sonohysterography

3D/4D USG (Not 2D USG)

↳ usually do

Gold Standard Investigation ⇒ Laparoscopy + hysteroscopy

↓

alone is Not a good Modality.

* All patients of Mullerian Anomalies Undergo evaluation for → Urinary tract anomalies (Renal USG / IVP)

⇓

High Risk

* ectopic ovary ⇒ ↳ Unicornuate Uterus → U/L dysmenorrhea
↳ highest association c
Urinary tract anomalies

* TOC for septate Uterus

↳ Hysteroscopic Resection
(Tompkins / Jones)

CERVICAL FACTORS

- Mucous affects fertility

↳ Characteristics — Impermeable to sperms

↳ Anti Sperm Antibodies — Post coital test
↳ Post coital Cx Mucus — observed under Microscope
Normal → Forward Motility
ASA (+) — (Abn) Motility
circulatory
Shaky
done @ 12-14th day of cycle

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(150)

* Newer test ⇒ Immuno bead Assay
Sperm Agglutination
Sperm Immobilization
} Not doing in current clinical Practice.

* Tx of ASA ⇒ i) Intrauterine Insemination (IUI)
↳ Put Sperm directly into Uterus ; bypass the Cx Mucus
IOC for Immunological Infertility.

ii) CC + IUI
↳ 6 Month — 3 month CC alone
3 month CC + IUI

iii) Mild Male factor Infertility
Semen Sample — Processing
↓
Sperm Swim up technique ↳ use Membrane Filter
Sample (highly fertile)

iv) Disorders of Sexual Intercourse
↳ Vaginismus
Failure of erection
} Sexual dysfunction

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

v) Absense of Male partner (Popular qn developed world).

GUG :- Semen Sample Inserted

O.P.D. Procedure ⇐
- ↳ 0.5 ml (Maxm)
- ↳ Mixed c Liquid Media
- ⇓
- Put it in Uterus
- Preferably on the day of ovulation.

Pelli's patient to be in Injected Position ⇐ — to Reach the site of fertilization c/in 10 minute
Minimum of 10min.

Male Infertility Factors

MC ⇒ defect in Spermatogenesis

Semen Analysis ⇒ Best ⇒ Masturbation

Abstinence ⇒ 2d - 7day

Reach the Lab c/in 60 min

done after Liquefaction

avg. time ⇒ 20-30min

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* WHO Parameters for Semen analysis ↳ (151)

↳ Lowest Most value → for fertile

Volume > 1.5mL

pH > 7.2

Total sperm count → > 39 million / ejaculate

(N > 100 million / ejaculate)

Sperm conc^{n} → > 15 million / mL

Total Motility → > 40%

Progressive (Forward) → > 32%

Morphology → > 4%

Vitality → > 58%

WBC count → < 1 million / mL

* Aspermia ⇒ Absense of ejaculate

Azoospermia ⇒ Absense of sperms in ejaculate

Oligospermia ⇒ < 15 million / mL

Asthenospermia ⇒ (Abn) Motility

Teratospermia ⇒ (Abn) Morphology

Necrospermia ⇒ Dead sperms

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Globospermia – Sperms – Rounded head
↓
Lack Acrosomal cap

* Azoospermia
↓ then 1st ly do
- Confirmation on a 2nd sample
(1–4 week gn-terval)
↓
ib azoospermia confirm
↓
Do LH | FSH | Testosterone

ib comes (N)
↓
Klas" obstructive } ⇒ obstruction in
Azoospermia" } Semen Pathway
→ ib site of ejaculation block vas deferens ⇒ Scrotal USG
→ ib site of ejaculation block on ED (volume les) ⇒ Trans-Rectal USG
↓
dilated seminal vesicle
→ absent seminal reside
↓
Cystic fibrosis (CFTR-gene Analysis)

delective ⇒ Spermatogenesis

ib Non-obstructive case
. (Testes) – M/c
↓
↑ LH | ↑ FSH | ↓ testosterone
↑ FSH | LH (N) | Testes (N)
↓
Sertoli cells affected
(Leydig cells (N)
. LH ↑ | Testosterone (N) | FSH (N)
↓
Partial AIS
↳ Testosterone (N)
↳ LH ↑es
FSH (Sertoli cell– Activin)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* if Testes involve ⇒ 1° Hypogonadism (152)
↓ (Hypergonadotropic)
↑LH, ↑FSH, ↓ testosterone

* Non-obstructive Azoospermia
↳ Micro surgical TESE (Testicular sperm extraction)
↓
ICSI (Intracytoplasmic sperm injection)
← do for Non-obstructive Azospermia cases

* if Sperm count (15 million/mL) → do IUI
(5-15 million/mL) → do IVF
(<5 million/mL) → do ICSI

* Sperm conc^n + Motility > Morphology (Most imp. Parameter in N Sperm)

* ART ≠ Simplest form ⇒ IUI
All are ART except ⇒ ~~IUI~~
ZIFT
GIFT
ICSI
IVF

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

gVF

- do for – i) Tubal factor infertility
  ii) Male factor infertility
  iii) Unexplained infertility

⇓

give 1st clomiphene citrate + hug X 3 cycles

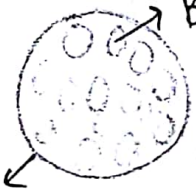
↙ for superovulation; Not for ovulation induction

↓ if don't conceive do gVF

iv) PIGD (Pre-Implantation Genetic diagnosis)

⇓

Site of Genetic Material taken



Blastomere → Polar bodies

⇓ Blastomeres — M/c site biopsy

Usually Blastocyst trophoectoderm (Best)

Pierce the zona pellucida — take one cell (Maxm 2 cell) — done on D5

Blastomere biopsy done on D3

v) Premature ovarian failure

- Parts of gVF :→ 1st ovulation induction

↳ by inj. Gonadotropins

↓

Follicular grow (Monitor growth by Number, size; E2)

↓

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(153)

↓

Ovulation triggered by Inj. HCG

↓ 34-36 hr after

Ovum pick-up (under USG guidance)

↓ on same day

IVF (test-tube Embryo formation)

↓

do Embryo transfer (M/c on D3).

↳ Never Put one embryo ; Min^m - 2 Embryo Puts at 2 cm below fundus under USG guidance

ENDOMETRIOSIS

- Presense of Endometrial glands & stroma outside the Uterus.
- M/c site ⇒ Ovary > Pouch of douglas > Posterior leaf of broad Ligament > Utelosacral Ligament > Fallopian tube

Occur at all sites except ⇒ Spleen.

- dependent on Estrogen for growth (ovarian steroids)

↳ so; disease of Reproductive age g/p (25-35yr)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

- It is Rare in adolescent & Perimenopausal / Post Menopausal women

- In Pregnancy — Maxm time endometrium Regress
  ↳ bic of continous - Progesterone Rich cond^n
  ⇓
  decidualization

PGI

Theory of endometriosis

↳ Most accepted theory
  ↳ Retrograde Menstruation (Sampson's theory)

2nd Most accepted theory
  ↳ Coelomic Metaplasia

3rd ⇒ Immune Mediated theory
  ⇓
  Women c endometriosis have deficient cell Mediated / humoral immunity

4th ⇒ Genetic theory ⇒ K-ray
if one First degree Relative affected
  ↳ chance of endometriosis is 7 times more

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

5th ⇒ Lymphatic/ hematogenous (154)

⇓

Umbilical Endometriosis

↳ Lymphatic explains it very well

IOC ⇒ Diagnostic Laparoscopy

↙ ↘

Confirm the diagnosis — Stage

↓

Biopsy (HPE)

↳ if altered coloured blood ⊕

↳ Choclate cyst ⇒ prt. in ovary

↳ Red flame lesion (New lesion of endometriosis)

↳ Powder burnt lesion (chronic lesion of endometriosis)

↙

Minimal → Superficial isolated Implants

Mild → Superficial + Multiple aggregates diameter < 5cm

Moderate → Superficial + deep lesion

↳ (7.5mm deep)

Severe → if endometriosis distorts Pelvic Anatomy

↳ dense adhesion

↳ choclate cyst

On USG ⇒ Choclate cyst can be pickup

↳ Homogenous Ground glass appearance

On MRI ⇒ Only pick up the choclate cyst

↳ do In Adolescent girl comes ☹ Endometriosis.

↳ "MushRoom gap sign" seen.

* CA-125 ⇒ Raised in Endometriosis

⇓ ⇓

Normal <35 In Endometrioma ⇒ CA125 7/100 (Rupture)

*** 24/5/18 Presentation ⇒ Pain + Adnexal Mass + Infertility. (M/C)

↳ Menstrual complain — Menorrhagia

↳ Bowel/Bladder Symptoms ⊕

↳ Catamenial Hemothorax / Pneumothorax

↳ @ the time of Menses (May be endometriosis goes to Lung)

PAIN :- M/C ⇒ Dysmenorrhoea > Chronic Pelvic Pain > Dyspareunia > Low Back Ache

↳ 2° dysmenorrhoea

[1° dysmenorrhoea

d/t Progesterone withdrawl

2° dysmenorrhoea

d/t Underlying disease process (Endometriosis PID)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

1° dysmenorrhoea	2° dysmenorrhoea
Spasmodic	congestive (SS)
center (suprapubic)	Localised (on one side)
begins Mostly on the 1st day of Menses	PreMenstrual (week before Menses)
Improves ↓ blood flow	doesn't improve ↓ flow;
↓ in 72 hrs — Relief	persist even Post Menstrual
Rx ⇒ Very Responsive to NSAIDs	Less Responsive to NSAIDs
	* also has Dyspareunia; ↓ seen in Rectovaginal septum; deep endometriosis

Why Pain in endometriosis ⇒

Implants ⟶ [Bleed] ⟶ Inflammatory cells

↓ Release

Inflammatory Mediators

Sign of chronic Inflammation

↳ healed by Fibrosis

↳ cause Adhesion

↳ also cause Pain

cause of Pain

* Pain in — Implants

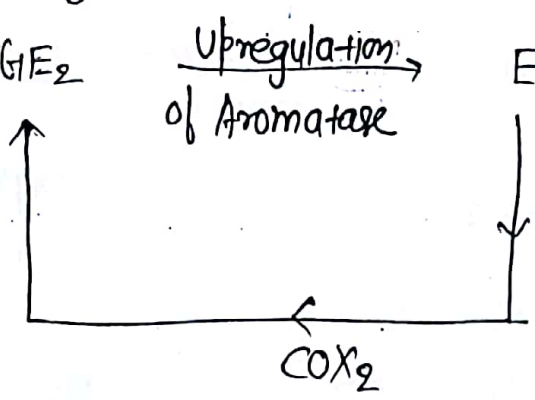
⇓

Neuromodulation (↑ Nerve Endings — Pain sensation)

↳ cause by Estrogen,

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Implants → Estrogen is in Permanent Excess state



(N) Endometrium doesn't have excess Aromatase for Upregulation of Aromatase

⇓

Eutopic

(N) Endometrium has 17-β OH. dehydrogenase; which Metabolizes E_2.

* What we do for Pain in Endometriosis :⇒

Pain (Suggestive of endometriosis)

Nature of Pain ??

Minimal – Moderate

⇓

OCP's + NSAIDs → Reduce the Mediators

⇓

It Supress the ovary

If She wants to conceive then only NSAIDs given

⇓

If No improvement → Give Progesterone (do decidualization)

Dienogest (Latest Progesterone)
L oral
oral MPA
DMPA (im drug; works for 3 Months)
Mirena (LNG-IUD)

Severe Pain

⇓

Give GnRH Agonist (given after diagnostic Laproscopy)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(156)

If After Progesterone female is Not Responsible

⇓

Give GnRH Agonist. (given after confirmation of endometriosis)

⇓

by Laproscopy

↳ given in continous Manner

can also Give GnRH Antagonist.

↓ if Not Responsive

Give Danazol ⟶ higher Androgen S/E

Aromatase Inhibitor ⟶ it can produce hypoestrogenic state

↳ if given for More than six Months ⇒ Result in Bone Loss;

So; given "ADD-BACK THERAPY" ⇒ Given NORETHINDRONE

⇓

to protect bone loss.

* Surgical Management of Pain ⇒ i) Adhesiolysis;

ii) Fulguration of Implant;

iii) LUNA (Laproscopic UteroSacral Nerve Ablation);

iv) Presacral Neurectomy

↳ Not effective; Not done Routinely.

v) Adrenal Mass

↳ Endometrioma ⇒ Not Responsive to Medical Mx of GV

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Tx of Endometrioma

↳ Cystectomy

I & D of the cyst → Recurrence Rate (80%)
(destroy the cyst wall)

if cyst is < 5cm → wait & watch

if cyst is > 5cm → do cystectomy.

vi) Hysterectomy (Last Resort)

↳ only in case of family is complete

ADNEXAL MASS

P/v examination :- findings who tells about endometriosis ⇒

i) Tenderness in Pouch of Douglas;

ii) tender Nodules on Uterosacral Ligament;

iii) Fixed Retroverted Uterus

iv) Adnexal tenderness.

v) Adnexal Mass

⇊

Ground glass appearance on USG

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Infertility in Endometriosis ⇒ Main Reason ⇒ Ovarian (157)
(Not Anovulatory)

- folliculogenesis ⇒ defective
- Genetic Material ⇒ Not good of ovum

In Moderate - Severe endometriosis ⇒ Main Reason ⇒ Ovarian + Tubal

In Minimal - Mild Endometriosis ⇒ Rx Clomiphene Citrate + Intrauterine insemination X3 cycle (3 Months)

↓

Superovulation

↓

don't conceive

↳ do IVF

In Moderate - Severe Endometriosis ⇒ Rx IVF + Sx

↳ do Mainly; Surgery is Not Necessary to do.

* GnRH Agonists has No Role in improvement of Infertility in endometriosis

* Endometrioma ⇒ If during the IVF; we find the Choclate Cyst

⇓

don't operate: b/c if operate, blc of Follicle damage, Infertility may occur.

← Wait & watch

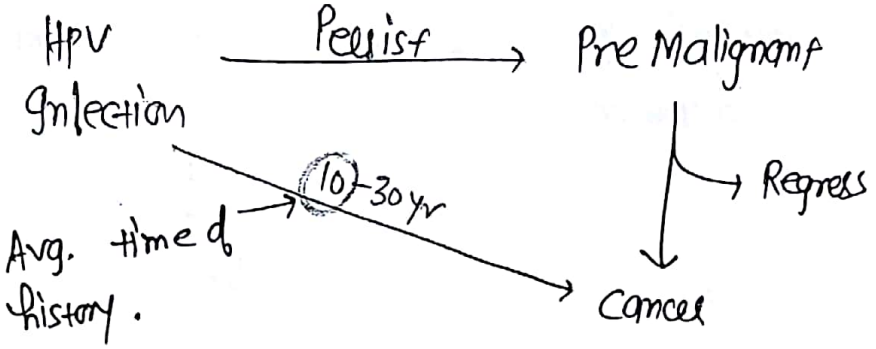
http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* MALIGNANCIES

* M/c Cancer among Indian women ⇒ Breast Cancer
2nd " " " ⇒ Cervical cancer
M/c cause of Mortality d/t Cancer in Indian women ⇒ "

CERVICAL CANCER

- Very commonly a/w HPV infection (Most women clear this infection)



if all History is given do "Universal Screening"

- Acc. to ACS/FIGO

Starts screening In ⇒ 21 yrs (irrespective of Sexual activity)

How ?? ⇒ PAPs → 3 yearly in 21-25 yr; everyone will turn out +ve; so: Not do.

PAPs + HPV → 5 yearly (Co-test) → Higher Sensitivity (Ideal ≥ 30 yr, can do in ≥ 25 yr)

Higher specificity ←

Stop ⇒ @ 65 yr (provided the PAPs in Last decade (N))
if Not Normal Stop @ 75 yr.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

WHO Programme

Start of Screening ⇒ begins @ ≥ 30yr

3rd - 4th decade (30-49 yr) } More targeted Population Age group.

↓

WHO says " SEE & TREAT ".

⇊

do single test

⇊

How ?? ⇒ via HPV > VIA > PAPs

≡ (visual inspection c Acetic acid) ↳ ideal ↳ for confirmation

Best Method ⇒ HPV + VIA

if HPV alone done ⇒ 5 yearly do

if VIA & PAPs done ⇒ 3-5 yearly do

Treatment Protocol a/c to WHO ⇒ do cryotherapy (?) LEEP > Conization

if Not eligible goes for LEEP

* Screening Methods ⇒ HPV testing (DNA testing)

⇊

· For high-Risk viruses

↳ do via Hybrid capture Technique

↳ expensive

· if HPV + PAPs → Cotest

· if do PAPs 1st then follow up by HPV ⇒ Reflex testing

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* High Risk virwes

↳ HPV 16, 18, 31, 33, 35, 45, 52, 56, 58

↓ 70% of cervical cancer

↓ 30% of cervical cancer

* Routinely in India we do ⇒ VIA (visual inspection c Acetic acid 5%)

↓

Abnormal → White area (dysplastic cells ⊕)

↓

Aceto white area (Stained Tes)

Unstained Area ⇒ Normal

VILI test — Lugol's Iodine - 4-5%.

Also "Schiller's test"

↳ Brown — Ⓝ test — Normal cells c Glycogen

↳ ⊕ in mature cells

↳ Unstained (Abnormal test)

↳ blc of ⊖ve of dysplastic cells (immature cells)

• PAPs Smear — Screening test (highly specificity)

↳ Taken by "Ayer's spatula & cytobrush".

↳ taken secretion from endocervix

↓

Pap Smear is always taken from Bifid end of it & turn it by 360°.

(②)

Taken from Transformation Zone > Squamo columnar Junction > Ectocervix of cervix,

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(159)

* Smear taken on ONE SLIDE

No Air drying do

↓

Fixative — ?! AIIMS Nov'17 ~~95% Ethyl alcohol~~ + 5% ether

* No Absolute contraindication for PAP Smear; but if actively bleeding patient comes then tell her to come after bleeding stops.

* PAP Smear is also klas " Secretion Cytology ":

* BETHESDA CLASSIFICATION ⇒ ↳ tells about Report comes on PAP Smear.

① Normal Report

② Reactive & Reparative changes (Healing Inflammatory changes);

③ Infection — Specify the organism

* Organism lies inside endocx ; tough to catch in PAP Smear ⇒ Chalamydia Gonorrhoea

④ ASCUS — Atypical Squamous cells of Undetermined significance

ASC — US (Modified Bethesda classification)
↘ H → high Risk

⑤ LSIL — Low grade Squamous Intraepithelial Lesion

⑥ HSIL — High " "

⑧ Cancer

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

*	LSIL	HSIL
Nucleus	↑	↑↑
Cytoplasm		
No. of cells	Less	More
Granules	evenly distributed (Granular chromatin)	Clumps
Membrane	Shrivelled Membrane	Double

Ideally → PAPs done ⟶ For Confirmation

⇓

Biopsy done

(For looking Abn Area

⇓

Use Colpo Scope → Focal Length = 30
Maxm Magnification = 30

⇓

if PAPs comes abnormal ⇒ Colposcopic directed Biopsy

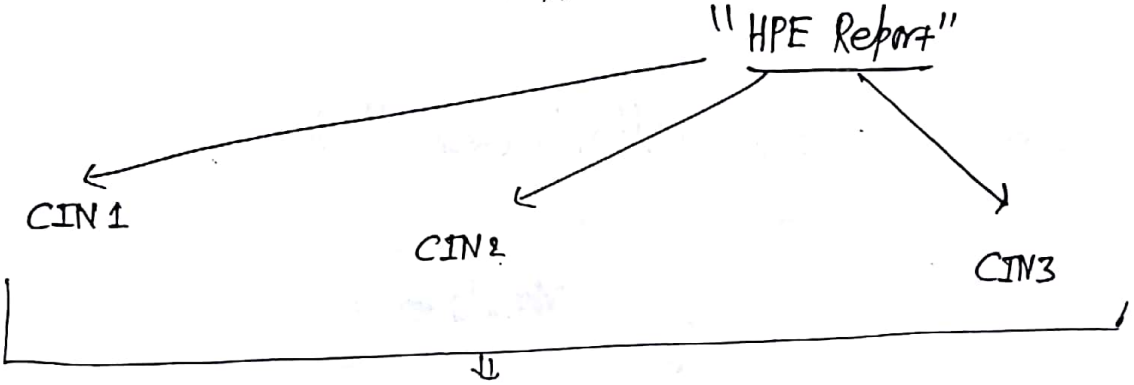
We can see Ectocx
vaginal wall
vulva;

but we can't see Endocx

* Abnormal Area from where Biopsy should be taken ⇒ (160)
  i) Irregular Surface contour
  ii) Mucosa – Pale in colour
  iii) On Acetic acid → White area seen
  iv) On vascular pattern of
    - Reticular
    - Mosaic
    - Punctate

  ↓ to visualise vascular pattern clearly; we add Green filter to colposcope

* Since it is Biopsy; so; Colposcope Report called as "HPE Report"



all are Pre Malignant cond^n i.e all have basement Membrane Intact.

* HPV cells affects basal & Parabasal cells; so; Cancer starts from Lower part of epithelium
* Dysplastic cells – all Seen in Lower 1/3 of the epithelium
  - ↳ CIN1 ⇒ Mild dysplasia
  - ↳ LSIL = CIN1 = Mild dysplasia

CIN2, CIN3 = HSIL

- Moderate dysplastic ↓ Lower 2/3 of the epithelium → Dysplastic
- Severe dysplastic ↓ ? Lower 2/3rd of the epithelium – dysplastic

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

LSIL ⇒ if the case is of LSIL

Age

- <25yr ⇓ Repeat PAP's
- ≥25yr ⇓ Preferred HPV test
  - if ⊕ve → Can also do Colpo Biopsy
  - if ⊖ve → do Screening.

HSIL ⇒ do colpodirected Biopsy

+

ECC (Mandatory)

⇓

Endocervical curretage

HPV testing has No value; once the Report is HSIL.

Direct Treatment done if the patient will not follow up.

- Cryotherapy ⊗
- LEEP

ASCUS ⇒

- Asc-US
  - if Age
    - <25yr ↓ Repeat PAPs
    - ≥25yr ↓ ⊖ve HPV testing → Repeat
    - ⊕ve → do colpo directed biopsy
- Asc-H ⇓ do colpodirected biopsy;

(161)

* if colpo Reports — confirming the lesion

CIN-1 ⟶ Ca 1-1.

↓

Follow up

↓

Co-test 1Yearly for 2 years

↳ Usual time of CIN1 to Regress

↓

if Persistant for 2 years

↓

Treat

CIN-2 → 5-1. (cancer)] Treat.
CIN-3 → 12-40-1.

* How to Treat ⇒

Cryotherapy > LEEP > conization

↓

Who is eligible — 2 criteria

all are known by visual inspection by acetic acid

i) Entire Squamo columnal junction visible
ii) entire lesion should be on Ectocervix;
iii) if lesion should occupy < 75% of Ectocervix

↓

do CRYO ABLATION → apply cold gases (CO_2 / Nitrous oxide)

↳ OPD Procedure

↳ destroy the cells & in tissue

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Mech^{n} of cryoablation

↳ Freeze – Thaw → Freeze)

↓ crystallization of intracellular water

⇓

Causes Dessication

Pain Managed by Analgesics

Long term complication ⇒ Persistant watery discharge

↳ bleeding is Not a complication of cryoablation.

* Laser Ablation do → i) If Depth of Lesion is More;

→ ii) Lesion extends on the vaginal wall

* LEEP = LLETZ →

⇓ Loop electro-Surgical excisional procedure

⇓ Large loop excision of Transformation Zone

→ electric current

do cutting + coagulation

* Bleeding is Not the S/E of LEEP. ***

- No training Required;
- OPD Procedure;
- takes < 4min in completion of Procedure

* Cryotherapy doesn't give us any specimen; while LEEP give us specimen after procedure. (Specimen of Transformation zone)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(162)

* CONIZATION :→ Invasive ;
O.T. procedure ;
Remove Tissue ;

* Indication of cone / CI for LEEP :⇒

○→ Apex towards inside
→ Cut from Transformation zone

Shallow cone
Deep cone

- ectocx
endocx
Junctional zone
(Mucosa & Stroma

} given by cone

i) Unsatisfactory colposcopy
↳ entire Transformation zone is Not visible ;

ii) When there is discrepency b/w cytology & HPE

iii) if PAP's Smear is HSIL → do colpo. + ECC
↳ ⊕ve

iv) if there is Suspicion of Microinvasion

v) if Biopsy Report says ⇒ Adenoca (Suspicion of endocx involvement).

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Q: 38yr old Lady P_3L_3 CIN3 ??

a) ~~Cryo~~

b) LEEP
c) Conization
} → we need for follow up.

d) Hysterectomy.

↳ only Indication to pre-invasive lesion

4. In Recurrent CIN :
- if Patient will Not follow up;
- if Suspicion of Adeno histology & family complete ⇓

May be case of endometrial Ca:
So; do hysterectomy

- Other Pelvic pathologies which justify a hysterectomy.

CANCER

R|F for Cx cancer :→
i) early Age of 1st Intercourse
ii) " " " 1st child birth;
iii) Multiparity
iv) Multiple sexual partner
v) Low Socioeconomic status
vi) STD
vii) Smoking → ↑ Sq. cell Ca
⊛ Adeno Ca.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

viii) Pre Invasive Lesion ⊕

ix) OCP → Tes Risk if use beyond or equal to 5yr
↳ Nullify Risk if Leave for ≥10yr
↳ ↑ Related to Adenoca

x) family history
Early Menarche
Late Menopause
} ⊗ Not a R/F for Cx Cancer

Etiology of Cx cancer ⇒ HPV
↳ also a/w cervix; vaginal; vulval cancer; Penile; Anal; oral

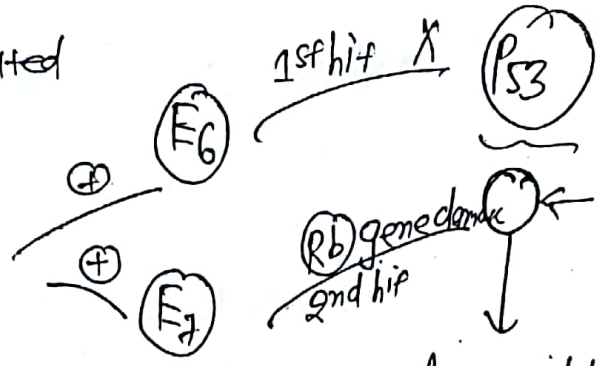
High Risk HPV ⇒ Cause Cancer

Low Risk HPV ⇒ 6, 11 → Cause genital warts
↓
condylomata Acuminata
↳ Laryngeal Papillomatosis

* On HPE of HPV infected cell
↳ Koilocytes
↳ Perinuclear halo.

Cancer ⇒ E_1 E_2 E_6 E_7 viral proteins
Ⓝ function ⊖

* When virus integrated
c host genome
↓
E_1 E_2 altered



after 2nd hit; immortal cells complete the cell cycle
↓
Malignant transformation
↳ E_7 E_6

* HPV vaccines

	Gardasil	CERVARIX
	Quadrivalent	Bivalent
-	Made from inactivated capsid protein	
	16, 18, 6, 11	16, 18
-	Latest FDA approved Gardasil-9 (Nonavalent) 16; 18; 6, 11, 31, 33, 45, 52, 58	
-	given 0.5ml i/m	given 0.5 ml i/m
-	0, 2, 6 Months	0, 1, 6 Months
-	Ideal age to give the vaccine ⇒ 11-12yr can be given ⇒ 9yr - 21yr	
-	Girls/Boys both taken	Girls taken

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

S/E of vaccine ⇒ Syncopal attack (164)

⇓

So; there has to be observation time of 15 min; then send her to home

* Protection Rate – Quadrivalent Gardasil ⇒ 70%
  Gardasil 9 ⇒ 95%

* M/c virus a/w Cancer Cx ⇒ HPV16 = Squamous
  Most Specific virus a/w cancer Cx ⇒ HPV18 = Adeno

* For Cervical cancer ⇒

  M/c Age ⇒ 3rd–4th decade
  (Shows Bimodal Peak → 1st ⇒ 3rd–4th decade.
  → 2nd ⇒ 5–6th decade)

  M/c histology ⇒ Squamous cell Ca = 69%
  Adeno Ca = 25%
  Large cell Non-Keratinizing squamous cell Ca

  M/c Route ⇒ Direct; Lymphatic

  M/c Presentation ⇒ Irregular vaginal bleeding

  1st Presentation ⇒

  Most Specific presentation ⇒ Post coital bleeding

  ↓ Next
  Clinical examination

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

clinical examination

↓ ⊕

do PAPs Smear*

* Persistent Post coital bleeding ≥ 6 Months

↓↓

even with (N) PAPs

↓↓

do colpo Biopsy

QQ 35yr P_2L_2 C Post coital bleeding ; O/E 2×2 cm growth on the Anterior lip of cervix ⇒

do PUNCH BIOPSY.

QQ M/c site of distant Metastasis ⇒ Lungs
In Cx cancer

M/c cause of death ⇒ Uremia (Renal failure)
In Cx cancer

Risk of ovarian involvement ⇒ <1%
In Cx cancer (Ovaries - Spared)

Most imp. Prognostic Marker ⇒ Stage > Lymph Node status
In Cx cancer

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Staging for cervical cancer ⇒ (165)

FIGO – clinical staging

Investigation should not be used to change stage of cancer :-

USG, CT, MRI, PET ⊗ Not used.

- Cystoscopy (to look bladder cavity);
  - ↳ Part of staging
- EUA (Examination Under Anesthesia);
  - ↳ Part of staging

Stage 1

- A_1 – Micro invasion – depth < 3mm ; Horizontal Limit – < 7mm
- A_2 – Micro invasion – depth 3–5mm ; Horizontal Limit – < 7mm
- B_1 → Macro invasion – depth ≤ 4cm
- B_2 → Macro invasion – depth > 4cm

& all Microscopic condⁿ above than A_2.

Stage 2 – Upper 2/3rd of vagina

- A – Without invasion of Parametrium
- B – With invasion of Parametrium
  - ↳ clinically seen as Obliteration of Fornices

do MRI; but we can't ↓ change the stage ← connective tissue

Stage 3

- A → Lower 1/3rd of vagina is involved
- B → Spread to Lateral Pelvic wall (Ureter → hydroureter)
  - ↳ Seen by gyn/CT → approved to change stage to look for hydroureter.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Stage 4 :- A → Spread to bladder and/or Rectum

B → distant spread ↓

Inguinal L.N.

* Early Stage Cancer ⇒ Upto Stage IB_1.
  ↳ Primary T/t ⇒ Surgery

Locally Advanced Cancer ⇒ $\geq IB_2$
  ↳ Primary T/t ⇒ Chemo Radiation

T/t of Cancer Cervix ⇒

IA_1 → if Family is complete
  ↳ Hysterectomy
  (Type-1 Hysterectomy / simple Extrafascial hysterectomy)

if Family is Not complete

⇓

Fertility preserving conization.
(Therapeutic conization)

→ Cut Uterus; Cx & Overlying fascia And Remove

IA_2 → if Family is complete
  ↳ Type 2 Hysterectomy + Pelvic LN
  (Wertheims / Modified Radical) dissection

Cut Midway b/w Utero Sacral Ligament and/or cardinal Ligament

Remove Uterus; Cx & half of Parametrium ←

+ Lateral Pelvic wall

→ Parametrium

(166)

IA_2 – if Family is Not complete

⇓

do Radical Trachelectomy

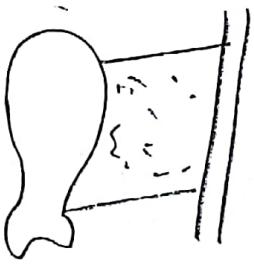
⇓

Remove Cx + Parametrium + Pelvic LN

Spares Uterus

IB_1 – if Family is complete

⇓



Type-3 Hysterectomy (Meigs/ Radical hysterectomy).

+

Pelvic L.N. dissection

↳ When we Remove all the Lymph Node

+

Para-aortic LN Sampling.

↳ Few L.N. Remove

⇓

Insertion on the

Lateral Pelvic wall we

cut the cardinal/ Uterosacral

Ligament

Type 1, 2, 3 Hysterectomy

↳ only for Malignancy

(Piver Rutledge classification)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

QQ. Cancer 1cm ; 4mm deep and 9mm Hz Limit II Stage ⇒ 1B1

9m case if tumor is ≤ 2cm ⇒ type 2 Hysterectomy (Wertheim's)

M/c Surgery in the Cx cancer ↵

* 1B1 → Family is Not complete

⇊

if ≤ 2cm ⇒ do Radical Trachelectomy.

CHEMORADIATION

9g stage ≥ 1B2

⇊

Chemo-therapy + Radio-therapy

(give concurrently)

Radiation sensitizers

Chemo Agent ⇒ Cis-platin > 5FU

9m 2A1 (< 4cm)

↳ type 3 hysterectomy

⇊

Upper 2/3rd of vagina Removed (or half of vagina Removed)

Not Recommendation; but we do.

* Radio-therapy → Distant → External beam RTH (EBRT) - K/as "Tele-therapy"

↓ Close

Brachy-therapy (9ntra cavitary)

M/c used = Iridium 192

* 1st/y EBRT gives then follow up by Brachy-therapy.

⇊

M/c used = Cesium

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(167)

* EBRT gives to Pelvis

↳ Dose ⇒ 50 Gy in 5 weeks
(5 fraction every weeks)

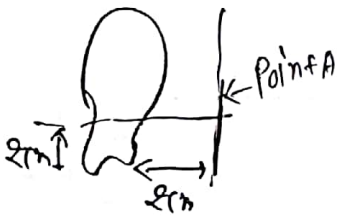
* EBRT gives to Pelvis + Abdomen (Extended field RTH)

↳ Dose ⇒ 30 Gy

* Brachy-therapy gives to Pelvis

Point A

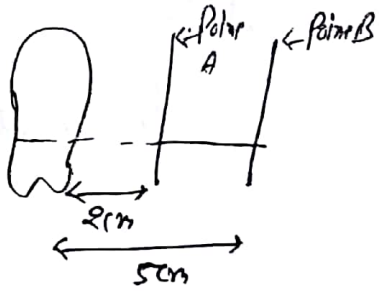
- 2cm above external os
- 2cm Lateral to cervix



- Corresponds to Paracervial Lymph Nodes ; Ureters
- Dose ⇒ 8000 cGy

Point B

- 3cm Lateral to Point A at the same Level



- Corresponds to Uterus

6000 cGy

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Radiosensitive order ⇒ Ovary > Rectum > Bladder > Vagina

- Ovary: Most Radiosensitive (can't tolerate Radiotherapy) for tolerant Mobilize it.
- Rectum: can tolerate 7000 cGy
- Bladder: can tolerate 7500 cGy

* Adjuvant chemoRadiation

↳ give Post-operatively

Reports says ⇒ i) Lymph Node ⊕
ii) Parametrium Invasion ⊕
iii) Tumor Margins are ⊕ve

QQ. What to do in Recurrence of Cx cancer ⇒

Primary ↑lt if Sx → do → chemoradiation

if Primary ↑lt chemoradiation

- Inoperable → Reached Lateral Pelvic wall ⇐ Seen by Looks for hydroureter; ULV (Local) Limb edema; Pain Radiating on one Leg.
  ↓
  Palliative ↑lt
  ↓
  chemotherapy
- operable → Central Recurrence
  ↓
  do Pelvic Exenteration Surgery

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

QQ Known case of Cancer cervix 3 cm growth upper vagina is involved ⊂ Parametrium ; CT - hydroureter ; cysto scopy (168) bullosa edema of bladder Mucosa

Stage 3B.

doesn't Mean Invasion of bladder ; i.e Lymphatics obstruction ; so ; Not change the stage

OVARIAN CANCER

- Not very common like of cervical Ca
- No specific sign & Symptom
- Routinely Not Screening for ovarian Cancer

⇓

Pt. comes ⊂ Adnexal Mass

(More Commonly in benign & Malignant ; Not a Rule)

Benign

⇓

In Reproductive Age

Pain ⊕

U/L

Cystic consistency

Malignant

⇓

In extremes of Age

- Pubertal
- Post Menopausal

⊖

B/L

Variable consistency

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Benign
tender

Malignant
Non-tender

IOC for Adnaxal Mass ⇒ TVS

U/L; Unilocular ; Anechoic ⇒ Benign cyst

Most commonly

* M/C cyst of the ovary ⇒ Follicular cyst *

B/L; Solid component ; Septae ; Neovascularity ; Ascites; Enlarged LN/ Matted Bowel Loop
(thick > 2-3 mm)

Ground Mass / Septae

⇓

Malignant cyst. (Highly Risk of Malignancy)

Sx ⇒ Malignancy – Laparotomy

Benign – Laparoscopy

Indication

i) High Risk condition on USG

ii) ovarian Mass > 7cm

Adnexal Mass > 10 cm

iii) Raised CA125 (N value < 35)

↳ only in Post Menopausal age group.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

iv Mass present as acute Abdomen → d/t Rupture
d/t Torsion (169)

* Benign looking Mass
(U/L; Unilocular; Anechoic Mass)

→ gn Reproductive Age Group patient
⇓ check size
if 3-5cm ⇒ wait & watch (Maybe follicular cyst)
if 5-7cm ⇒ Follow up 6wks; 12weeks
* Give OCPs → Pain
→ Menstrual Irregularity
→ contraception
⇓
gt prevents occurrence of New adnexal cyst;
but Nothing do ē currently exist cyst

→ gn extremes of Age patient
⇓
Tumor Marker
- Pubertal (Adolescent)
⇓
AFP + Hcg
- Post Menopausal
⇓
CA-125

* Adnexal Mass in a pregnant women ⇒
gn 1st Trimester ⇒ wait & watch;
gn 2nd Trimester ⇒ i) High Risk features
ii) >10cm (size)
iii) Acute Abdomen
⇓
Safest time for elective Surgery.

cyst seen common in ♀ ⇒ i) Theca Leutin cyst → Hcg (Pregnancy Marker)
(Adnexal Mass) ↳ also in Clomiphene citrate therapy

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

iii) Luteoma — Gn Pregnancy
↓
virilizing ovarian tumor
↳ Gn mother
Less common — Gn fetus
- Spontaneously Regress after ♀.

More the ovarian cycle
⇊
More the Risk of ovarian tumor
More the estrogen
⇊
More the Risk of ovarian tumor

* RIF for ovarian tumor ⇒
i) Early Menarche;
ii) Late Menopause;
iii) Gn fertility;
iv) obesity;
v) BRCA 1 & 2
HNPCC
vi) Smoking (only in Mucinous variety of ovarian tumor)
vii) PCOS

Protective for ovarian tumor ⇒
i) O.C.P
ii) Breast feeding;
iii) only Anovulation (Not a/c Any disease)
iv) Salpingectomy, Tubal Ligation, Hysterectomy } Ascending Mitogens don't Reach ovary

* Fallopian tube ca ; ovarian ca & Peritoneal carcinomatosis
↳ all have common origin ⇒ Fallopian tube

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Types of ovarian tumor ⇒ i) Epithelial ; ii) Germ cells ; iii) Sex cord Stromal

Epithelial → 90%
Germ cells + Sex cord Stromal → 10%

(A) Epithelial ovarian TUMOR (Features) -

- Serous — 75%
- Mucinous
- Endometroid } 10% each
- Brenners
- clear cells

Presentation Peak age - 60 yr. (6th - 7th decade)

- B/L
- Non-specific sign & symptom
  - ↳ Irritable bowel Sx
- Late Stage
- High Mortality Rate
- Sporadic - 90%
  - ⇓
  - So; only 10% tumor are familial.
    - ⇓
    - Gene involved ⇒ BRCA1 ***1 = 45 BRCA 2 - 25 HNPCC - 15,

Can tend to occur a decade earlier (50yr) ⇐

* if First degree Relatives affected → Risk Tes by 3 times.

QQ if patient is K/c/o Genetic Mutation →

Go for Prophylactically Sx
⇓
Go for BSO (Beyond 35yr Risk Tes every year)
↓

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

BSO (B/L Salphingo-oophrectomy)

↓

done @ 35yr or as soon as family complete

↓

This surgery protects → got from ovarian cancer

also protects from Breast cancer by 50%..

2nd Line approach ⇒ if Patient doesn't want to go for BSO

⇓

give OCP's + Screening – High Risk

⇓

High Risk { i) Strong family Breast/ovarian Ca
ii) K/c/o Genetic Mutation

Screening ⇒ TVS + CA125

Start @ 35yr 6 Monthly / 12 Monthly

Ovarian Tumor

⇒ M/c ovarian Tumor = Serous cyst Adenoma

M/c ovarian Ca = Serous cyst Adenocarcinoma

* Mucinous ovarian tumor ⇒ i) Decade earlier
ii) Grow to Large Size (20 cm)
iii) Diagnosed early
iv) Better Prognosis
v) UL (B/L in 10% cases)
vi) CEA (Tumor Marker)

* CA 125 ↓Tumor Marker for Serous tumor

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(171)

vii) Pseudomyxoma Peritonei

(Loculated Mucinous collections in Abdomen)

↳ M/C Seen ē tumor of Appendix; Not ovary.

* Endometroid ovarian Ca – high Risk for co existant ē "Endometrial Ca".

↳ 10% of total Epithelial

↳ U/L in Nature

* Clear cell ovarian Ca – higher association ē Endometriosis

⇓

also a/w Endometroid ovarian Ca.

↳ Hob Nail cells ⊕ (O)

↳ HPE findings.

* Brenners – U/L; Benign; solid lesion

↳ on HPE – Bladder Like epithelium – Transitional epithelium.

(B) GERM CELL TUMOR ≒ 5-8% of all ovarian tumor

. Teratoma → Mature cystic Teratoma (Dermoid)

↳ Immature.

. Dysgerminoma

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

- Embryonal cell Ca
- EST (Endodermal Sinus tumor) / Yolk sac tumor
- Choriocarcinoma
- Mixed tumor

M/c Germ cell tumor of ovary ⇒ Dermoid

M/c Germ cell cancer of ovary ⇒ Immature Teratoma > Dysgerminoma

* Feature ⇒ i) U/L (Unilateral);

of GCT Which GCT has higher Risk of Bilaterality ⇒

Dysgerminoma > Dermoid
(15%) (10%)

ii) Seen in Younger girls (10-30yr)

⇓

What % of ovarian tumor in this Age gp. are Germ cell tumor ⇒ 70%.

iii) Non-Specific sign & Symptom + (A) Precocious Puberty
(B) Acute abdomen

blc GCT Release hCG
⇓
& Submit similar to LH / FSH
EST / Yolk sac tumor
↳ Most Rapid growth of tumor

iv) Pick up in early stage:

v) Good Prognosis

vi) Conservative Sx.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

TUMOR — TUMOR MARKER

* Dysgerminoma ⇒ LDH (HCG + PLAP) (Tumor Marker) (172)
  - Fleshy; Lobulated & Tan in colour.
  - Not Secrete AFP.

* Endodermal Sinus tumor ⇒ AFP (LDH)
  - AFP ⇒ Tumor Marker
  - Not Secrete HCG.

* Choriocarcinoma ⇒ HCG

* Embryonal ⇒ HCG + AFP

* Dermoid ⇒ No Tumor Marker
  - Rarely HCG Secrete
  - Rokitansky Protrubance / Tip of Iceberg sign
    - White Area inside cyst (black) in USG.

* M/c ovarian tumor in Reproductive Age ⇒ Dermoid.
  - " " in ♀ ⇒ Dermoid
  - " Cancer ⇒ dysgerminoma

* Dermoid ⇒ Benign
  - Risk of Malignancy (0.2-2%)
    - type: Sq cell Ca
    - site: Rokitansky protrubance
  - M/c ovarian tumor to goes in torsion.

* Germ cell cancer ∈ Best Prognosis ⇒ Dysgerminoma

" " " Worst Prognosis ⇒ EST / Yolk sac tumor

* only ovarian tumor ∈ is Radiosensitive

↓↓

Dysgerminoma (Moderately Radiosensitive)

② Sex cord Stromal tumor (3+)

- Granulosa cell tumor
- Sertoli- Leyding cell tumor
- Leydig cell tumor
- Thecoma
- Fibroma (Stromal tumor of ovary)

Features ⇒ , U/L ; occur in all age gp / Peak Incidence in Peri Menopausal women;

- Non specific sign/symptom,
- AUB ⟶ Estrogen
  or
  virilization ⟶ Testosterone
- early stage pick up
- don't show any Lymph Node Metastasis.
- Best prognosis:
- Granulosa cells tumor ⟶ Inhibin
  ↳ Secrete estrogen → Risk of endometrial ca ††.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(173)

- On HPE ⇒ · Call exner bodies (follicle)
  - · Rokitansky Protuberance (also in dermoid)
  - · Walthard cell Nest
  - Coleb-bean cells (also seen in Brenner tumor)
  - · Reinke's crystal — Leydig cell tumor
  - · Schiller-duval bodies — EST tumor
  - · Psammoma bodies — Serous cystadenoma of ovary

- Krukenberg's tumor ⇒ Not a Primary tumor; Secondary tumor.
  - M/c Primary tumor ⇒ Gastric cancer
  - Spreads via Retrograde Lymphatics
  - B/L in 80% cases
  - Shape of the ovary Maintained;
  - Capsule of the ovary Intact
  - On HPE ⇒ Signet Ring cells*

* STAGING OF OVARIAN CANCER ↳ by FIGO; Surgical Staging.

Stage 1	A →	U/L ovary
	B →	B/L ovary
	C_1 →	Intra operative capsule Rupture
	C_2 →	Pre operative capsule Rupture
	C_3 →	Malignant Ascites
Stage 2	A →	Cancer Spread to Uterus / Fallopian tube
	B →	" Pelvic structures

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Stage 3 — A — 1 ⇒ ⊕ve Retroperitoneal Lymph Node
A — 2 ⇒ Microscopic extrapelvic peritoneal spread

B — Macroscopic ≤ 2cm extra pelvic peritoneal spread

C — Macroscopic > 2cm extrapelvic peritoneal spread
↳ if there is involvement of capsule of Liver/ spleen

Stage 4 A → Malignant pleural effusion

B → Parenchyma of the abdominal organ
distant spread
Inguinal Lymph Node

Stage 1/2 ⇒ early stage Ca

Stage 3/4 ⇒ Advanced stage Carcinoma

* For early diagnosis of ovarian Ca ⇒ TVS
or
K/C/O ovarian Ca ⇒ Best ⇒ CT-Scan
↳ Can't do staging by CT-Scan

* On Follow up; if CA 125 ↑es
↳ it Means Recurrence happen
↓
do PET Scan

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Staging Laparotomy ⇒ Steps

(174)

i) Midline vertical Incision
   ↳ Never give Pfannenstiel Incision or transverse Incision; Rarely Paramedian Incision given

↓

ii) Ascites → Sample taken → Cytology for Malignant cells

OR

Saline wash → 50–100ml → Cytology for Malignant cells

iii) Inspection & Palpation of all abdominal organs,

iv) Random Peritoneal biopsies

⇓

Paracollic gutters
Pouch of douglas
Surface of diaphragm → Scrapping (acceptable)

v) TAH ⊂ BSO (Pan hysterectomy)

↓

type 1 hysterectomy

vi) Infracolic Omentectomy.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

vii) Pelvic & Palaaortic LN Sampling

viii) closure

* Gn Stage 3/4 ⇒ Primary Rx ⇒ Surgery
↓
Debulking Sx

* Post-operative ⇒ Chemotherapy.

* Conservative Sx for ovarian cancer ⇒ U/L Salphingo-oophorectomy

↳ eg ⇒ Germ cell tumor
(U/L; Younger age patient)

- Stage 1A (if fertility is desired).
- Borderline epithelial ovarian tumor
↳ epithelial ovarian potential ≈ Low Malignant potential
(Stromal Gnvasion - Absent)
Very good prognosis
U/L
decade earlier

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Post-operative chemotherapy

(175)

↳ Epithelial ⇒ all stages except ≠ 1A & 1B graded cell ca Need Post-op. chemotherapy,

Chemotherapic Agent ⇒ Carboplatin + Paclitaxel } 6 cyc.
↓
Cisplatin + Paclitaxel }

given i/v + Peritoneal.

Germ cell ca, Sex cord ca ⇒ all Stages Need chemo. except ⇒ Dysgerminoma stages II No Need of chemotherapy

Only Advanced Stages Need chemotherapy.

Chemo. Agent ⇒ BEP (Bleomycin, Etoposide, cisplatin).

ENDOMETRIAL CANCER

Etiopathogenesis ⇒ ↑ Estrogen (unopposed)
↑ Menstrual cycles

· RF ⇒ Early Menarche;
Late Menopause;
PCOS;

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

iv) Infertility

v) obesity
vi) HTN
vii) Diabetes
→ Endoca (corpus cancer Syndrome)

viii) Tamoxifen → highest → 70%.

ix) BRCA1, 2, HNPCC → Lynch syndrome
↳ a/w ovarian ca; Not of Breast cancer

x) HRT (only Estrogen)

Protective of Endometrial ca :
- Smoking
- OCP (↓ Risk by 60%.)
  (↓ Risk of ovarian ca by 50%.)
- Exercise
- Green tea

Histology ⇒

Type 1	Type 2
Endometroid	Papillary; serous; clear cell
Most common in 80% cases	In 20% cases
Estrogen Responsive	Non Responsive
Pregnative	⊗
Good Prognosis	Poor prognosis (Worst Prognosis clear cells)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(176)

Type I		Type II
Gene association ⇒ PTEN ← Gatekeeper Gene KRAS		p53
Microsatellite deletions		High grade serous show p53 Mutation Low grade serous show KRAS Mutation
Peri Menopause early Menopause		Late More Age More type II
Obese Lady		thin Lady.

* Pre Invasive Lesion ⇒ Endometrial hyperplasia

which changes into the endometrial Ca

⇓

on HPE by taking endometrial Biopsy.

Kla "cystic glandulas hyperplasia": { Glands & Stroma both proliferate

- Simple hyperplasia c/out Atypia → 1%
- Complex " → 3%
- Simple c Atypia → 8%
- Complex c Atypia → 29%

Glandular Proliferation is Much more than Stromal proliferation

⇓

Back to Back arrangement of gland.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

- Hyperplasia c/out Atypia

↳ given Progesterone 1st ly

M/c ⇒ MPA X 6 Months
(daily) ⇓
Repeat Biopsy

also we DMPA
Mirena

- Hyperplasia c Atypia

Reconfirm ← ↳ do Hysterectomy (TOC)
(Frozen section)
↳ Intraoperatively Send & get a
Immediate Report & Reconfirm
⇓ if Not possible
do Endometrial sampling (Optional)
(FC + Hysteroscopy)
↳ Functional Curettage

2nd Line ⇒ if wants Preserving the Uterus
⇓
Reconfirm on Repeat Endometrial sampling
(Fc + hysteroscopy)
⇓
2ndly Progesterone (Prefer – Megestrol Acetate X 6 Months
Other MPA
Mirena)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Simple hyperplasia
  Cystic glandular hyperplasia → Metrophthica Hemorrhagica (177)

↓

Age ⇒ 40–45yr

8 weeks of Amenorrhoea ⇒ (Anovulatory cycles b/c Unopposed Estrogen)

History of bleeding ⇓ Painless

Endometrium on HPE ⇒ Absense of Secretory Pattern

Swiss cheese appearance

Ovary ⇒ Cyst

Ca ⇒ 1°

TOC ⇒ Progesterone

* Peak age for endometrial cancer ⇒ 60yr (5–7th decade)

M/c presentation / 1st presentation = Irregular vaginal bleeding

Most specific presentation = Post Menopausal bleeding (PMB)

% of PMB have endometrial Ca = 10%

↓

M/c cause ⇒ Senile endometrial Atrophy (Atrophic endometritis)

M/c cause of PMB in India ⇒ Ca cervix

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* M/c Cause of Pyometra ⇒ Endometrial Ca
  In India ⇒ Cervical Ca

* M/c Route for endometrial Ca ⇒ Direct spread
  " " ovarian Ca ⇒ Tumor Exfoliation

* No Routine Screening done for endometrial Ca
  ↓
  if Pt. is K/C/O "HNPCC" – do Routine Screening
  ↳ age 35yr
  do functional curettage (FC)
  6 monthly / 12 monthly.

* Any women comes ∈ Post Menopausal bleeding
  ↳ Rule out Endometrial Ca

* if women ≥ 45yr ≤ AUB
  ↳ Rule out Endometrial Ca

Next Step → do TVS (see endometrial thickness)
⇓
acc. to ACOG if thickness ≥ 4mm / ≥ 5mm (AIIMS May 18) (American Radiological) } → high Risk for cancer

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

If endometrial thickness < 4mm / < 5mm (178)
(Acoly) (American Radiology)
↳ No Tes In Risk of Cancer

* IOC ⇒ **Endometrial Biopsy**

* TVS do to Rule out other pathologies like fibroid; Polyp

↓

O.P.D Procedure; Aspiration do
(Endometrial Aspiration cytology)

⇓

We use "KARMAN'S CANNULA"

Other device "PIPELLE DEVICE"

"VATIRA ASPIRATOR".

* Gold Standard technique to Rule out endometrial Ca ⇒ Functional curettage + Hysteroscopy

May (D&C) → use synonymu ē Functional curettage

O.T. + Anesthesia Needed

⇓

Most Invasive

→ 1st ly do cervical curettage – (Endocervical curettage)

↓ then

dilate Internalos

↓ then

Endometrial curettage

← if 1st ly do endometrial cells comes In cervix.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Condition where Functional curettage done

- i) Endometrial biopsy – Benign ; while Symptom Persistant
- ii) Endometrial biopsy – No Endometrial cells seen
- iii) Hyperplasia c Atypia (preserve the Uterus)
- iv) Cervix Stenosed

* Should we do PAP Smears in Post Menopausal bleeding ⇒ Yes.

Staging → FIGO → Surgical staging

Stage 1 { A – only Endometrium or < 50% of Myometrium
B – > 50% of Myometrium
Intraoperatively Cut open the Uterus

Stage 2 – cervical spread
⇓
only if cervical stroma is involved

Stage 3 A → Cancer spread to Serosa / Adnexa
B → " Vagina / Parametrium
C1 → ⊕ve Pelvic LN
C2 → ⊕ve Para-aortic LN

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Stage 4 A ⇒ Spread to Bladder and/or Rectum (179)

B ⇒ Distant spread / Inguinal L.N

Staging Laparotomy

↳ Omentectomy is Not done Routinely

↳ for type 2 Endometrial Ca

- do TAH C BSO

↳ type 1 — Stage 2 — Type 3 hysterectomy

⇓

Cervical spread

- Pelvic & Paraaortic LN sampling ⇒ Type 2 cancers L.N dissection

- Stage 3/4 ⇒ Advance stage Ca

↳ Primary ∩x ⇒ Debulking surgery

- Post-operatively

⇓

Low Risk

- all three
a) Endometrioid
b) Grade 1
c) only endometrium

Intermediate Risk

In b/w Low & high Risk

High Risk

a) Stage 3/4 disease
OR
b) type 2 cancer

Tt of Low Risk ⇒ Need No Post-operative Tt; do Follow up

Tt of Intermediate Risk → Pelvic Radiotherapy

Tt of high Risk → Chemotherapy + Radiotherapy
↓
(Cisplatin + Paclitaxel)

PROLAPSE

→ Recent classification
↳ POP-Q classification
↳ Pelvic organ prolapse quantification
↓
Reference ⇒ Hymen.

* DeLancey Level of Support

Level I — Utero sacral Ligament + Cardinal Ligament
↓ if
weak ⇒ Uterocervical descent

[earlier classified as
1st degree → descent above vaginal opening
2nd degree → Uterus descent @ the Level of vaginal opening
3rd degree → Uterus descent outside the vagina
Procidentia → Uterus completely outside the vagina
↳ Fundus is also outside

→ Apical Prolapse → Enterocele → Prolapse of GUT into Pouch of Douglas.
→ vault Prolapse (apex of vagina)
(Post hysterectomy)
→ Uterocervical descent

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Level 2 ⇒ Paravaginal tissue & their attachment (180)
fascia coveling Levator Ani
↳ weak causes ⟹ Cystocele (upper 2/3rd Anterior wall)
↳ M/c type of Prolapse

Level 3 ⇒ Perineal body & Muscle attach to it
↳ B ⇒ BULBOSPONGIOSUS;
L ⇒ LEVATOR ANI MUSCLE;
E ⇒ EXTERNAL ANAL SPHINCTER
S ⇒ SUPERFICIAL TRANSVERSE PERINEAL MUSCLE
S ⇒ SPHINCTER URETHRAE
D ⇒ DEEP TRANSVERSE PERINEAL MUSCLE
↳ Weakness causes ⟹ Rectocele (Post. vaginal wall)

* Prolapse is disease of older Age.

- R/F of Prolapse ⇒ i) No. of deliveries & process deliveries
(Prolonged Labour
Instrument delivery
episiotomy "
Perineal tear
obstructed Labour

ii) Teg Age (d/t loss of estrogen)

* Younger age women also have Prolapse of uterus by → May
i) Connective tissue d/o.
ii) Congenital elongation of Cx
iii) Spinal cord Injury

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Smoking ↑es Risk of Prolapse

* Intra abdominal Pressure ↑ ⇒ ↑es Risk of Prolapse

↳ Chronic cough ; Ascites.

Case I :→ Old woman P_3L_3 ; 3rd degree Utero cervical descent + cystocele + Rectocele

Utelocervical descent → do Vaginal hysterectomy

⇓

Sequence of cutting & clumping of sequence

Firstly Utelosacral Ligament

↓

Cardinal Ligament

↓

Uterine Artery

↓

Utelo ovarian Pedicle

Sequence of cutting & clumping the structure in TAH

⇓

Reverse the sequence of vaginal hysterectomy

* Sequence of cutting & clumping the structure in TAH & BSO ⇒

Utelosacral Ligament → Cardinal Ligament → Uterine Artery → Infundibulopelvic Ligament

↓

Utelo ovarian Pedicle

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Usually we prefer : vaginal hysterectomy ; but (181)
it is difficult in — Uterine size > 12wk
Obese
Pelvic Adhesions.

* Urinary Tract Injuries
↳ Laparoscopic Sx > Abdominal hysterectomy > Vaginal hysterectomy
↳ highest Risk for Urinary tract injuries
↳ Seen c hysterectomy for Malignancies
(Wertheim's hysterectomy)
↳ in Benign cond^n

* Rx of Cystocele → Anterior colporrhaphy
(Vagina)

Interrupted suture

Rx of Rectocele → Posterior colpoperineorrhaphy
Strengthen the Levator Ani Muscle

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

VH + Ant. colpo + Posterior colpoperineorrhaphy

⇓

VH + Pelvic Floor Repair

⇓

Ward Mayo Sx **

+ Enterocele Sx

⇓

do prophylaxis; also do for vault Prolapse

⇓

McCalls culdoplasty

↳ vaginal Repair

Other Surgeries for Enterocele ⇒ Moschcowitz Repair, Halbains Repair

Both are Abdominal Repair; Not used Now a day

Support the vaginal vault ∈ Utelosacral Ligament in Mccalls culdoplasty.

2nd case — Younger Age group — Reproductive + Prolapse (Uterocervical descent).

↳ can't do hysterectomy

TOC ⇒ ** Sling's Surgery

↳ Modified Shriodkers abdominal Surgeries

Anterior sling (if cue tie's at anterior aspect of isthamus)

* Pyrandale Sx

↳ Autologus (tendon fascia lata)

↳ and — Aponeurosis external oblique muscle

Posterior sling (if cue tied at Posterior aspect of isthamus)

* khanna's Sling.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(182)

Khanna's sling

↳ one end at ~~Posterior aspect of~~ Isthamus;
Other end ~~Anterior Superior~~ Iliac spine.

Shriodkar sling ⇒ Posterior sling

↳ Meselene tape used
↳ on the left hand side first pass through Psoas Muscle (Form Psoas hook) then goes to sacrum

⇓

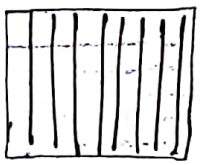
to prevent compression & obstruction of sigmoid colon / Rectum.

Vikrud's sling ⇒ Composite sling

(Anterior + Posterior sling)

Abdomino cervicopexy ⇒ For putting Mesh we have to clear Pre-Sacral Area; technically difficult; but Results are better.

Mesh



↳ higher complication

* Non sling surgery ⇒ Manchester Repair

(Kas" Fothergill's Surgery)

↳ *done in Reproductive age women who completed child bearing..

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

- also done in congenital Cx elongation

UCL (Utelocervical Length) estimation

↓

- Process ⇒ D&C (to prevent the complication of Cervical stenosis)

of Manchester Repair

↓

Cervical Amputation

↓

. Reattach Cardinal Ligament anteriorly

↓

Cover the Cervix → by Vaginal Mucosa

Cystocele done

Rectocele Repair done

if the UCL Yes ; don't do sling operation ; do Manchester Repair

UCL = Utelocervical Length

(N) UCL Length ⇒ 6 to 8 cm.

* Shriodkar Modification of Manchester

↳ Can be done even if woment want to conceive.

↳ All steps are same in it except there is No cervical Amputation in it.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

3rd case — Old woman + Co-morbidities (183)

↓

PAC (Pre-Anesthetic Check-up) — fit for short Sx.*

Latzko colpocleisis ⇓ done for Vesico-vaginal Fistula.

Rx ⇒ LeFort's colpocleisis

- DeNude Mucosa – Anterior Vaginal wall
- DeNude Mucosa – Posterior vaginal wall

Means Scrape Mucosa from Anterior & Posterior vaginal wall

1st ly we Rule out Cx Cancer & Endometrial Cancer

& Patient Can't be Sexually active

- Done Under Local Anesthesia.

{colpocleisis ⇒ closure of vagina}

4th case — Co-Morbidities + old woman

↳ PAC ⇒ Unfit for short Sx.

Rx ⇒ Pessary → Space occupying device - Insert into vagina

Gellhorn Pessary

Doughnut Pessary

* Early ♀ ∈ Prolapse – also Indication of Pessary

↳ Remove – 16–18 weeks.

* Other Indication of Pessary – Puerperium

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Ulcer on Prolapse part

↳ Decubitus Ulcer

Relative c/I for Pessary

Seen d/t venous congestion

↑/t ⇒ Reposit

How to Reposit ??

Use Tampon (Hygroscopic) → Like Pads; used to absorb Menstrual Flow

↳ Use Glycerine Acridine (Tampon Soaked in it) → Antiseptic in Nature

healing Requires ⇐ b/c Surgeon Never Operate on Nuded area.

also use Local Estrogen Creams for faster healings.

5th case

Women who have Vault Prolapse

Abdominal Surgeries

- Abdl. Sacrocolpopexy (Best) → Technically difficult Suture the vault to Sacrospinous Ligament
- Uterosacral Suspension
  ↳ M/c done*

Vaginal Surgeries

- Sacrospinous fixation
- Uterosacral Suspension

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Colpocleisis (Lefort) can also done in vault prolapse (184)
  ↳ in short time Sx.

* all are Sx of vault Prolapse except ⇒ Colposuspension:
  ⇓
  done in Stress Urinary Incontinence (SUI)

Burch colposuspension
⇓
Gold Standard Surgery for SUI

MMK colposuspension (Marshall-Marchetti-Kranz surgery)
⇓
Not done
Support the urethera by Periosteum of Symphysis Pubis

TOC for colposuspension ⇒ TVT | TOT
TVT ↙ Transvaginal tape
TOT ↳ Trans obturator tape

Transvaginal tape
⇓
Mid urethral Sling

- Kind of Abdominal Surgery
- Support the proximal urethera by Cooper's Ligament.

i) They are as good as Burch colposuspension
ii) Day-care Sx;
iii) Lesser complication;
iv) vaginal Surgeries;

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Trans vaginal tape ⇒ Retropubic Surgery

Trans obturator tape ⇒ Not Retropubic Surgery

↳ In it we enter the Space of Retzius

⇊

So; More complication than TOT, so,

We prefer TOT Now a days.

* Pt c Vault prolapse + SUI??

⇊

Abdominal Sacrocolpopexy

Rx ⇒ Burch colposuspension.

* 1st Line Mx of SUI ⇒ Kegel's exercise i.e Pelvic floor exercise
* Drug Rx of SUI ⇒ DULOXITENE (only drug Rx of SUI).

FIBROID

- Smooth Muscle tumor of Uterus ♀♀
- M/c benign Pelvic tumor in females. ♀♀
- a/w Estrogen; so, Seen in Reproductive Age

  in >35yr women; it is More common
- In PostMenopausal women → Regression Seen.
- In Pregnancy — Most of the fibroid don't enlarge

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

(185)

Types :→ Intramural (M/c)** ⇒ 75% → grow within Myometrial wall.

↳ Most fibroids to begin as Intramural & Later converted into different types

Subserosal → grow outward toward the peritoneal surface

Sub Mucosal → grow toward the uterine cavity.

Hysteroscopic appearance (Wamstekers classification).

↳ Type 0 → Completely Intracavitary

Type 1 → >50% Intracavitary i.e <50% in Myometrium

Type 2 → <50% Intracavitary i.e >50% in Myometrium

↳ can't be Removed hysteroscopically

M/c presentation ⇒ ASymptomatic

M/c Symptom ⇒ ① Bleeding → Menorrhagia

⇓

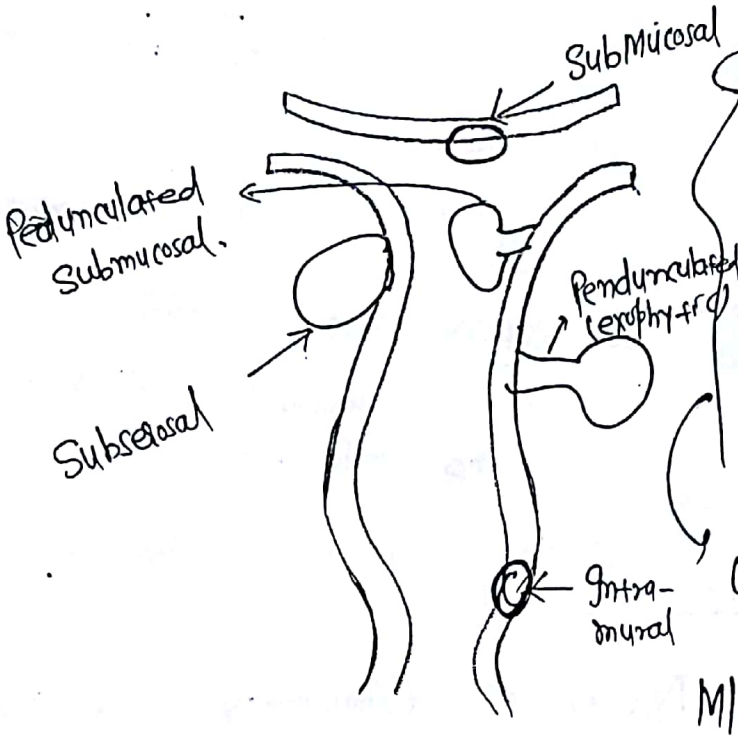
Cycles — Regular

Flow — ↑↑↑

M/c cause by which fibroid ⇓ Submucosal

While Subserosal fibroid Not a/w bleeding

http://mbbshelp.com WhatsApp: +1 (402) 235-1397



Fibroid Polyp
↳ cause Menorrhagia

Fundal Fibroid Polyp
↳ cause Inversion of Fundus.

Uncommon.

M/c presentation of fundal fibroid (Submucosal)
⇓
Menorrhagia **

② Pain → if it Undergoes - degenerations

Torsion - Pedunculated Subserosa

M/c degeneration ⇒ Hyaline ***

Least common !! ⇒ Sarcomatous **

↓

Rare Malignant change
↳ < 0.5%
↳ Post Menopausal fibroid enlarge & Pain.

* Womb Stone – Subserosal fibroid stone ; (186)
  - ↳ old bladder stone
  - ↳ it is eccentric
  - ⇓ calcification
  - ⇒ Differential diagnosis

* Red degeneration ⇒ Seen in ♀
  - M/c in 2nd Trimester.
  - presenting as acute Abdomen (Pain + Nausea; vomiting ± Fever)
  - Mx – Conservative
    N.P.O + i/v fluids + analgesic
  - ↓
    - Stained Salmon Pink & or Red
    - Fishy odor. &
    - Histologically : evidence of thrombosis in some vessels. &
  - ↳ aseptic cond'n ⇒ No Role of Antibiotic **
    - ↳ Fever is Reactionary only

* In Fibroid ⇒ dysmenorrhoea ⊕ ; but Not a primary complaint.

* Fibroid doesn't cause dyspareunia
  Fibroid May show Pressure symptom
  - ↳ Ant wall Fibroid ⇒ Urinary Symptom
    Post wall Fibroid ⇒ Bowel symptom **

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Ant. wall fibroid cause ⇒ ↑ Frequency of Micturation

Post. " " " ⇒ Urinary Retention

* BROAD LIGAMENT FIBROID

False

↓

Subserosal uterine fibroid outgrown into the Layers of Broad Ligament

True

↓

denovo b/w the Layer of broad Ligament

Lateral to the Fibroid ← Uterus → Medial to the Fibroid.

* Fibroid also presents Infertility, Recurrent Loss } Submucosal Fibroid only **

* Pregnancy complication of Fibroid

apart from RPL & Red degeneration

↳ Abruption
Pre-term Labour
Malpresentation
dysfunctional Labour
PPH

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

IOC ⇒ USG (Hypoechoic)

↳ Well-circumscribed Masses; Pseudocapsule

Small Submucosal fibroid May Miss In USG

⇓

Best Ix ⇒ Hysteroscopy

2nd Best ⇒ SIS (Saline Infusion Sonography)

* Don't do MRI ⇒ Routinely

↓

do in pre-op. condⁿ to know ⟨ No. / Size / Location

* D/d

Fibroid	Adenomyosis
• Smooth Muscle tumor	Endometrial glands & stroma inside Myometrium
• > 35yr age	40-45yr age
• Menorrhagia	Menorrhagia + dysmenorrhea
• Non tender	Tender (Half ken size)
• Irregular growth (Lumpy Bumpy growth)*	Symmetrical growth (Globular)*
• Grows upto uterus sized 20 week	10-12 week

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Fibroid

gyc ⇒ USG

Adenomyosis

MRI

On USG we see ⇒

Salt pepper appearance

Venetian blind ⇒ alternate dark & light band

Myometrial cyst

Subendometrial cyst

Poorly defined Junctional zone ⇒ don't tell about where endometrium starts & Myometrium ends

* Degenerations / Secondry changes in Fibroid

↳ Mnemonic

↳ Avoid → Atrophy;
Red → Red degeneration;
Hot → Hyaline degeneration (MIC)
Fatty → Fatty degeneration or calcification
Meat of → Myxomatous degeneration
Chicken → Cystic degeneration.

On MRI ⇒ Junctional zone thickness

> 12mm ⇒ Likely adenomyosis

< 8mm ⇒ Unlikely ⇒

· For confirming Adenomyosis ⇒ (HPE) - Postoperatively

⇓

See depth of these endometrial glands in Myometrium

⇓

Atleast 1 HPF deep / 2.5mm deep } to the Junctional zone

TOC ⇒ Hysterectomy *

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

T/t for Fibroid ⇒

(188)

Medical ——— **Surgical**

Minimally Invasive (Not Responsive to Medical Rx; Not willing for surgical)

Bleeding

(don't Reduce the size)

DOC → OCP
Mirena
Tranexa ← Yes blood Loss only.

↓ size
↓ bleeding

1) GnRH Analogue (continuous)

conceive if stop → Regrow fibroid

we don't use GnRH Anlogue for Long time

Used in pre-operatively to Yes Intraoperative blood loss

↓ before 6 month - GnRH starts

Fibroid → Regress

Intraoperative bleed Yes

(Sx → Surgeon Not prefer to give 6 Month back to Pre-Op.)

GnRH agonist →

↓

planes are lost

Surgical planes are easily bind

Drugs that ↓ size of Fibroid :-

U → Ulipristal
Are → Aromatase Inhibitor
Gynae → GnRH Agonist/Antagonist
M → Milepristone
D → Danazol.

ii) GnRH Antagonist

iii) Milepristone } Progesterone (R) Modulator

iv) Ulipristal

(Wants to conceive
↳ don't give)

v) Aromatase Inhibitor - Anastrozole

(S/E - Severe Hypoestrogenic)

- Minimally Invasive

UAE → Embolization → Uterine artery embolization
↳ do if family is complete

MRg HIFU

MRI Magnetic Resonance Guided High Intensity Focused USG

USG

- Rapid Symptom Improvement
- Fibroid Keep shrinkage

do if only family is complete; expensive

* Surgical M/t

Radical

- Hysterectomy
M/C Indication for TAH → Fibroid ***

Conservative

Myolysis
↓
Cryo
Laser

Submucosal (Type 0, 1)
↓
Hysteroscopic

Myomectomy
↓
Laparoscopic } others

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Gn Laparoscopic hysterectomy (189)
  ↳ Slightly higher Recurrence Rate
    ↳ Not Statistically significant.
* Laparoscopy is better than Abdominal in all except ⇒ Recurrence
* M/c Side effect of Hysteroscopy ⇒ Uterine Perforation
  fluid overload
* Myomectomy ⇒ gt is enucleation of Myomata from the Uterus leaving behind a potentially functioning organ capable of Future Reproduction

INFECTIONS

Bacterial vaginosis	Candida	Trichomonas
- all causing Vaginal Discharge/Vaginitis		
- M/c - Bacterial vaginosis >	Candida >	Trichomonas
- Gardenella vaginalis (Mycoplasma Ureaplasma Mobilincus)	Candida albicans	T. vaginalis
	Doderline Replaced by Gardenella.	
	After passing urine; Pain left bl/c of excoriation of skin	
- Foul Smelling discharge Itching ⊗ Dyspareunia ⊗ Urinary symptoms ⊗	- Pruritis - Discharge may present - Urinary Symptom ⊗ (SPLASH DYSURIA)	- Discharge ± Dyspareunia ± Urinary symptoms ± Itching

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Discharge → Foul Smelling	Curdy	Green
Off white / Greyish	White	(Yellow)
pH > 4.5	< 4.5	> 4.5

- IOC – Saline Microscopy

Clue cells (+)	Pseudohyphae	organism see itself ↓↓ dlt flagella

- Ratio of $\frac{\text{Polymorphonuclear cells}}{\text{epithelial cells}}$ ↳ < 1

- Gold standard – Gram Staining

Nugent Score ⇒ 7–10

Culture has No Role in Bacterial vaginosis	Culture in SDA Media	Culture in Stuart's medium

- Amsel's Criteria

if 3 out of 4 – Bacterial vaginosis	Splash dysuria ↓ Painful Urination due to exfoliation of vulva	Strawberry cervix (Punctate Hemorrhage)
i) Foul Smelling (off white) discharge		
ii) pH > 4.5	Whiff test – (−)	Whiff test – (+)
iii) Clue cells (atleast 20% of the epithelial cells)		
iv) whiff test (addition of 10% KOH to D/S → Fishy Amine odour		

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Not a STD	Usually Not STD	STD
Partner Not treated	Usually Not (done if partner is symptomatic)	Yes
Dx ⇒ Metronidazole ↓ Clindamycin	Single dose Fluconazole	Metronidazole
• Can cause Pre-term Labor in ♀	• Recurrent Vulvovaginal candidiasis ↓↓ ≥ 4 episodes/year	

PID (Pelvic Inflammatory Disease)

- Infection of Upper Genital Tract (Uterus / Fallopian tube / ovaries)

M/c organism ⇒ Chlamydia + Gonorrhea

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

age group ⇒ 15-25yr

higher R/F ⇒ Multiple sexual partners.

PID in virgin girl ⇒ dlf Tuberculosis

PID in IUD users ⇒ dlf Actinomyces

* Clinical diagnosis :⇒

↳ Pain Lower abdomen & Any of the following

a) Uterine tenderness

b) Cx Motion //

c) Adnexal //

Ix ⇒ * USG ⇒ Cog wheel sign; Beads on string sign; Waist sign

Endometrial Bx → Plasma cell endometritis

↓

Chronic endometritis

↓

TB of chlamydia

Laparoscopy → Best (Gold standard)

↳ F-H's - Hugh curtis Sx.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

F-13 Fitz-Hugh Curtis Syndrome (191)

↳ Perihepatitis

violin string Adhesions b/w Liver & Anterior Abdominal wall

↳ Rt. upper Quadrant Pain

Liver enzyme (N)

↳ M/c caused by ⇒ Chlamydia > Gonorrhoea

* Long term complication of PID ⇒

i) Infertility;

ii) Ectopic ♀;

iii) Chronic Pelvic Pain;

iv) Recurrent PID;

v) Hydrosalpinx.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

CONTRACEPTION

* Methods of contraception

TEMPORARY METHODS

(Used to postpone pregnancy or space birth)

- BARRIER METHOD :
- NATURAL CONTRACEPTION ;
- OCPs ;
- Injectables
- Implants
- IUCDs

PERMANANT METHODS

(Aim is to Purposefully & Permanently destroy the Reproductive capacity of an individual).

- Female → Tubectomy
- Male → Vasectomy

* OCPs

* On the basis of Amount of estrogen ; they can be classified as →
  - i) Low dose Pills : < 50 mcgm (Avg : 35 mcg) Ethinyl estradiol
  - ii) High dose Pills : ≥ 50 mcg (Ethinyl Estradiol)
  - iii) Very Low dose Pills : ≤ 20 mcg (Ethinyl Estradiol)
  - iv) Lowest Possible Pills : 10 mcg (Ethinyl Estradiol)
    (Lo Lo Estrogen)

* Mala D & Mala N
  - both have 30 mcg ethinyl Estradiol + 0.15 mg Levonorgestrel (LNG)
  - Both have 21 hormonal tablets & 7 lemon fumarate tablets;
  - Mala D available @ a cost of 2 Rupees ; while Mala N free of cost by Govt of India

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

M.O.A of OCP :→ Mainly : Inhibition of ovulation.

(192)

* M/c side effect of OCP : Breakthrough bleeding

↓

Progesterone breakthrough bleeding.

* In Anovulatory DUB

↓

Estrogen breakthrough bleeding.

* If a Lady misses 1 pill ; take 2 pills the following doses ;
  If she misses 2 pills ⟶ Backup Method of contraception

* In the event of Missing a pill :→

Take the Most Recent Missed pill Immediately ; Use condoms for 7 days & continue the packet

↓

Now if

≥7 pills are Remaining in packet

Finish the Remaining tablet &
Start the New packet after 7 days gap.

< 7 pills are Remaining in packet

Finish the Remaining pills & Start the New packet Next day without a 7 days gap.

Q: A women who is taking combined OCPs misses 2 consecutive Pills. There are 10 Pills Remaining in the Packet. Next ?

a) Take both pills immediately continue the packet & Use condom for 7 da

b) Take the Most Recent Missed pill Immediately ; continue the packet & Use condom for 7 days.

c) Take the Most Recent Missed pill Immediately ; continue the Packet ; Use condom for 7 days & commence the Next packet after a 7 days gap.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Fertility Return ⇒ ∈ in 3 Months of withdrawal of the drugs in 90% cases
  ⇓
  (Ovulation Return)

* Which contraception have Least chance of Ectopic ♀ ∴ OCP

* OCP also ↓es Risk of PID.

  But ↑ Risk of candida & chlamydia are seen by Combined oral contraceptives

* Other M.O.A. of OCPs ⇒ Prevention of Fertilization;
  Interference ∈ Implantation;

* OCP & Cancers ⇒

  - OCP & Cervical cancer → ↑es;
  - ovarian cancer ↓es by 50%;
  - Endometrial cancer ↓es by 60%;
  - Colon cancer ↓risk;
  - Breast cancer : No ↑es Risk
    ↳ OCPs are protective against benign breast disease.
    But Role of OCPs are controversial in Ca of Breast,
  - Using HRT (Hormone Replacement Therapy) ↑es chance of breast cancer.
  - Hepatic Adenoma : ↑es Risk;
  - HCC : No ↑es Risk (Not decrease Risk also);
  - Gallbladder Cancer : No ↑es Risk.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* Absolute C/I of OCP (WHO category 4) :⇒ (K93)

Mnemonics ↳

Banks → K/c/o Breast Cancer
Have → Severe Hypertriglyceridemia / Hypercholesterolemia
Various → Undiagnosed Vaginal bleeding
Scheme → Stroke ; Smoker over age of 35 years.
To → Thrombophlebitis | Thromboembolic disorde
Provide → Pregnancy
Home → Uncontrolled Hypertension (≥ 160/110 mm of Hg)
Looms → Acute Liver disease (Hepatitis ; ~~cirrhosis~~ ↳ Not C/I of OCP.
During → Diabetes c Vasculopathy
May → Migraine c Aura (i.e Focal Neurological deficit).

also; Coronary Artery Disease is absolute C/I of OCP.

* Newly Married couple : choice of contraception : OCP
Living far apart ; Meeting occasionally
↳ Barrier Method.

* Safety : Which contraception is safest : "Barrier"
⇓
S/E ⇒ very high failure Rate
∴ Pregnancy is S/E

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

PROGESTERIN ONLY PILLS (POP)

aka " Minipills " (75 mcg Progesterone)

M.O.A. : Thickening Cervical Mucus

* Should be taken on Same time Everyday
  ⇓
  (Sale Margin < 3hrs)
  ⇓
  If delay was for > 3hrs - Back Method should be used.

- POP's are contraception of choice in Lactating Female
  ↳ can be started immediately after delivery, POP > IUD

* Contraception of choice in Lactating's Female : POP > IUCD
  ↳ but Not Lactating Amenorrhea
  ↳ b/c high failure Rate

* Minipill available in India ⇒ "CERAZETTE"
  ⇓
  M.O.A. ⇒ Mainly Again
  ↳ Inhibition of ovulation
  Sale Margin : 12hrs
  (A delay of ~ 12hrs can be accepted)

* M/c side effect of POP : Irregular vaginal bleeding.

* Absolute C/I : i) Pregnancy;
  ii) Undiagnosed vaginal bleeding;
  iii) K/c/o Breast Cancer
  } Same for all

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

PROGESTERONE INJECTION

(194)

DMPA (Depot Medroxyprogesterone Acetate)

Dose ⇒ 150 mg i/m

To be Repeated every 3 Months

Pt. can wait upto 4 weeks late for Next injection

Net En (Norethisterone enanthate)

200 mg i/m

Repeated every 2 Months

Pt can wait upto 2 weeks Late

* DMPA :- 2 Good things ⇒ i) Useful in Female ⊂ Epilepsy ↑ Seizure threshold;

ii) Reducing Sickling crisis : Useful in Sickle cell Anemia;

2 Bad things ⇒ i) Significant Bone loss;

ii) Delay in Return of Fertility;

Avg. delay : 12 Months

Maxm. delay : 18 Months.

* M/c side effect of DMPA : Irregular Vaginal Bleeding.

* Absolute C/I : Same three S/E

↳ Undiagnosed vaginal bleeding

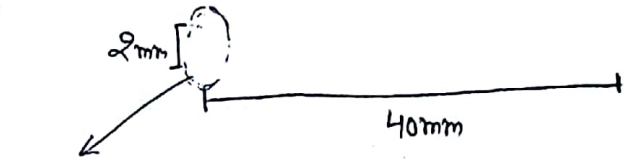
Pregnancy

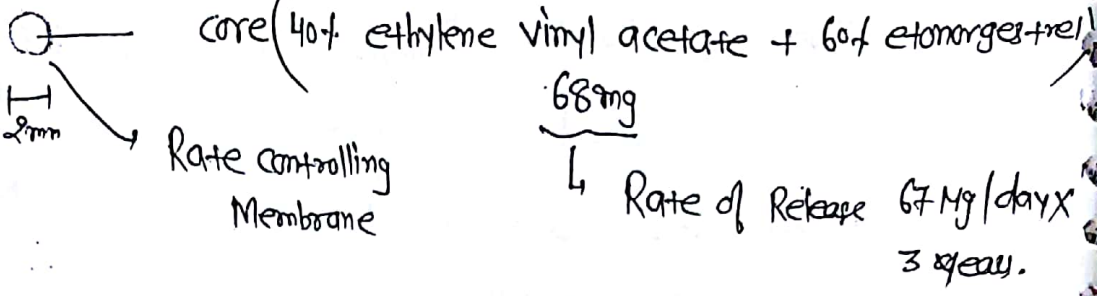
K/c/o Breast cancer

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

PROGESTIN ONLY IMPLANTS ⇒ Among all contraceptives; Least failure Rate = 0.05%

IMPLANON :→





- Single Rod ≅ Keto-desogestrel
- OPD Procedures (Most Popular Implant Now a days);

M.O.A. ⇒ Inhibition of ovulation.

Site of Implantation ⇒ Non-dominant Arm (Medial aspect of Upper Arm).

- It is Not Radio opaque.

∴ Next Generation of IMPLANON : NEXPLANON → Radio opaque

M/c side effect : Irregular vaginal bleeding.

Absolute C/I : Same 3
- i) Pregnancy
- ii) Undiagnosed vaginal bleeding
- iii) K/C/o Breast cancer

NUVA

- It is Vaginal Ring (Blue or white);
- It is E+P Compound (E = Ethinyl Estradiol : 15 Mg/day; P = Etonogestrel : 120 Mg/day)

M.O.A : Inhibition of ovulation.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

How to Use : Insert in vagina on 1st day of her Menstrual cycle & keep it for 3weeks; after 3 week ; Last week is "Ring free" (195)

↓

then : Insert New Ring.

Safe period of Ring : 3 hours before sex.

it Means if the expelled Nuva Ring has been out of vagina for more than 3 continuous hours; during weeks 1 & 2; you may nt protected from ♀.

INTRA UTERINE DEVICES

1st Generation IUD's

Inert OR Non-Medicated Devices

eg ⇒ Lippe's Loop

↳ Inserted by "Push out technique".

- CUT 380A
- Release Rate : 50 Mg/day
- Radio opaque : coated ē Barey
- Free of cost by govt of India

2nd Generation IUD's

It consists of copper or silver containing IUDs

eg ⇒ CUT-220C; CUT-380A

NovaT; MuHiload Cu 250/375

→ Klas "PARAGUARD".***

CUT 380A → Arms (i.e copper wire is also found on Arms)***

- copper wire
- Shape
- Surface Area

3rd Generation IUD's

It consists of hormone Releasing IUDs.

eg ⇒ Progestasert; Mirena

MIRENA (aka) LNG-20

↳ LNG = 52mg

20 Mg/day

Radio opaque

- Not free (7000/-)

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

CUT 380A

- Effective for span of 10 years;
- presense of beak : ↑es Risk of Perforation & for identification and Removal.
- Can be used as Emergency contraceptives
- ↑es Menstrual blood Loss

M/reng

- Effective for span of 5 years.
- Drug presents on Lower Limb only. (drugs Release for a span of 7 years).
- Not an Emergency contraceptives
- ↓es Menstrual blood loss (amenorrhic for atleast 6 Months).

* M/c Side effect of IUD ⇒ ↑ Bleeding;
  M/c cause for Removal ⇒ Pain of IUD
* I.U.D. : Mech^m of Action ⇒ Mainly "Spermicidal"
  ∴ Acts ⇒ Inhibition of Fertilization
  Inhibition of Implantation.

M/c Infection of IUD : Actinomyces;

* IUD insitu c ♀ : Remove IUD ↓why b/c ↑es Risk of Abortion
* ** DO USG b/c failure of IUD (or) ♀ c I.U.D. Mostly : Ectopic *
* Max^m Infection c IUD : c/in 20 days of Insertion *
* Multifilamentous : Olden days → ↑ Risk of Infection;
* Monofilamentous : Now a days → ↓ Risk of Infection → that too by design

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Misplaced GUD (Missing thread) ⇢ G.O.C ⇒ USG

↓ If Not found

X-Ray (196)

. GUD Missing ∈ Perforation ⊕nt in Abdomen * : Mx : Laparoscopy **

. if GUD Embedded in Myometrium : Mx : Hysteroscopy & Remove it.

* Contraception in HIV⊕ Patient ⇒ GUD + Barrier

D.M. ⇒ GUD

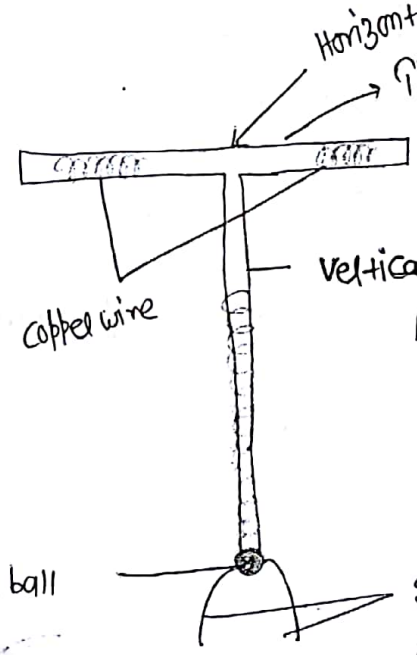
Heart disease ⇒ GUD

* M/c Mode of contraception used in India : Barrier Method *

* Best contraception; if Family is complete : Vasectomy > Sterilization > GUD, OCP *

Best Non-permanent contraception; if Family is complete : GUD > OCP. *

* No Risk of Teratogenecity ; if a ♀ Female continue ♀ ∈ GUD



↳ usually Rest in the body of cervix.

CU-T 380A

Silver Line CU 380Ag ⇢ M/c CU T used worldwide

↳ have flexible Arms : Silver core (A) & Rest Same as CUT380A

* Absolute c/I of IUCD - Category 4 of WHO :-

Mnemonic →

Please → Peurperal Sepsis or Postabortal sepsis

Don't → DUB / Unexplained vaginal bleeding;

Try to → Gestational Trophoblastic Disease;

Put → Current PID / STD or c/in Past 3 Months

Condom → Puerperal sepsis; know Pelvic TB
Ca cervix
Ca endometrium.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

STERILIZATION (Permanent Method).

(197)

* No. of children Required for sterilization ??

Ans ⇒ At least 1 child of 1yr old.

* It is a Legal procedure → Concent is Mandatory; but only of client.

* Concent of spouse is Not Mandatory.

- 22yr - 45yr can Undergo Sterilization;

QQ. UnMarried women can Undergo sterilization ?? ⇒ NO

Married or evel married ⇒ Yes

- Most cost effective Mode of contraception : Vasectomy
- Most effective contraception : Implant
- How Many days after vasectomy should avoid coitus or use another contraception : > 3 Months till azoospermia
- Post-partum Sterilization :- Within 7 days of delivery (or) after 42 days of Post-partum (can't do @ 8th or 9th ___ days)
  - This is Klas " Interval Sterilization."
- M/C Method used for Post-partum Sterilization : Mini Laprotomy (3 cm Long)
  - by Pomeroy technique
    - Babcock forceps used
- We don't use Laparotomy / Laproscopic Sterilization in Post-partum Sterilization.

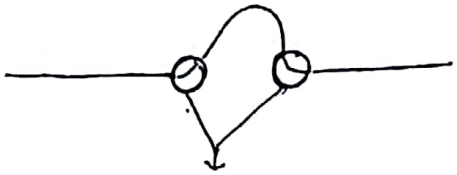
* Post-placental IUD ⇒ if we put IUD in/in 10 min of delivery;
* Post-partum IUD ⇒ if we put IUD in/in 48 hr of delivery.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

* M/c part of Fallopian tube that we Ligate in sterilization
↳ Isthmus.

Modified Pomeroy

aka "Parkland Method"



double Ligation of tube is done

Failure Rate = 0.2

Pomeroy

Middle part of tube (3-4 cm from fundus) is formed into loop using babcock forceps; which is tied & excised.

0.4

* Interval sterilization :- Non-pregnant state

Whenever we do sterilization in Non-♀ Female is k/as "Interval"

M/c. Method used: Laproscopy

* M/c Method of Female sterilisation ⇒ Laparoscopic sterilisation.
  - ⇓
  - Intraabdominal Pressure b/w 8-12 mm ; Max^m 15 mm of Hg
    - Not More than 15 mm of Hg b/c it ↓ venous Return
  - CO_2 gas used
* M/c Method for Laparoscopic Ligation ⇒ Yoon falope Ring / Sialistic band
* Site of Ligation ⇒ Isthamus

* Among sterilization technique ⇒

Least failure Rate: Unipolar cautery > Modified Pomeroy
(Never Used)
↳ b/c of intestinal burn

Highest Failure Rate: Clips > Bipolar cautery
⇓
HULKA CLIPS

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

Reversal Methods : ~~Clips~~ > Falope Ring > Modified Pomeroy > Cautery

(198)

Laparoscopic Ligation :→ Pt in Lithotomy position

⇓

With help of ~~Verses Needle~~ (Introduced at an Angle of 45°) Pneumoperitoneum is created

↳ CO_2 gas used

⇓

Procedure is done under Sedation & Local Anesthesia

* M/c used Method in Minilaparotomy : Modified Pomeroy.

* Highest Risk of ectopic ♀ : Cautery > Madlenal > Modified Pomeroy.

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

http://mbbshelp.com WhatsApp: +1 (402) 235-1397

ORTHOPEDIC

Handwritten Note

MBBS Help

http://mbbshelp.com

http://www.youtube.com/mbbshelp

http://www.facebook.com/mbbshelp.com

Name: _____

Subject: **Orthopedic**

Blank

HISTORY

1) GALEN — Father of Sports Medicine

2) NICHOLAS ANDREY
- coined the term Orthopaedics
- wrote 1st book —
- Father of orthopaedics.
- Crooked Tree symbol of Ortho

3) JEAN ANDRE VENEL
- Father of Orthopaedics

4) HIGH OWEN THOMAS
- Father of British orthopaedics.
- Thomas splint < was made for TB knee / was used for # SOF
- Thomas collar – soft cervical collar
- Thomas wrench – # reduction
- Thomas Test – Flexion deformity @ Hip

5) PERVICAL POT
- Pott's # → Bimalleolar # (MM + Ly)
- Pott's Spine → TB of spine

6) JAMES PAGET
- Paget's Disease of Bone
- " " " nipple

FRACTURE DISEASE

7) ROBERT JONES
- Father of modern orthopaedics
- Jones # – Robert Jones Bandage

ALBIN LAMBOTTE
Father of modern internal fixation
Coined the term 'osteosynthesis'
described the usage of Biodegradable implant

LORENTZ BOHLER
Father of Traumatology
Bohler Braun splint
Bohler's Angle → # calcaneum
Bohler's Stirrup → skeletal traction

GERHARDT KUNTSCHNER
Kuntschner nail

MARTIN KIRSCHNER
Kirschner wire

MAURICE E. MILLER
Cofounded AO - Arbeitsgemeinschaft
Fur Osteosynthesefragen

ARRAHAM COLLES
Colles #

JOSEPH LISTER
Father of Antiseptic Surgery

AMBROISE PARE
Father of amputation surgery

WTG MORTEN
Father of modern anaesthesia

W.C. ROENTGEN - discovered X-Ray ↓ World Radiology day
Father of Radiology on 8th NOV; 1895

ENNEKING
Father of orthopaedic oncology

John Charnley
Father of arthroplasty — 1st Joint → HIP

INSALL
NORMAN W. SCOTT — I.S.K. → Total Knee Replacement
KELLY

MASAKI WATANBE
Father of Modern Arthroscopy

JOHN BARTON
Barton's #
Barton's Disease → {Vit C = scurvy; Vit D = Rickets}

KENJI TAKAGI
Father of arthroscopy

CAFFEY
Caffey's Syndrome - Battered ~~Bad~~ Baby Syndrome
Caffey's Disease - Infantile Cortical Hyperostosis
↳ M/C Bone - Mandible

GAVRILL ABRAMOVICH ILIZAROV
Distraction Histiogenesis

DR. B.B. JOSHI
JESS Joshi's Ext stabilising system

DR. S.M. TULI
Musculoskeletal TB

DR. P.K. SETHI
Jaipur Foot

DAYS

Bone & Joint Day - 4th Aug
World spine Day - 16th Oct
World Arthritis Day - 12th oct
World Radiology Day - 8th NOV
World Clubfoot Day - 3rd June

SPINE

ANATOMY

DENNIS 3 COLUMN CONCEPT OF SPINAL STABILITY

ANT	MIDDLE	POST
1) Ant. longitudinal Ligament (ALL)	1) Post 1/3rd of V. Body	1) Post Longital Lig. complex
2) Ant 2/3 of V. Body	2) Post 1/3rd of I.V. Disc	2) NEURAL ARCH Pedicle Transverse process Sup. articular process Inf. articular process Laminal Spinous process
3) Ant 2/3 of I.V. Disc	3) Post. longitudinal ligament (PLL)	

LIST-① - TERMS IN SPINE

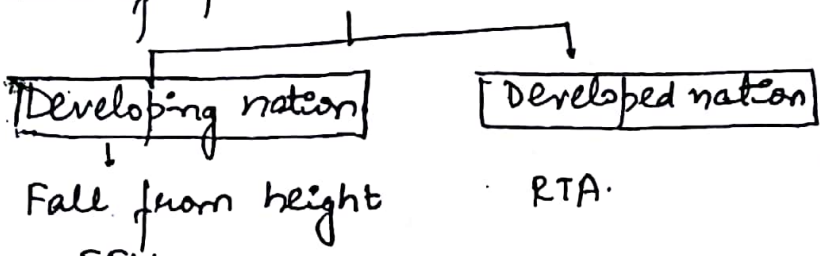
Spondylitis → Paraspinal M/c spasm

Spondylolysis → # of pedicle / Pars Interarticularis

Spondylolisthesis → ~~slip~~ slippage of 1 V. Body over another V. Body.

LIST-② M/C In SPINE

→ M/c Mode of spinal Trauma



→ M/c mechanism of spinal Trauma
Flexion distraction > Flexion

→ Worst mechanism of spinal Trauma
Translation > Flexion rotation

→ Spinal canal widest at C_2 level

→ VERTEBRAE – always constant in no. → Cervical
most variable in no → coccygeal

M/C site of
Spinal Trauma → Cervical spine
Spinal # – Lower thoracic spine
Spinal cord injury – Cervical spine
Peripheral N/V injury – Radial n/v (PNI)
PNI ō BEST Prog – Radial n/v
PNI ō WORST " – ULNAR N/V

PNT ī Worst Prognosis. = SCIATIC N/V
(despite surgical Repair

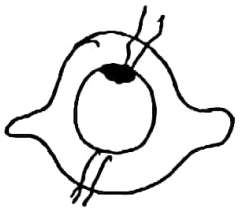
M/c site of Skull Bone # - TEMPORAL

M/c site of Facial Bone # - Nasal > zygomatic

M/c site of Mandible # - Neck of condyle

LIST- 4 #s/ Injuries of Spine ī Eponyms

JEFFERSON's #



Burst # of C_1 Ring (atlas)
Involves ® Ant- & Post Arch
85% pts - No neurological deficit
Undisplaced # → collar
displaced # → HALO VEST

HANGMAN's #

Mech:- Hyperextension followed by distraction
Spondylolysis (# of pars interarticularis/pedicle)
of C_2 (axis) ī Spondylolisthesis of C_2 over C_3. ī
C_2-C_3 I.V. Disc disruption.

CLAY SHOVELLER's #

avulsion # of tip of Spinous process of C_7 > T_1
seen in the Labourers who do heavy wt
lifting ī arms extended

CHANCE #/ SEAT BELT INJURY/ JACK KNIFE INJURY

Head on collision of during ~~seat belt~~ RTA

Mech:- Flexion → Distraction → Rotation.

Horizontal # Line Traversing the vertebral Body through all three columns.

Level - T_{12} - L_2

50% pts → concomitant intraabdominal injury

UNDERTAKER #.

Post Mortem fending

due to careless handling of dead Body by undertakers Q.

subluxation of lower cervical spine :
C_6-C_7 I.V. disc disruption. / tear.

SCIWORA ★ (PGI)

spinal cord injury without Radiological Ab (N)

children < 8 yrs

Initial X-Rays - (N)

Presentation - Neurodeficit
No spinal reflexes

IOC: MRI

Upper cervical Spine

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

NEUROGENIC SHOCK / SPINAL SHOCK

young ♂

RTA.

Unconscious

Hypotension.

Bradycardia → Hallmark

M/c site of spinal cord Injury – Lower C. spine

COMPLETE		INCOMPLETE
⊖	Sacral sparing	⊕
⊖	Perianal sensations	⊕
⊖	Flexor Hallucis Longus	⊕
⊖	Rectal motor tone	⊕
⊖	Bulbocavernous Reflex / Anal wink	⊕

(last reflex to disappear
1st reflex to reappear
in pt. of spinal shock)

IOC – MRI.

PAEDIATRIC SPINE

(I) KLIPPEL FIEL SYNDROME (AIIMS)

Dystrophia Brevicollis Congenita
Bony pathology / segmentation failure
Congenital fusion of cervical vertebrae
child
TRIAD OF KFs → short webbed neck
→ Low post hairline
↓ ~~Restriction~~ Range of movement @ neck
Short statured child
M/C association → sprengel's deformity
Other associations-
Congenital heart defects
ocular anomalies
GUT Abn
Mx- to prevent complications
Cervicothoracic scoliosis
Avoid collision sports.

CONGENITAL MUSCULAR TORTICOLLIS (CMT)/WRY NECK

Muscular pathology
overcontract of sternocleidomastoid (SCM)
fibromatosis of SCM.
PALPABLE NECK MASS → @ birth
→ in 4-6 wks after birth.

Associations- Developmental dysplasia of Hip.
Metatarsus Adductus

Contracted SCM @ junc' of U 2/3 - L 1/3
Ⓡ side > Ⓛ side.

90-95% pts → Regular stretching exercise.

5-10% pts → Surgical release of muscle only after swelling/mass persists >1 year of age

Forceps Injury → Injure SCM

Complications → ,, I/L Head tilt
C/L Chin left deformity
(Cock Robin ~~def~~ appearance)

2) PLAGIOCEPHALY
(asymmetrical development of skull & face).

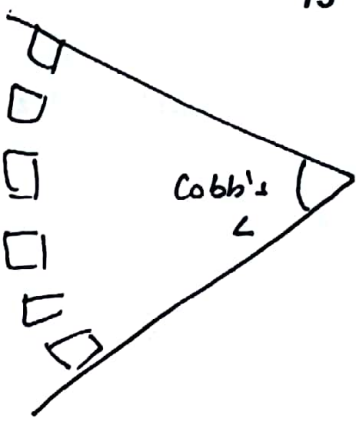
Ⓘⓘ IDIOPATHIC ADOLESCENT SCOLIOSIS

♀ > ♂
around puberty
Double curve
↓
Thoracolumbar

Single curve
↓
Thoracic spine (R/C) R > L
Lumbar spine

Double curve progress earlier than single curve

COBB'S ANGLE



$< 30°$ → unlikely to progress

$30° - 50°$ → 10-15° progression

$> 50°$ → progress @ 1°/year

3% → scoliotic ~~fit~~ tilt

↳ less than 10% of population. - requires Rx.

→ SPONDYLOLISTHESIS

slippage on 1 v. body over another V. Body

M/C Level :- $L_5 S_1 > L_4 L_5$

M/C N/v root irritated - L_5

TYPES OF SPONDYLOLISTHESIS

A) ISTHMIC/LYTIC

M/c type

Defect in Pars Interarticularis

Congenitally weak pars Interarticularis

↳ sports activity → FATIGUE # of pars

B) DYSPLASTIC

Rare, congenital type

No defect / No # in pars

Defect in formation of 1st sacral arch & superior facets of S_1

Neurodeficit is more in this type compared to isthmic type

As there is growth spurt (14 year ♀, 16 year ♂)

LISTHETIC CRISIS

Acute onset of sudden pain & Rigidity in paraspinal M/s c functional / spastic scoliosis.

C> DEGENERATIVE

2nd M/c type > Isthmic

M/c Level $L_4 L_5$

♀ > 50 yrs

Senility → disc generation → Facet Injury
Osteoarthrosis /
2° osteoarthritis

slippage ← Facet Joint ↓
(usually low grade) Unstable

D) TRAUMATIC

in an area other than pars → slip.

E) PATHOLOGICAL

Generalised / Localised Bone pathology → # of pars interarticularis

⇒ Clinical Spectrum

Asymptomatic initially

Incidental Δ

1st symptom → Backache → degenerative type
Low back discomfort

→ Dysplastic type
Acute, sudden pain.

Radiculopathy

spasm on passive stretching of legs

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

⇒ Δ :-

X-Ray :- oblique view of L.S. spine

↓

defect in pars Interarticularis

↓

Break in neck of SCOTTY TERRIER DOG SHADOW

↓

Beheaded scotty Terrier sign/

Scotty Dog wearing a collar sign.

(scotty dog terrier shadow is a (N) finding in oblique X-Rays of L.S. Spine)

AP view - Inverted Napolean HAT sign

(Least useful) (due to superimposition of sacrum & L5)

Flexion & Extension views - to see spinal stability

Mx of spondylolisthesis :-

Based on Meyerding's classification/staging

(AP diameter of Sup. surface of lower vertebral body is divided into quarters)

I	<25%	→ Conservative
II	25-50%	
III	50-75%	→ Surgical when there is
IV	>75%	

a) progrencre neurological deficit

b) canal stenosis

c) Refractory pain

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

LIST -5 MYOTOMES

C_5 - Deltoid

C_6 Wrist Extensors

C_7 Wrist Flexors / elbow flexors.

C_8 Finger Flexors

T_1 Finger Abductors

$L_1 L_2$ Hip Flexors (Iliopsoas)

L_3 Knee Extensors (Quadriceps)

L_4 Ankle Dorsiflexors (tibialis ant)

L_5 Extensor Hallucis longus

S_1 Ankle Plantar flexors (Gastro soleus)

LIST- 6 REFLEXES

C_5 Biceps

C_6 Supinator (Brachioradialis)

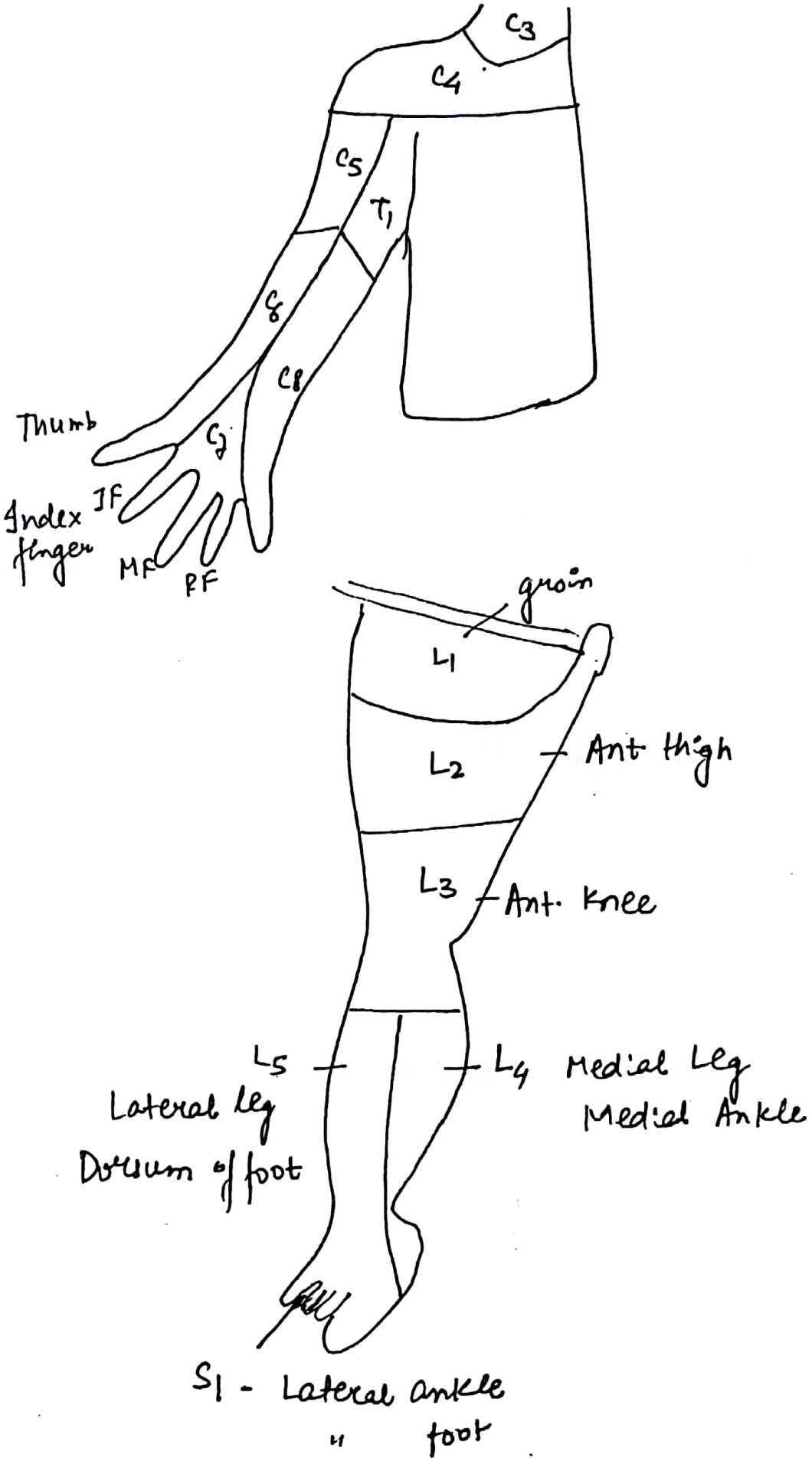
C_7 Triceps

$L_3 L_4$ Knee Reflex (Quadriceps)

$L_5 S_1$ Plantar Reflex (Femoris)

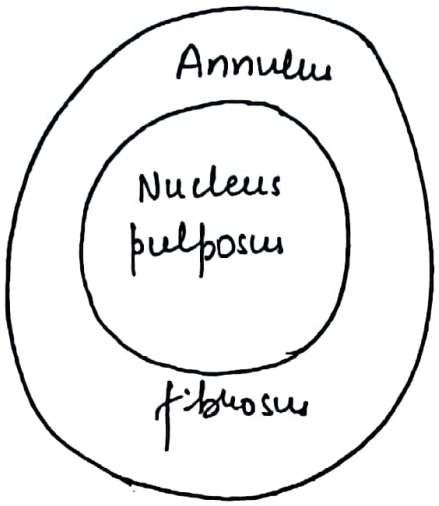
$S_1 S_2$ Ankle Reflex (Gastro soleus)

LIST 7 **DERMATOMES**



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

PROLAPSE INTERVERTEBRAL DISC



M/c Level- $L_4L_5 > L_5S_1 > C_5C_6 > C_6C_7$

MRI BASED STAGING

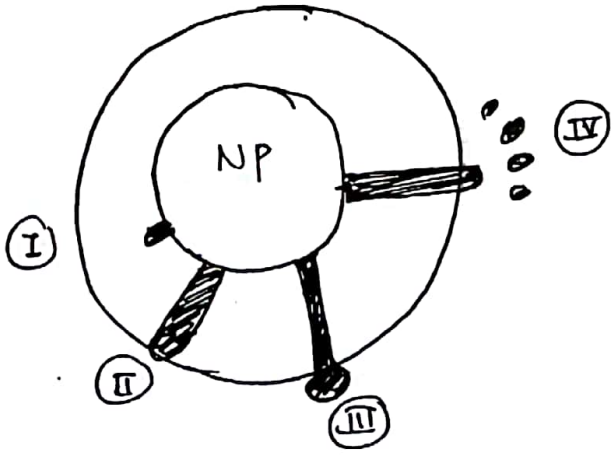
I → Disc Degeneration / Disc Bulge

II → Disc Protrusion

III → Disc Herniation / Extrusion

IV → Disc Sequestration.

SCHMORL's NODE



⇒ TYPES of PIVD - Depending upon the direction of prolapse

- POSTEROLATERAL/ PARACENTRAL — Lower level of N/V Root
- FAR LATERAL/ FORAMINAL — Upper level of N/V root

⇒ CLINICAL TESTS

1) Straight Leg Raise
2) Braggard's sign
3) Lasegue sign
4) Bowstring sign of McNAB

IOC :- MRI.

Mx- Conservative Mx :-

Bed Rest
NSAIDs
M/s Relaxant
} Acute Pain.

Intermittent Lumbar Traction
Superficial Heat
→ Hot packs
→ Infrared therapy
Deep Heat
→ Short wave diathermy
→ Ultrasonic therapy

TENS for Radicular pain.
Transcut. electrical N/V stimulation

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Lumbar Belts / Corsets
Epidural steroids
Spine extension Exercises
} Chronic Pain

Indications for Sx

ABSOLUTE

1) Progressive neurological Deficit
2) Cauda equina Synd.
   ↳ If established Sx should be done in 6 hours or irreversible damage occurs

RELATIVE

1) Severe sciatic pain despite 6 weeks of conservative Rx
2) Recurrent incapacitating sciatica attacks. (>3 per year)

SURGERY – Decompression ± DISCECTOMY

* SURGICAL APPROACHES AIIMS May 2015
  - Laminectomy
  - Hemilaminectomy
  - Laminotomy (fenestration Sx)
    of choice → via microscope

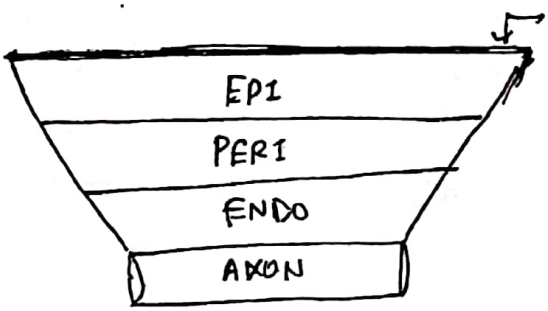
LAMINOPLASTY → was done in cervical canal stenosis

LIST - 8 Flag Signs of Backache (AIIMS 21 2015)

RED	YELLOW
1) Age < 20yrs	1) Anhedonia
2) Age > 50yrs	2) Low mood
3) Cachexia	3) poor job satisfaction.
4) Constant pain	4) High functional limitation > 1 month
5) Saddle anaesthesia	5) psychological disturbance
6) H/o malignancy/steroid use/ I.V. drug abuse	6) Social ~~isolation~~ isolation
	7) Alcohol dependence

~~BARASTROP's~~

PERIPHERAL NERVE INJURY



SEDDOM's CLASSIFICATION

NEUROPRAXIA	AXONTOMESIS	NEUROTMESIS
Physiological conduc" Block	Partial anatomical Conduction block.	Complete anatomical Conduc" Block.
Anatomy: Axon, N/v sheath → (N)	Axonal disrup" sheath (N)	Axon + sheath disrupted
Transient demyelination.	Surgery (I)	Surgery is compulsory
		Rg. I

Spontaneous recovery is a rule. ≤ 6wks

Eg. postural / positional
N/V palsy
Traumatic
Saturday Night palsy · RN

Rx - Dynamic cock up splint is done in Rx to avoid contractures & deformities Later

BAASTRUP's DISEASE / KISSING SPINES

→ Degenerative Disease
→ Hypertrophy & Enlargement of adjacent spinous process in Lumbar spine in elderly pts
→ FOCAL MIDLINE Backpain which worsens in
⇒ extension
→ M/c Level - L_4L_5

Rx - Conservative

LIST - 9 COMPRESSION NEUROPATHY

Carpal Tunnel sy - Median N/v @ wrist

Guyon's canal sy - Ulnar N/v @ wrist
(~~pitho~~ pisohamate canal)

Cubital tunnel sy - Ulnar N/v behind medial epicondyle

Radial Tunnel sy - Post. Int. N/v (motor Br).

Pronater sy - Median N/v between two head of pronator Teres

Kiloh Nevin sy - Ant. Int. N/v (motor Br. of median N/v

Piriformis sy - Sciatic N/v compression

Meralgia paraesthetica - Lateral cut. N/v of thigh

Cheralgia paraesthetica - Sup. sensory br. of Radial N/v

Morton's Metatarsalgia - Interdigital plantar N/v compression.
excruciating pain on squatting

NOTALGIA PARAESTHETICA - Sup. sensory neuropathy in infrascapular area.
Pruritus + Dysaesthesia
Rx - Pregabalin.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

MEDIAN NERVE

↓

Wrist

Superficial Br. → Palmar cutaneous Br. → Skin over thenar eminence

Carpal Tunnel

Deep Br. → Lateral Division MOTOR

1) Abductor pollicis Brevis
2) Flexor pollicis Brevis (sup. head)
3) Opponens pollicis
4) 1st Lumbrical

Sensory: thumb lateral half (IF)

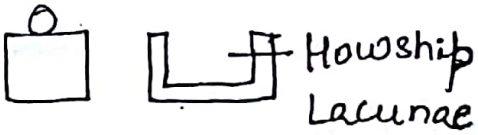
Deep Br. → Median Division SENSORY

1) Medial IF
2) MF
3) Lateral RF

MOTOR: 2nd Lumbrical

OSTEON

- ORGANIC (30-35%)
  - MATRIX (90-95%)
    - PROTEINS
      - CP → Type I collagen
      - NCP → osteocalcin / Bone Gla protein ★
        - Osteonectin
        - osteopontin
      - Enzyme – Alkaline Phosphatase
  - CELLS (5-10%)
    - OSTEOBLASTS
      - CP
      - NCP
      - ALP
      - OSTEOID
        - Ca^{2+}
        - PO_4^{-2}
      - OSTEON
    - OSTEOCYTES
      - Resting / spent / Mature / Quiescent osteoblasts
      - Most abundant cells
      - Most long lived cells
    - OSTEOCLASTS
      - GIANT CELL FAMILY
      - Monocyte-macrophage cell lineage
      - 2R's
        - ReModelling
        - Resorption of Bone
- INORGANIC (65-70%)
  - MINERALS
    - Ca^{2+}
    - PO_4^{-2}
    - Calcium hydroxy apatite



PHYSIOLOGY

CALCITONIN → ↓ S. Ca^{2+}

PTH → Osteo Blast (RANK-L)* → OSTEOCLAST → Bone Resorption → ↑ S. Ca^{2+}

ANOTOMY

Long Bone has 4 Layers

Epiphysis
Physis/growth plate
Metaphysis
Diaphysis

EPIPHYSES

CLASSIFICATION

1) PRESSURE – Body wt bearing
eg. Head of femur

2) TRACTION – attachment of to soft tenue
eg. Tuberosities (humerus)
Trochanters (femur)

3) ATAVISTIC – eg. Coracoid process

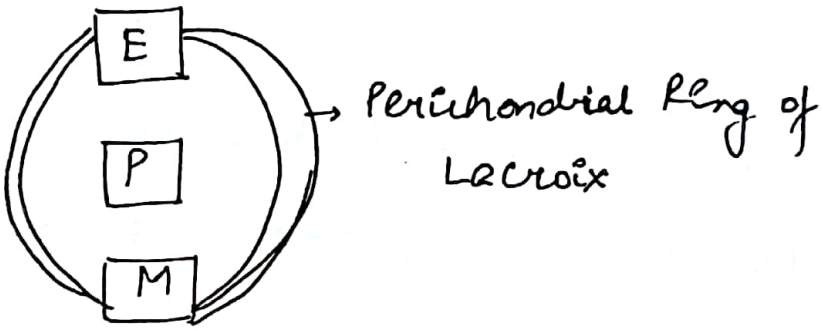
4) ABERRANT

Eg. epiphysis @ Head of 1st Mc.

PHYSIS

STRUCTURE Real People Have Career options.

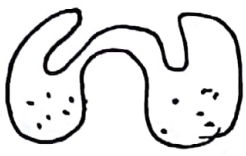
1) Resting zone
2) Proliferative zone
3) Hyperproliferative zone
4) Zone of calcification
5) Zone of ossification.



METAPHYSIS

Loose / spongy / cancellous
Highly vascular

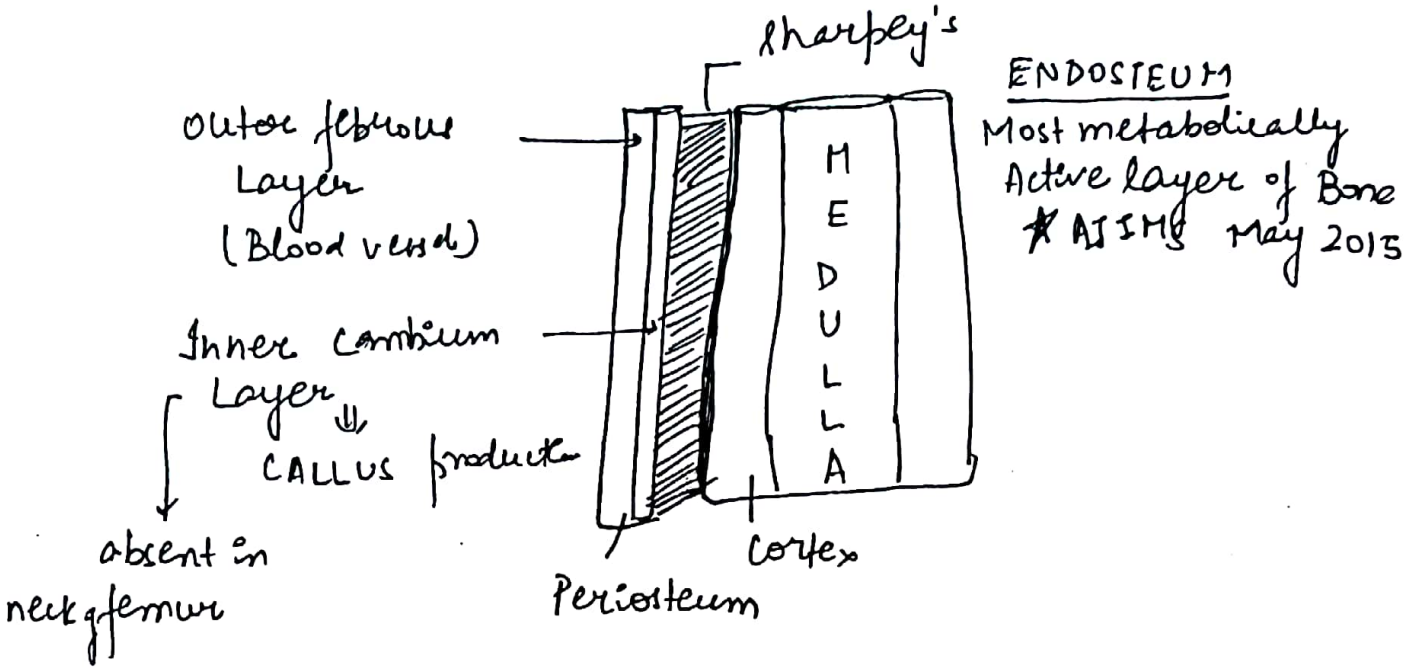
Metaphyseal # → Higher union potential common
↳ malunion common
Non-union rare



HAIR PIN LOOP of vessels

blood vessels → dilated tortuous
→ Stagnation of blood
↓
Ischaemia ← Stasis
↳ Infection → osteomyelitis

DIAPHYSIS / SHAFT



LIST 10 BASICS (ONE LINER)

Most abundant cell of Bone = Osteocyte

Most long lived cell of Bone = "

Clavicle (long Bone) has no marrow cavity

PHYSIS - Temporary 1° cartilaginous joint

HUETER VOLKMANN's LAW:-

Compressive forces across physis ⇒ INHIBIT GROWTH

Shearing / tensile forces " " ⇒ PROMOTE GROWTH

Ossification centres present @ Birth

Distal Femur	Fe
Calcaneum	Cal
Talus	Tal
Cuboid	Cum

Capitate:- 1st Carpal Bone to ossify [@ 2 month] - AIIMS Nov 2017

LAW OF OSSIFICATION

2° ossification centre that appears 1st fuses last
[Fibula doesn't follow this rule]

METABOLIC BONE DISORDERS

(I) OSTEOGENESIS IMPERFECTA / Brittle Bone Disease / Fragilitas Ossium / Vrolik Lobstein Disease

COL1A1 gene mutation
↓
Glycine substitution.
↓
No cross linkage in Type I collagen
↓
No Tensile strength in bone
Type I collagen synthesis defect

Clinical Spectrum:-
Pre school child → Multiple Long Bone # (PATH #)
No H/o Trauma
↓
Blue Sclera
poor & delayed dentition

X-Ray - 3D
Diaphyseal
Different stages of Healing
Deformities

Mx- 1) Braces to prevent further deformity
2) Bisphosphonate
3) Corrective osteotomy
(realignment osteotomy)
4) Sofield Miller Surgery
4) Internal fixation = Telescopy nail
Bailey & Dubow Rod.

D/D :- BATTERED BABY SYNDROME / Caffey's Synd.

Pre school child
Multiple long bone #s
Signs of violence (+)
X-Ray = METAPHYSEAL #s
(distal radius/ulna)

CORONER	BUCKET HANDLE #.

(II) OSTEOPETROSIS / Marble Bone Disease/
Albers chongberg Disease
Defect in Carbonic Anhydrase II Proton Pump
⇓
Defective osteoclastic bone Resorp^n
⇓
Excessive deposition of (N) osteoblastic Bone
formation
⇓
THICK/ DENSE/ SCLEROTIC BONE

C/F :- Infants - Bone Marrow failure
↓
Pancytopenia
↓
Recurrent Infn"
↓
osteomyelitis of mandible
↓
Hepatosplenomegaly
↓
Recurrent hemorrhage

X-Ray of long Bone - 2E → Endobone sign
Erlenmeyer Flask.
Deformity.

X-Ray Spine - RUGGER JERSY SPINE (Renal osteodystrophy > osteopetrosis)

(III) PAGET'S DISEASE / Osteitis Deformans

High turnover Bone Disease
Excess osteoblastic bone formation &
Excess osteoclastic bone resorption
M/C Bone → PELVIS
Age Grp → 4th / 5th decade
Asymptomatic in most cases
Western > Asians.
1st M/C Symptom - BACK PAIN

Δ :- BIOCHEMICAL → ALP ↑↑↑

BONE BIOPSY → Gold Std.

Mosaic pattern

X-RAY-

OSTEOPOROSIS CIRCUMSCRIPTA

COTTON WOOL SKULL

TAM O SCHANTER SIGN

FLAME SIGN / BLADE of GRASS SIGN / ADVANCING WEDGE SIGN

PICTURE FRAME SPINE

BRIM SIGN (Thick sclerotic iliopectineal line)

M/C premalignant Lesion for 2° osteosarcoma

DOC - Bisphosphonates.

(IV) OSTEOMALACIA / MALACOSTEON / Hungerwerk Osteopathy

Qualitative Bone defect

O' Blast → osteoid $\xrightarrow[PO_4^{-1}]{Ca^{2+}}$ Osteon.

Cause-

↓ dietary intake of Ca^{2+}

Poor GI absorption

Poor Renal tubular Reabsorption

→ Deficient Ca^{2+}

↓

Lack of properly formed osteon

↓

Compensatory ↑ in Osteoblastic activity

↓

↑↑ osteoid ↑↑

$\frac{\text{Osteoid}}{\text{Osteon}} > 1.$

C/F - young ♀ (15-40yrs)
Bone pain
Polyarthralgia.
Proximal myopathy
H/C – Spine

Biochemical Analysis
S. Ca^{2+} ↓
S. PO_4^{2+} ↓
S. ALP ↑↑↑

Bone Markers of Formation
serum levels of Type I collagen
osteocalcin
osteonectin
osteopontin.

X- Ray - SPINE → Fish mouth spine
PELVIS → LOOSER's ZONES. (PAI)
Emil Looser
Ribbon shaped translucencies
Cortical infarct / pseudo #
Milkman's #.
No displacements
No callus.

SITES
a) pubic ramus
b) NOF
c) Ribs
d) clavicle
e) Outer border of scapula
f) Subtrochanteric fem

Also seen in.- Renal osteodystrophy
Fibrous dysplasia
Hypophosphatasia
Osteogenesis Imperfecta

Mx- 1) Diet rich in Calcium → Milk
Green Leafy vegetables

vit D – Cod/fish oil
sunlight

2) Supplements

(V) OSTEOPOROSIS

» Porous Bone Disease

» QUANTITATIVE Bone Defect

M/C R/F ⇒ Post Menopause

M/C cause ⇒ senile / Ageing

Drugs → corticosteroids → Thyroxine
→ Anticonvulsants. → GnRH analogue

↓

2° osteoporosis.

Excess osteoclastic Bone Resorption > (N) osteoblastic Bone formation.

4F-
Perimenopausal ♀
Mostly asymptomatic
Earliest symptom → BACK PAIN
M/C complication → Pathological #.
(V. Body of T_{12})

Biochemical Analysis
S. Ca^{2+} (N)
S. PO_4^{2-} (N)
S. ALP (N)

Bone Markers for Resorption
serum & Urine levels of
Type I collagen degradation products
Proline
Hydroxyproline
Deoxypyridinoline
N - Telopeptides
C - Telopeptides.

X-Ray - SPINE
→ Fish Mouth spine

DEXA SCAN - Gold Std
(Dual energy X-Ray Absorptiometry)
WHO defines osteoporosis → T. score ≤ -2.5

Mx

DRUGS

① Antiresorptives
→ Bisphosphonates (DOC)
→ Denosumab
MOA = ⊖ RANK-L

Sx

vertebroplasty
kyphoplasty (better)
↓
percutaneous Inj" of Bone cement in ν Body

② OSTEOPROMOTIVES
Teriparatide
Recombinant PTH in low intermittent doses
DOC for Bisphosphonate resistant osteoporosis

③ ANTIRESORPTIVE + OSTEOPROMOTIVE
Strontium Ranelate

FISH MOUTH SPINE ⇒ Osteomalacia > osteoporosis

RUGGER JERSEY SPINE ⇒ Osteopetrosis < Renal osteodystrophy

Excess Consumption of Bisphosphonates

Dose — Duration

ADYNAMIC BONE SYNDROME

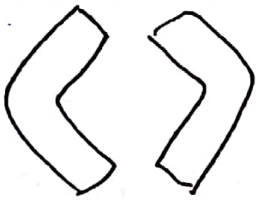
Clinical — X-Ray

Vague hip pain — Atypical Subtrochanteric femur #.

Transverse
Lateral cortical thickening
Medial spike
No communication

Risedronate = 35mg tab weekly
Ibandronate = 150mg tab monthly
Zolendronate = 5mg I.V. yearly

Q.



GENU VARUM
Bow Legs
M/C Cause
Children: Rickets / Idiopathic
Adults: O.A.

GENU VALGUM
Knock Knee
M/C Cause
Children: Idiopathic > Rickets
Adults: R.A.

* Father 2yr child GENU VARUM

Rickets — Idiopathic

Ca^{2+} ↓ PO_4^{2-} ↓ Vit D ↓ ALP ↑↑↑

vit D_3 intramuscular inj" of
oral Vit D × 6weeks

↓

6 weeks Later

Genu varum corrects

Genu varum persists

↓

Repeat ALP

ALP ↑↑↑

↓

Vit D resistant
Renal Rickets

↓

ped. nephrologist

Rickets — Best Astic → x-Ray
Best Prognostic → ALP

ALP ⊗

↓

Corrective osteotomy

CLAVICLE

ANATOMY

LONG BONE → Horizontal
- Subcutaneous
- → Intramembranous ossification (IMO)
- Two 1° , one 2° ossification centre

1st Bone to start ossifying (5th week IUL)
Last " " get ossified

Medial 2/3rd → cylindrical
Lateral 1/3rd → Flat

Junc" of medial 2/3rd , Lateral 1/3rd = weakest point of clavicle

FRACTURE CLAVICLE

M/C # overall / delivery / newborn
M/c site - Junc" of Medial 2/3rd , Lateral 1/3rd
M/C complication - Malunion.
Most serious complication - N.V. Injury → Subclavian vessel
↓
Brachial plexus (lower Trunk)

Mx- CONSERVATIVE :- Figure of 8 bandage
Clavicular Brace

SURGERY → Indications of Sx

1> N.V. Injury

2> # @ Lateral end of clavicle ± A.C. Joint disruption

3> cosmetic defect

4> Floating shoulder
(I/L scapular/glenoid neck #
mid shaft clavicle #)

SHOULDER JOINT

ANATOMY

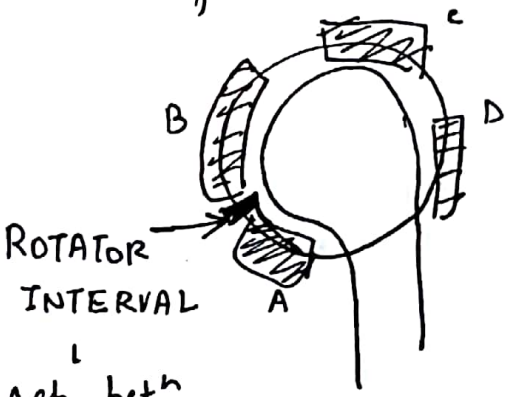
M/c Joint to undergo dislocation shoulder

WHY?

1) Synovial Joint (Ball & socket type)
Glenoid / Head of humerus = 1/3

2) Excess mobility ↓ stability

3) Inj. Deficiency of Rotator-cuff



↓
gap bet^n Subscapularis & Supraspinatus

ROTATOR CUFF

Capsule +

Ⓐ Subscapularis ⇒ Lesser Tubercle
↳ Missed/forgotten m/s I.R. @ shoulder

Ⓑ Supraspinatus → 0-15 Abduction

Ⓒ Infraspinatus ⇒ Greater Tubercle

Ⓓ Teres Minor → E.R. @ shoulder

** SHOULDER STABILISER

STATIC

1) Capsule
2) Glenoid Labrum ~(50%)
3) Negative intra articular pressure
4) Glenohumeral ligament
   - S.GHL → 0° Abduction
   - MGHL → 45° "
   - IGHL → 90° " ****

DYNAMIC

1) Rotator cuff ≤ v Imp
2) Deltoid
3) Biceps

TRAUMA AROUND SHOULDER

SHOULDER DISLOCATION

CLASSIFICATION

	A.S.D.	P.S.D	I.S.D
M/c subtype ↓ subcoracoid	>>> (95-98%)	> (3-4%)	(1-2%)
Mech. of Injury	Abd" ER	Add" IR	Hyperabduc".
Examples	Vigorous Throwing of Ball	Epilepsy, Electric shock	Pt. locks arm by side of head (Salute posture)
	PAINFUL	Minimally painful/painless	

X-Ray of PSD
Electric Bulb sign
Empty Glenoid Sign

CLINICAL TESTS for A.S.D.

DUGAS TEST-
Inability to touch opposite shoulder

CALLAWAY'S TEST-
Paraxillary palpation of Head of humerus

HAMILTON RULER TEST-
Ruler touches both acromian & Lateral condyle simultaneously

COMPLICATIONS

M/C (overall) → Recurrent

M/C (immediate) → Injury to circumflex Br. of Axillary N/v

M/C (delayed) → Recurrence

Mx- Closed Reduction.

* Methods of CR -

1) Hippocratic method
2) Stimsons Gravity Technique
3) Modified Kochers Technique (TEA-1)
[Traction - ER — Adduction → IR]

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

RECURRENT SHOULDER DISLOCATION

MATSEN's CLASSIFICATION

TUBS
Torn Loose

(T) Traumatic

(U) Unidirectional
M/c → Ant.

(B) Bankart's Lesion
* Avulsion of Ant. Inf. glenoid Labrum

* M/c cause of Recurrent ASD.

HILLSACH's LESION
* Bony defect @ posterolateral aspect of Head of Humerus due to repeated impaction against glenoid

* 2nd M/c cause of Recurrent ASD

(S) Surgery
↳ Arthroscopic Bankart/ Hillsach's

AMBRI
Born Loose

(A) Traumatic

(M) Multidirectional

FULCRUM Test - Ant. Instability
JERK test → Post. Instability
Sulcus test - Inf. »

(B) ilateral
MRI → capsular Laxity
Connective tissue disorder
Marfan / Ehler Danlos variant

(R) ehabilitation.
Isometric Rotator Cuff strengthening exercise

(I) nternal Capsular Closure

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

CAUSES OF RECURRENT PSD

* REVERSE BANKART LESION

Detachment / avulsion of Post. Inf. glenoid labrum

(BAI → PI)

* REVERSE HILLSACH'S LESION

Bony defect in Antero-medial aspect of Head of Humerus.

(TROUGH SIGN)

(opp. to Hillsach literally)

ROTATOR CUFF TEAR

young ♂ (20s/30s)

↓

Pain, swelling } Ⓡ shoulder

↓

O/E - Limitation of initiation of Abd°

↓

1st Inv = USG

IOC = MRI

↓

Acute traumatic R.C. Tear

↓

TOC: Arthroscopic RC Repair

↓

Long Later

↓

young ♂ (30s/40s)

↓

↓ Chronic

MRI. Irreparable Rc tear

↓

Rx OC = A'scopic R.C. Tendon Tranfer using deltoid / Biceps

↓

10 yrs Later

↓

Elderly ♂ (50s / 60s)

↓

Irreparable R.C. tear +
2° Glenohumeral arthritis

↓

Rx O.C.- Reserve shoulder arthroplasty

LIST- 11

M/C #

OVERALL = clavicle

Newborn - clavicle

Delivery - clavicle

Difficult Delivery - Humerus

Children - Greenstick # (Radius > Ulna)

Children around elbow - Supracondylar # Humerus

M/C CARPAL BONES - # → Scaphoid

Dislocation → Lunate

M/c - TARSAL BONES

- Calcaneum

Dislocation - Talus.

M/c Bone

open # - Tibia

Pathological # - ↓ Body (T_{12})

Stress # - Tibia > shaft of 2nd metatarsal (MARCH #)

M/c Joint to undergo ~~Shoulder~~ dislocation = Shoulder

LC " " " = knee

M/c Joint to undergo Recurrent " = shoulder

L/c " " " " = Ankle

M/c - Tendon injury supraspinatus > Tendoachilis

M/c Ligament to undergo sprain A.T.F.L. (ant. Talo fibular Lig)

STRONGEST LIGAMENT = BIGELOW's Lig
Iliofemoral Lig (IFL)

M/c Peripheral N/v injury - Radial n/v

Best Prog (PNI) = Radial n/v

Worst Prog (PNI) = Ulnar n/v

Worst Prog despite S_x = Sciatic n/v
Repair

M/c # due to Fall on Out Stretched HAND (F.O.O.S.H.)

Children = S.C. # Humerus

adults = # Scaphoid

Elderly = Colle's #

M/c Arterial Injury = Popliteal

LARGEST CARPAL BONE = Capitate

1st carpal Bone to ossify = Capitate

M/c Joint to undergo Dislocation in children = Elbow

L/c Carpal Bone # = Trapezoid

Most centrally located carpal Bone = Capitate

M/c Tarsal Bone to develop stress # = Navicular.

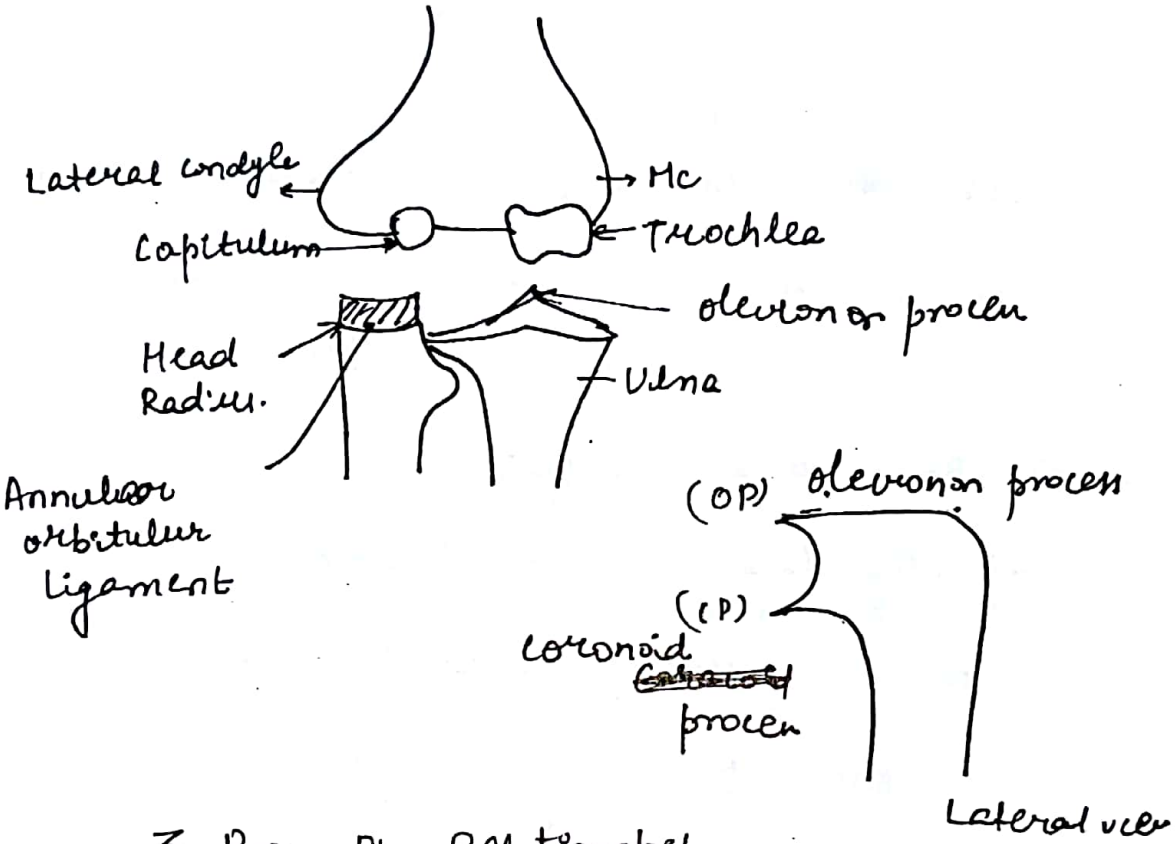
Last Carpal Bone to ossify = Pisiform

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

ELBOW JOINT

→ Synovial Joint (Hinge Joint)

Radiocapitellar < Ulnotrochlear JT



3 Bony Pt. Relationship

olecranon LC MC

Elbow @ flexion → △

Elbow @ extension → ——

ALTERED – # LCH / # MCH / # olecranon

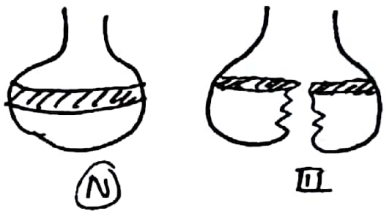
NORMAL – SC # H.

SALTER HARRIS CLASSIFICATION (I-V)

I No obvious # line
Minor - major physeal slip
eg. slipped capital femoral epiphysis

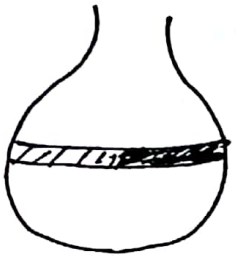
II Extra-articular injury
Triangular metaphyseal Bone fragment
(Thurston Holland sign)
eg. SC # Humerus

III Intra articular injury
Physeal # line extending into epiphysis
eg. lower end of Tibia #



IV 2nd MC type
Intra-articular injury
Rotation of distal fragment
↳ articular surface becomes non articular & vice versa
eg # LCH # of necessity ⇒ ORIF is compulsory

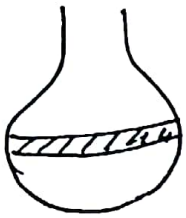
V Worst prognosis
Least common type
due to fall from height



Initial x Rays (N)
partial / complete physeal crushing injury
IOC = MRI

Complication:- Growth disappear
Limb length deformities

RANG - VI Injury to Perichondrial Ring of La' croix.



FRACTURES OF DISTAL HUMERUS

(A) SUPRACONDYLAR # HUMERUS

M/C # due to F.O.O.S.H. in children
MC # in children around elbow
Salter Harris type II
Extra-articular #
Three Bony pt Relationship (N)
M/C → Mode of Injury → F.O.O.S.H.
→ Mech. of Injury → HYPEREXTENSION

TYPES

- EXTENSION (96%) — Displacement of distal fragment
  - Dorsal / Posterior
    - **Posteromedial** > Posterolateral
      - M/C Displacement overall
  - Volar / Anterior
- FLEXION (4%)

GARTLAND'S CLASSIFICATION

(I)	(II)	(III)
Minimally displaced	Unicortical	Complete #
undisplaced	Angulation (+)	Bicortical #
Impacted #	No displacement	Completely displaced #
X-Ray (N)		
Mx Above elbow POP slab/Cast x 3 weeks	CR + Above elbow POP slab/Cast	CR + K-wire Fixation

COMPLICATIONS of SC#H

1) M/C Malunion → CUBITUS VARUS (Gunstock Deformity)
2) Neurological Injuries
3) Vascular Injury (MC - Brachial artery)
4) Compartment
5) Volkmann's Ischaemic contracture
6) Myositis ossificans

CUBITUS VARUS

→ Gun stock Deformity
→ Malunited SC #H most commonly compliate this way
→ occurs due to Uncorrected medial Tilt
→ static deformity
→ cosmetic "
→ Mx

FRENCH OSTEOTOMY — Modified French osteotomy

Incision: post midline — posterolateral

Whole Triceps — Triceps detachment — Lateral Triceps

Explored · kept safe — Ulnar N/V — Not explored

Broken — Medial cortex — Intact

NEUROLOGICAL INJURIES in SC #H

Usually neuropraxia
Recover Transiently
M/C Nerve Injured in SC #H
↳ overall = AIN br. of median N/V
↳ posterolateral = " displacement
↳ posteromedial displacement = Radial N/V

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

AH/volar displacement = ULNAR. N/N

COMPARTMENT SYNDROME

ETIOLOGY

↑ contents

1) Bone :- #

2) M/c #
children = SC # H
adults = # prox · Tibia

3) Muscle → crush
Traumatic Rhabdomyolysis

4) Vessel → vascular injury

↓ size

1) Tight circumferential POP dressing / Cast

2) Post Burn contractures

e/F :- "7P"

1st Symptom = Pain.

1st sign = Pain on passive stretching [Most Astic/ Sensitive]
(STRETCH TEST +ve)

Pallor
Paraesthesia
Paralysis
Pulselessness → late feature
→ Not Astic criteria

Pressure ↑↑↑ (N) 6 - 12 mm Hg
Astic ≥ 30 mm Hg

Mx - fasciotomy

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

V.I.C.

Compartment Syndrome → Ischaemia → Necrosis of M/s

↓

contracture ← fibrosis

Volkmann's Deformity

Forearm → thinned / atrophied

Wrist → flexed

Palm → Hollow

MCPJ → Hyperextended

PIPJ → Flexed

Mx of V.I.C. ⇒ GRADE WISE

Mild

Passive stretching / correction.

Turn Buckle Splint

Moderate

Maxpage Sx

Distal sliding of common flexor origin

Severe

Proximal row carpectomy

MYOSITIS OSSIFICANS

Muromer (no m/s inflammation)

Heterotrophic ossification.

Ectopic, benign, pathological bone formation in soft tissues

⇒ **Myositis ossificans traumatica**

child SC #H

Passive manipulation/ massage

Mechanical stimulus to periosteum

ectopic bone formation.

Acute MOT ⇒ Pain relief/ Ice packs/ Elevation

Chronic MOT ⇒ Sx excision of bone block in toto

⇒ **Myositis Ossificans Progressiva**

Rare,

AD inheritance

fatal Cond^{n}

children < 6yrs

Microdactyly

Bone formation in cardiac M/s

Diaphragm, Tongue, EOM M/s spared

Death due to resp. failure

M/C Joint involved in Myositis ossificans = ELBOW > HIP.

(B) # LATERAL CONDYLE HUMERUS

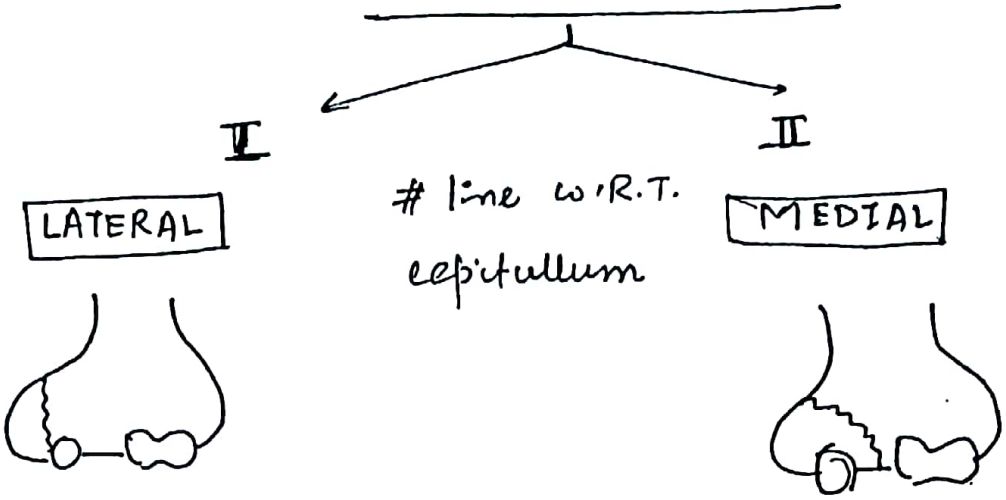
Intra-articular

Salter Harris type IV

3- Bony Paint Relationship ALTERED

Less common in incision than SC #H

MILCH CLASSIFICATION



M/C Comp. → Lateral spur formation.
due to ossification under periosteum

M/C complication Requiring Rx = NON UNION
↓
Cubitus Valgus

Dynamic
Functional

Mx = Milch Osteotomy.

M/C N/V Injury :- Tardy Ulnar N/V Palsy
(due to progressive increase in
cubitus valgus)

Mx - # Lateral condyle humerus is # of necessity
ORIF is the only Rx possible

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

SHAFT OF HUMERUS

HOLSTEIN LEWIS

oblique, displased # of shaft of humerus @ Junc of upper $^{2}/_{3}^{rd}$ & Louser $^{1}/_{3}^{rd}$ of shaft. ~ Radial N/V ~~Inj~~. Palsy.

LIST- 12 :- CLASSIFICATION IN ORTHOPAEDICS

Graff's - DDH
(USG)

Kashiwagi (MRI) = DDH

Stulberg's
Catterall
Salter thompson
Herrings
→ Perthes Disease

~~Atke~~ Aitken's - Prox. femoral focal deficiency

Boyd's - Tibia pseudoarthrosis (C.P.T.)
↓
Congenital pseudoarthrosis of Tibia

Stecberg's - A.V.N.

BADOS - Monteggia's #

Mason's - # Head Radius

MATSENS - Recurrent shoulder dislocation

NEER's - # proximal humerus

Bayne & Klug - Radial Club Hand

Arnold & Hilgartner's - Hemophiliac arthropathy

Outerbridge's — Articular cartilage arthritis

Ahlback's - OA knee

Rockwood - Acromioclavicular Joint

Judet & Letournel - # Acetabulum

Winquist & Hansen - # SOF

Schatzkers - # prox. Tibia

★ Hawkins - # Neck Talus

Sanders (CT) - # calcaneum

Essex Lopresti - (X-Ray) # Calcaneum

ALLmani's
Frykmann's
Fernandez
Melones
] # distal end of radius

Tiles
Young & Burgess
] # pelvis

Pipkins → # head femur

Salter & Thompson's - Perthes disease

Salter & Harris - Physeal Trauma

Thompson & Epstein - Post- Hip Dislocation

List- 13 # / INJURIES ~ Eponyms (Elbow/ forearm/ wrist)

1) Pulled Elbow / Nursemaid's Elbow.

Distal subluxation of Head of Radius → widening of Radio capitellar Groove

↓

Annular/ orbicular ligament gets stuck in widened radiocapitellar groove

↓

→ child locks elbow in extension, doesn't allow anyone to touch. → Apprehension test +ve

Mx = Closed Reduction

2) HOTCH KISS & TERRIBLE TRIAD

Post. elbow subluxation / dislocation

Head Radius

Coronoid process of ulna

3) ESSEX LOPRESTI # DISLOCATION

Distal Radio Ulnar Jt. Disruption

Interosseus membrane disruption.

Head Radius.

4) MONTEGGIA's #

# of proximal one third of Ulnar shaft + Radial Head dislocation.

BADO's classification (I - IV) → I - M/c overall [redacted]

II - [redacted]

M/C N/V Injured - P.I.N.

# of necessity (ORIF is compulsory)

5> GALEZZI's #/ REVERSE MONTEGGIA's #/ PIEDMONT #

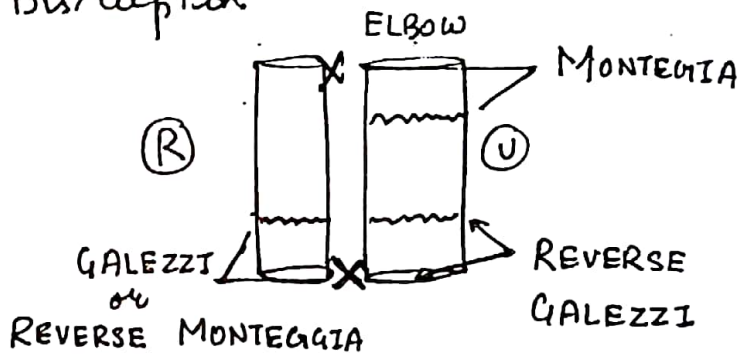
shaft of Radius @ Junc' of middle + distal 1/3rd of shaft ~ D.R.U.J' disruption.

of necessity (ORIF is compulsory)

3 terms more common than Monteggia's #

6> REVERSE GALEZZI's

# of shaft of ulna (@ Junc' of middle. Distal 1/3rd) ~ D.R.U.J. Disruption



7) LAUGIER's #

# of Trochlea

8) HUME's #

→ # of olecranon (prox. ulna) ~ ant. elbow of. dislocation of Radial Head

→ monteggia's variant

9) NIGHSTICK #

Isolated # of shaft of ulna

MOI - direct trauma to forearm while in a defensive stance

10) GREENSTICK #:

[redacted] children.

unicortical # of forearm bones (Radius & Ulna) ~ concavoconvex deformity

11) BARTON's #

Intra-articular # of distal end. radius (DER) ~ c
Radio-carpal joint subluxation.

* Barton's Disease → Vit C ↓ scurvy
Vit D ↓ + Rickets

12) CHAUFFER's #/ HUTCHINSON # /BACKFIRE #

Intra-articular # of distal end of radius ~ #
Radial Styloid process.
Radio carpal Jt. (N)

13) SMITH's #/ REVERSE COLLES's

Extra-articular # of Distal end of Radius ~
volar/anterior displacement of distal fragment
M/c comp^ - Malunion ('Garden spade deformity

14) COLLE's #

Extra-articular # of Distal end of radius ~
dorsal/posterior displacement of distal fragment
(Dinner fork Deformity)

ABRAHAM COLLES

Displacements :- DILS (ALLMC)

- Dorsal → characteristic
- Impac^
- lateral
- Supination

Complications of Colle's #

a) M/c → finger stiffness
b) 2nd M/c → Malunion (Dinner fork defor[redacted] pseudo modelling

c) Carpal Instability

a) carpal tunnel

e) Rupture of extensor pollicis longus

f) Post. Traumatic shoulder stiffness

g) Sudeck's Osteoneurodystrophy
(reflex sympathetic dystrophy)

Mx - COLLE's CAST (Hand shake cast)

- 15° pronation
- 15° palmar flexion
- 15° ulnar deviation

15) SUDECK's OSTEONEURODYSTROPHY

Reflex sympathetic dystrophy

CRPS I (complex Regional Pain syndrome)

- (I) Bony / Soft tissue injury
- (II) N/v Injury

Rare / delayed complication of Colle's #

Pain (severe / Intense) out of proportion

swelling (Stiffness / thin, shiny, stretched skin)

Hyperaesthesia

. Unenhibited v sympathetic stimulation.

[redacted] over

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

X-Ray = Osteopenia (↑ blood flow in sympathetic stimulation)

Mx = 1) sympatholytics

2) NSAIDs/ M/s Relaxant (amitryptiline)

3) Sympathetic Ganglion Blockade

4) Surgical Sympathectomy

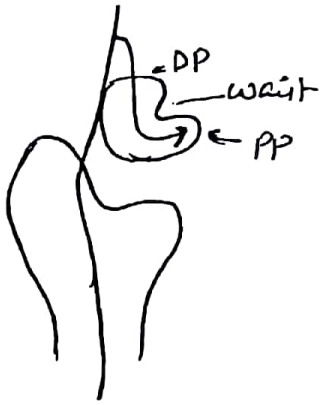
5) Vit C = prophylactic Role

16) # SCAPHOID

M/c Carpal Bone #

M/c # due to FOOSH in adults

Retrograde blood flow
(distal → proximal)



M/c mode of injury → FOOSH

M/c site → Waist

Scaphoid = floor/Base of anatomical snuff Box

C/F- Tenderness / swelling in anatomical snuff Box

X-Ray - Oblique
PA view in 15° Ulnar Deviation.

M/c Complication - NON UNION.

2nd M/c ↓ - AVN of prox. pole

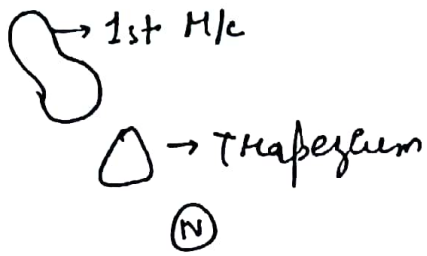
Mx - undisplaced # → scaphoid/ Glass holding cast
- displaced # → O.R.I.F. ē Herbert screw

17) BENNETT's

I/A # of 1st Mc

OBLIQUE

more displaced

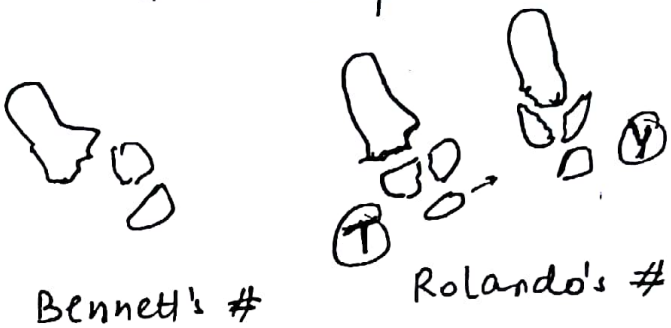


18) ROLANDO's #

I/A # of 1st M/c

T/Y shaped communited

less displaced



Bennett's #

Rolando's #

19) BOXERS

Neck of 5th Metacarpal

(M/C Metacarpal #)

20) MALLET FINGER

Avulsion of extenser tendon from dorsal aspect of Base of distal phalanx → flexion deformity @ D.I.P. joint

21) JERSEY FINGER

Avulsion of F.D.P (flexor Digitorum Profundus) from Volar aspect of base of distal phalanx

22) Gamekeeper's / SKIER's THUMB

Avulsion of Ulnar collateral ligament (ULL) from 1st metacarpophalangeal Jt.

23) MADELUNG DEFORMITY

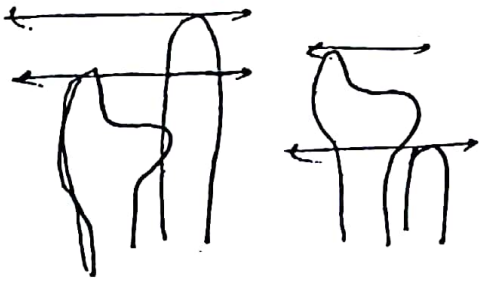
B/L pediatric congenital deformity

Growth retardation of ulnar aspect of distal end of radial physis.

DISTAL ULNA :- Thick
prominent
⊕ Ulnar variance

Dinner Fork Deformity

Mx = osteotomy
(DARRACH's PROCEDURE)



⊕ ULNAR VARIANCE — ulnar plus deformity

⊖ ULNAR VARIANCE — Ulnar minus deformity

24) RADIAL CLUB HAND

Longitudinal Deficiency Disorder

complete absence of radius > partial absence of radius.

Thumb/ scaphoid/ Trapezium = Absent

BAYNE & KLUG CLASSIFICATION

B/L pediatric Congenital deformity

⇒ Syndromic Associations ★★(POT)

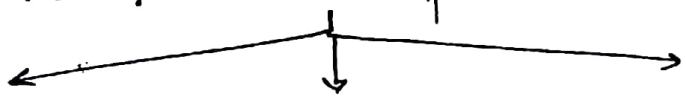
TAR Syndrome = Thrombocytopenia
Absent Radius

HALT ORAM Syndrome = ASD
fanconi's anaemia
Radial club hand

VACTER Syndrome = (V) ertebral Anomalies
(A) nal Atresia
(TE) Tracheo-oesophageal fistula
(R) enal & (R) adial dysplasia

25) POLY DACTYLY

M/c Congenital/ Hand malformations



Pre-axial > Central Post-axial

Thumb

26) SYNDACTYLY

fused/ conjoined/ webbed finger

COMPLETE (Syndactylism) < INCOMPLETE

M/c site:- Middle & Ring finger

Apert's syndrome-
craniosynostosis

Poland's Syndrome-
I/L absence of Pec. Major

27) PREISER's DISEASE

Non traumatic AVN of Scaphoid

28) KEIN BOCK's DISEASE

pressure Osteochondritis non-traumatic AVN of LUNATE

29) KAPLAN INJURY

Irreducible dislocation of finger (M/C- IF) / Index finger @ MCP JT

LIST- 14 TESTS IN ORTHOPAEDICS

Pen Test- Abductor Pollicis Brevis (MN)

Card Test- Palmar interossei (UN)

Elgawa's Test- Dorsal interossei (UN) → hold the fingers, ask to abduct

Book Test/ Froment's sign- Adductor pollicis (UN)

PHALEN's TEST Carpal Tunnel syndrome

DURKAN's TEST " "

COZEN's TEST - Tennis elbow (Lateral epicondylitis)

YERGASSON's Test- Bicipital Tendinitis

LIFT OFF TEST- subscapularis

DUGAS TEST
CALLAWAY's T
HAMILTON RULER T
} → Ant shoulder Dislocation

FINKELSTEIN's T- De Quervain Tenosynovitis

ALLEN's T- patency of sup. Palmar Arch

ADSON's T- thoracic outlet syndrome

THOMAS T- Flexion deformity @ Hip

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

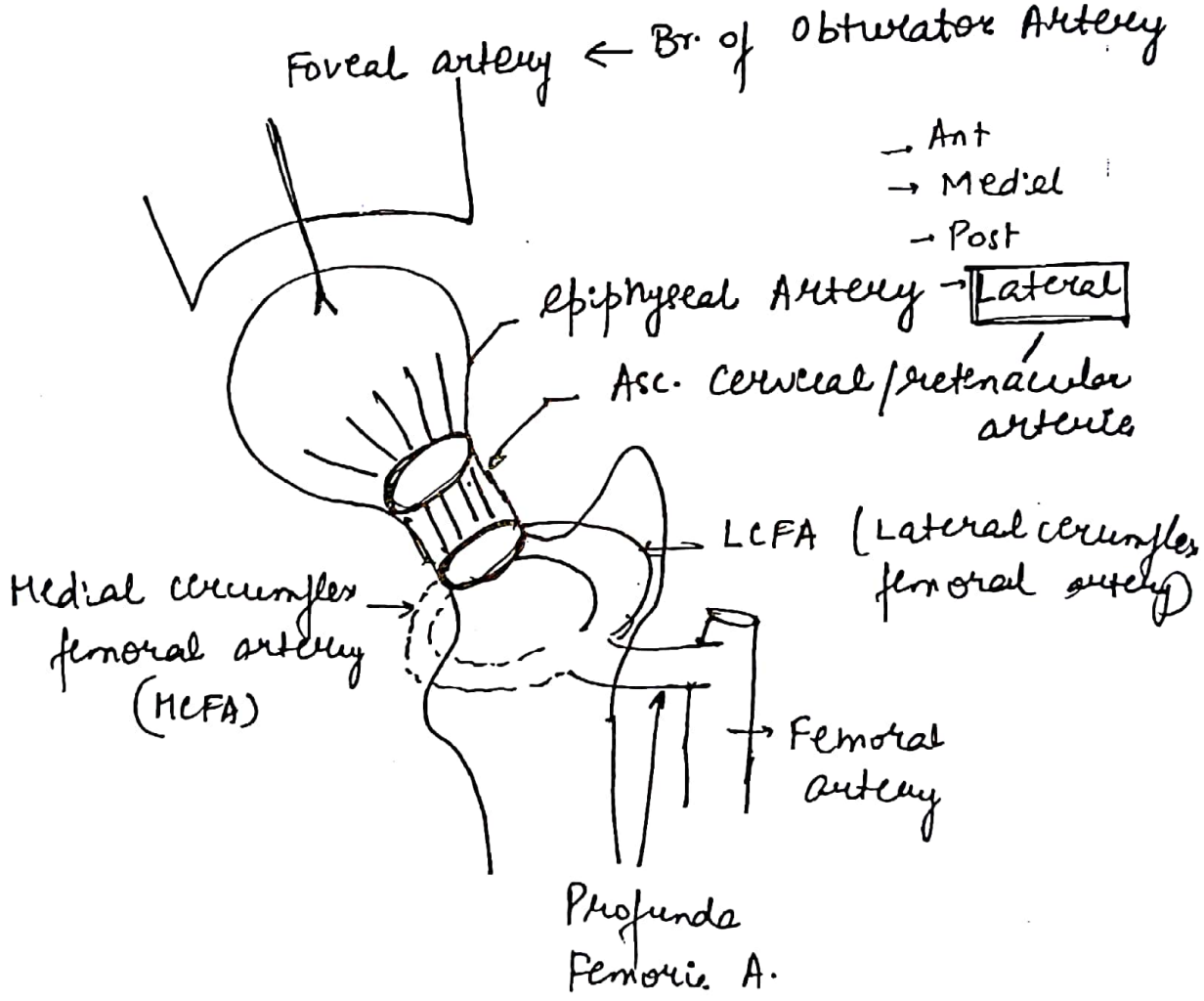
OBER'S T.– Iliotibial band contracture

SIMMOND THOMPSON T– Tendoachilis tear
Tendinctis /tear

HIP JOINT

ANATOMY

BLOOD SUPPLY Retrograde (distal → proxima)



LURCH		LIMP
Painless		Painful
Diseased side ←	Trunk Deviate towards	→ (N) side
Developmental Dysplasia of Hip	eg.	Septic arthritis
Poliomyelitis		Transient Synovitis Hip.
Sup. Gluteal N/v Palsy		
U/L Trendelenberg's/ Abductor/ Lurching gait		U/L Antalgic/ Limping Gait
B/L Duck Waddling Gait		B/L Not applicable

LIST 15 RADIOLOGICAL ANATOMY OF HIP

1) SHENTON'S ARC
Connects Inf. margin of sup. pubic ramus to medial aspect of Head & Neck of femur
Arc is interrupted/ broken in supratrochanteric pathologies.
eg. DDH

2) HILGENREINER'S LINE
Horizontal line connecting the centres of two acetabula

3) PERKIN'S LINE
Vertical line from superior acetabular margin I^r to Hilgenreiner's Line

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

4) PERKIN'S QUADRANTS

Intersection of above two Lines.

(N) Location of Head of femur < Inner / Lower

DDH < upper / outer

5) KLEIN'S LINE

Line along superior surface of Neck of femur
& (N)ly intersects Head of femur But in SCFE (slipped capital femoral epiphysis), it doesn't intersect head of femur

↓

POSITIVE TRETHOWAN'S SIGN

(frog leg Lateral view)

PAEDIATRIC HIP DISORDER

(A) DEVELOPMENTAL DYSPLASIA OF HIP

Def^{n}:- Idiopathic spontaneous subluxation / dislocation of Head of femur from Acetabulum.

Before Birth

Oligohydramnios

Packaging Disorder

IUPD
- Congenital Muscular Torticollis
- Metatarsus adductus
- Congenital knee dislocation

High Relaxin (H)

At Birth

Malpresentation

M/c association
Breech delivery ± extended knees/legs (10 times)

After Birth

Post Natal ☠ Theory

If u carry baby ± hips/knees extended
↓
D.D.H

STATISTICS:

Incidence = 1/1000 live births

Western > Asians

♂ : ♀ = 1:7 (♀ >> ♂)

B/L = 20%

Amongst U/L case - Left > Right

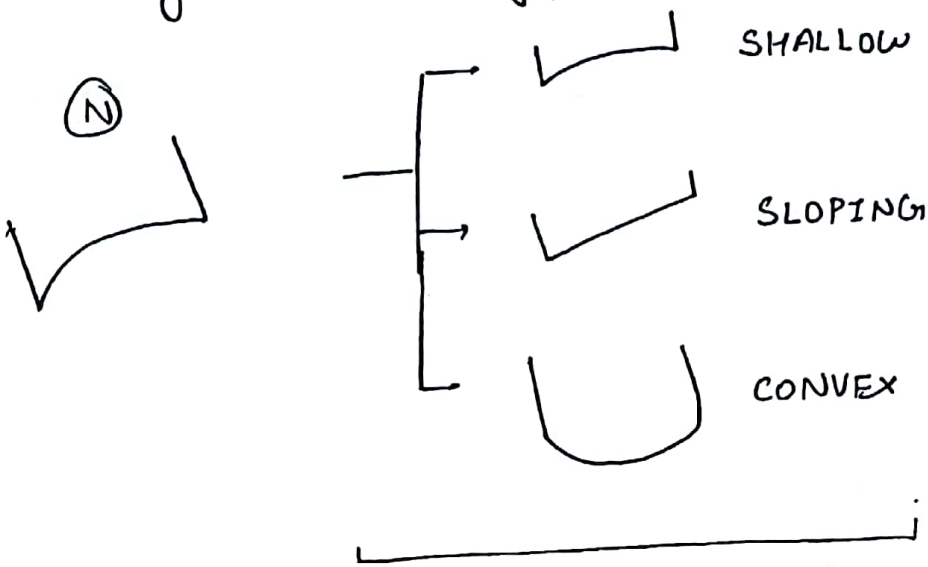
Overall sequence = Left > B/L > Rt

Five 7s
- ♀ child
- 1st born ♀ of family
- Fair complexion (white/western)
- Family History
- Faulty Intrauterine Position

M/c cause - Idiopathic

M/c association - Breech delivery ± extended knees + legs

Pathogenesis :- Dysplastic Acetabulum



upward + Lateral subluxation of / dislocation of Head of femur

↓

SHORTENING

* Hypertrophied, Inverted, infolded, Acetabular Lesion Labrum (fibrocartilage) (Inverted Limbus Sign)

* Hypertrophied fibrofatty tissue (PULVINAR) fills up empty acetabulum

* Hypertrophied ligamentum teres + Transverse Acetabular ligament

* HOURGLASS CONSTRICTION OF CAPSULE

Clinical Presentation :-

Risk factor Identification

↓

Asymmetrical skin crease < Thigh / Gluteal folds

↓

Wide perineum

↓

ORTOLANI's Test : Dislocated Hip } Age < 3months

↓

BARLOW's Test : Dislocatable Hip }

↓

ALLIS SIGN/ GALEAZZI's Test : Shortening

↓

Walking age group > U/L – Trendelenberg/ Abductor/ Lurching Gait

B/L – Duck waddling Gait

Δ :-

X Ray

Broken Shenton Line

Upper outer Perken's Quadrant

USG

IOC for screening of DDH

American Academy of Pediatrics

↓

Routine USG screening for DDH at 4-6 wks in ♀ infants > ⊕ family history, Breech delivery

GRAF's classification

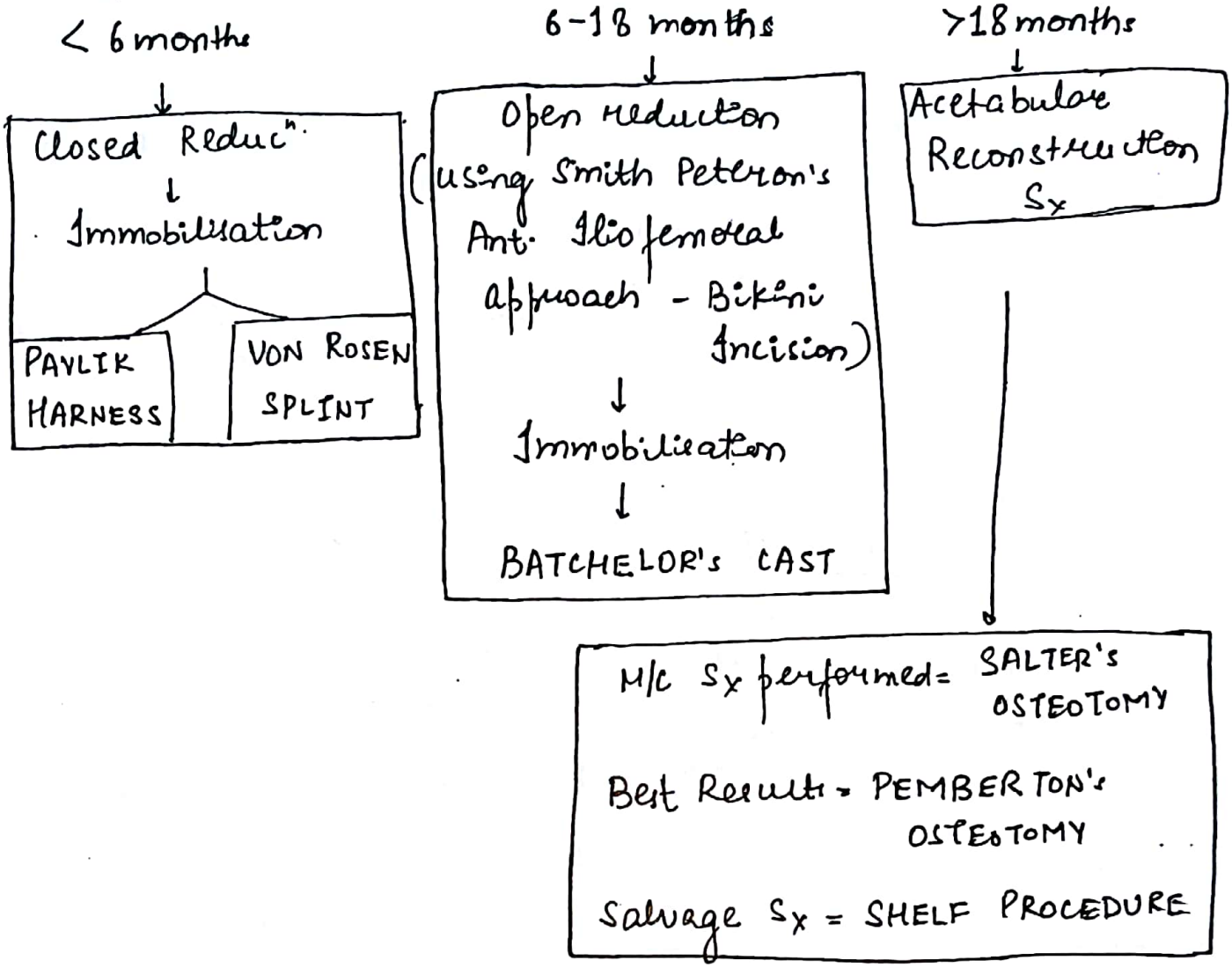
MRI

IOC for Δ of DDH

overall age ≤ >6mnth

Kashiwage classification

Age Wise Mx :-



(B) SLIPPED CAPITAL FEMORAL EPIPHYSIS

→ Minomer

→ Capital femoral epiphysis is well seated inside Acetabulum. It is the anterolateral disruption of Neck & gives apparent Posteromedial epiphyseal slip.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

STATISTICS:-

Incidence = 1/2000

M/c cause = Idiopathic

M/c R/F = Obesity (↑ W/A)

M/c Association = Hypothyroidism

Other Association = Hypogonadism
GH excess
Craniopharyngioma

Age Group = ♂ = 13-17 yrs
♀ = 11-14 yrs

♂ : ♀ = 2:1

B/L = 30-35%

PATHOGENESIS:-

GH TT → Prox. femoral physis (Head) ← Hypogonadism

↓

Hypertrophied + Immature physis

↓

M/c ppt factor → PUBERTY ← GH surge

↓

Anterolateral disruption of PHYSIS

↓

Apparent posteromedial epiphyseal slip

CLINICAL SPECTRUM:- SHORT/ FAT/ Sexually immature
13-17yrs.

c/c- Limping/ Antalgic Gait
OUT-TOEING GAIT

→ Obligatory ER @ Hip during Hip Flexion
[DRENNAN's SIGN].

→ Child sits in W posture

→ Restricted Abduc" & IR

DIAGNOSIS:-

X-RAY	CT	MRI
TRETHOWAN's SIGN	Acute/chronic slip	Ioc for Δ

Mx

- Mild <33% → CR in situ pinning
- Moderate 33-50% → CR in situ pinning
- Severe >50% → OR + in situ pinning
  ↓
  prevents further recurrence

Sx is always done B/L as otherwise length discrepancy occurs.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

(c) PERTHE'S DISEASE / LEGG CALVE
Germany USA France

COXA PLANA / OSTEOCHONDRITIS OF FEMORAL HEAD

Defn :- Idiopathic spontaneous osteonecrosis of Head of femur mainly due to blockade of venous outflow

↓

thick & distended veins

↓

arterial compression

↓

Ischaemia

↓

OSTEONECROSIS

STATISTICS :

Incidence = 1/10,000

♂ : ♀ = 5:1 ♂ >> ♀

Age Group = 4-9 yrs

B/L = 10-12%

H/c association = Protein C & S Deficiency
(factor V Leiden mutation)

Other associations - sickle cell anaemia
Passive smoking
Trauma
Mutation in Type II collagen

PATHOLOGY — WALDENSTROM CLASSIFICATION / STAGING

I) Ischaemia

II) Revascularisation + Repair ⇒ fragmentation of Head

III) Reossification → flat head (Coxa plana)
- Mushroom head (Coxa Magna)
- Small head (Coxa Brevis)

IV) Healed : Residual deficit

CLINICAL SPECTRUM

- 4-9 yr old child
- Ist clinical symptom = Limping / Antalgic Gait
- Pain in Hip → Groin, Knee, Thigh (Referred Pain)
- Limitation of Abduc" + IR @ Hip
- Obligatory **ER** while hip is flexed **CATTERALL SIGN**

DIAGNOSIS

X-RAY :- 1) GAZE SIGN - Ⓥ/Ⓤ shaped translucency in lateral portion of head

2) SAGGING ROPE SIGN - Horizontal Radio-opaque line in upper femoral metaphysis

IOC:- MRI > Bone scan

D/D TB of Hip

→ early acetabular involvement → **TB**

→ Late " . → **PERTHE`s Ds**

Mx of Perthe's Disease

self Limiting Condition.

AVASCULAR PHASE- Non- weight Bearing
Bed Rest (offload Hip)
Abduction Braces for containment of hip.
Skin traction to maintain joint space to relieve pain/ spasm.

REPAIR/HEALED PHASE:. Sx
CATERALL AT RISK SIGNS (X-Ray)
(head at risk)

Gaze sign
Metaphyseal cyst
Lateral calcification
" subluxation of Head
Horizontal Lying physis.

CAFFEY's SIGN:- Loss of sphericity of femoral Head i subchondral # line mainly in weight bearing antero lateral part of femoral head.

LIST - 15 NAMED SURGERIES

1) French Osteotomy (modified): Cubitus varus deformity (malunited supra condylar humerus)

2) Milch Osteotomy - Cubitus Valgus deformity (Non union Lateral Condyle Humerus)

3) Maxpage operation - Volkman's Ischaemic Contracture (moderate)

4) Bankart's operation - Anterior shoulder instability due to Bankart Lesion

5) Putti - Plat operation - Ant. shoulder instability due to Hill Sach's lesion

6) Bristow - Latarjet operation - " >>

7) Steindler's Release - Plantar Fascia Release for Pes Cavus (High Arched foot)

8) Fernandez osteotomy - Malunited ⊛ Colles #.

9) Varus derotation Osteotomy = Perthe's disease

10) Girdle stone Arthroplasty = T.B. hip

11) Core Decompression = Non Traumatic AVN femoral Head

12) McMurrey's Osteotomy = Non union # neck femur

13) Pauwel's Osteotomy = Non-union # neck femur

14) Lambrinudi Arthrodesis - Fixed equinus deformity at foot

15) Grice Green Procedure (Subtalar arthrodesis) (PID)
Congenital vertical Talus.
↳ Rocker bottom foot

16) Keller's operation (Excision arthroplasty) = Hallux valgus

17) Mitchell's / chevron Osteotomy = Hallux valgus **

18) Anterolateral Decompression = TB spine
(M/C surgery)

19) Hong Kong Procedure (Radical Anterior Decompression & Bone grafting)
TB cervical spine

20) Smith Peterson osteotomy = Ankylosing spondylitis

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

INFECTION

(A) OSTEOMYELITIS

Term OM was coined by NELATON.

ETIOLOGY LIST- 16

M/C cause of OM

Overall = S. Aureus

Acute OM / chronic OM / developing nation / developed nation / HIV / AIDS / Diabetic / open # / post-Sx / Immunocompromised disease ⇒ S. Aureus

Sickle cell Disease = Salmonella (Diaphysis)

I.V. Drug Abuser = Pseudomonas

Animal Bite = Pasteurella

Human Bite = Eikenella

Diabetic foot ulcer = Staph aureus

PATHOGENESIS :-

M/C route = Haematogeneous (blood stream)

↓

Skeleton

Axial < Appendicular

↓

Femur > Tibia

Prox < Distal (metaphysis)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

M/c Bone Involved in OM

overall → Metaphysis of distal femur

Infants/children → ,,

Adults → vertebral Body

WALDVOGEL CLASSIFICATION

Based on duration of symptoms

Acute OM	Subacute OM	Chronic OM
<2 wk	2-4 wk	>4 wk

Immunity * < Virulence

ACUTE OM —(M/c complication of Acute OM)→ CHRONIC OM

Path. Hallmark

ABCESS

Staph aureus

pus

Necrotic bone debris

Path. Hallmark

SEQUESTRUM

* dead, Radiodense, Ischaemic, Necrotic, non-viable piece of Bone
* separate ~~bone~~ from underlying viable healthy parent bone
* surrounded by reactive, immature, subperiosteal, new bone INVOLUCRUM
* Two surface [Rough, Smooth]
* Never Bleeds
* ↓ Microscope = No haversian canal
* floats in pus, sinks in H_2O

LIST- 17 TYPES OF SEQUESTRUM

Tubular = Pyogenic OM

Ring = Amputation stump, around insertion site of Steinmann's pin

Conical/ Annular = Amputation stump

Ivory = Syphilis

Feathery = TB(intra cavitatory) > syphilis

Sand = Fine sand viral OM

Coarse sand TB (extra cavitatory)

★ Rice Grain = TB

Black/ Coke = Actenomyces/ fungal OM

Coralliform = Perthes Disease

Kissing = Paradiscal TB. spine

Bombay = H_2S inhalation.

Mx of Acute OM :-

young child

Rural background

RUBOR
DOLOR
CALOR
TUMOR
Functio Laesa

× 48-72 hrs

Knee

(I) Blood Counts

CBC/ ESR/ CRP

TLC↑ N↑ ESR↑

CRP ⊕

(II) Blood culture

⊕ in 50% of pts

Gram staining — Antibiogram.

>48-72 hrs.

S. procalcitonin Level ⇒ >0.4 ng/mL.

↓

Sensitive/Specific marker for OM

(III)
- Pain Relief (NSAIDs)
- Rest
- Immobilisation (splint)
- Cold Packs
- Elevation

Broad spectrum I.V. Antibiotics (empirical therapy)

(IV) X-RAYS

1st/earliest X ray Sign = Soft tissue shadow/ Lucency ∵ in 48 hours.

2nd X-Ray Sign = Periosteal Reac^n (Classical) (new bone formation 7-10 days)

(V) MRI

IOC for Dx of Acute OM

≤24 hrs = marrow oedema

(VI) $Indium_{111}$ labelled Leucocyte scan/ Gallium-67 scan/ $Technetium_{99m}$ HDP Scan

Mx of CHRONIC OM

pt → Clinical Hallmark = SINUS
pt → Pathological " = SEQUESTRUM

Rx = 1) Sinogram
2) Sinus Tract Exploration
3) sequestrectomy
4) Saucerisation
5) Curettage
6) Bone Grafting
Antibiotic laden Bone Cement Bead.

Punctate bleeding spots during curettage intra-operatively
↓
PAPRIKA SIGN
(DNB June, 2017)
good outcome

7) Debridement
8) Sinus Tract Excision
→ To prevent Recurrence
→ to prevent Sq cell carcinoma of Tract (delayed/ rare complication)

→ pre-op / intra-op / post-op Antibiotics. (I/v or oral)

Post-op → drain
Skin Traction
I.V. Antibiotic x6 week
oral Antibiotic x6 week

VARIANTS OF OM

BRODIE's ABCESS

Subacute OM

Tibia

M/c Bone

Microbe gets entrapped in fibrous tissue proliferation

Immunity > Virulence

GARRES SCLEROSING OM

Long standing chronic OM

Mandible > Tibia

Causes periosteal rxn. by an extremely sensitive periosteum in response to low grade anaerobe

(+) ← Pus → (+)(−)

Pain deep dull aching

swelling (+)

(+)(−)

Sinus
Sequestrum

(−)

Curettage +
Bone Grafting +
Antibiotic cover

Mx

Antibiotics +
NSAIDS

ADULTS

CHILDREN

SEPTIC ARTHRITIS

Surgical Emergency

ETIOLOGY:- M/C cause of Septic Arthritis

overall → Staphylococcus Aureus

Sexually Active Age Group = Gonococcus

PATHOGENESIS:-

S. Aureus

M/C Route - Hematogenous

↓

M/C Joint → KNEE > HIP

S: Aureus

↓

proteolytic enzymes (degradative)

collagenase

elastase

Aggreconase

Gelatenase

Matrix Metalloproteinase (MMP)

↓

destroy Articular cartilage

in 2-8hrs

↓

once degenerated never regeneration

↓

pathological fusion of joint

↓

End result:- BONY ANKYLOSIS

Articular

Avascular

Aneural

Alymphatic

devoid of perichondrium

Type II collagen

Clinical Spectrum:-

Child

Rural background

Rubor	Acute onset
Dolor	Severity ↑↑
Calor	critically ill
Tumor	Septicaemia
Functio Laesa	Shock / Rigor

Earliest / 1st symptom = PAIN

Antalgic / Limping Pain

ROM. can't / shouldn't be checked

Attitude of deformity — Flexion / Abduction / ER

FABER

(most comfortable position of Hip Capsular volume is maximum)

Mx:

(I) Blood Counts

CBC / ESR / CRP

TLC ↑↑ N ↑↑ ESR ↑↑ CRP (+)

(II) USG Guided Aspiration (NEXT STEP)

for therapeutic purpose

(not for Acute purpose)

(III) Arthrotomy (Best step)

Surgical irrigation + debridement of joint

- via wide incision + exposure
- Thorough lavage
- post-op I/V Antibiotic + drain + skin Traction

GONOCOCCAL SEPTIC ARTHRITIS

M/C - Knee
Not surgical emergency
Responds to Penicillin / Cephalosporin.

TOM SMITH ARTHRITIS (NEET 2018 - Epiphyseal cartilage)

septic arthritis of infancy
M/C - HIP
spread mainly due to umbilical sepsis
Since head is entirely cartilagenous, it gets completely absorbed. ⇒ poor outcome

TB:- M/C cause of monoarthritis in children ★

LIST-1B BASIC TERMINOLOGY

1) Arthroplasty - Surgical Joint Replacement
2) Arthrodesis - " " fusion.
3) Arthroscopy - Minimally Invasive Surgery
   (B) Diagnostic + therapeutic

4) Arthrotomy - Surgical I & D of Joint via wide excision

5) Arthrocentesis - Surgical aspiration of Joint

SACH FOOT	JAIPUR FOOT
Solid Ankle Cushioned Heel	Base of LL. Prosthesis
Base of LL prosthesis	
40,000 - 50,000 INSD.	40,-50 INSD
Expensive raw material	Cheap material (Hair)
Not Cosmetic	COSMETIC
NO Barefoot walking	Barefoot walking possible
Compulsory shoe wear.	Shoe wear optional
Squatting not possible	Squatting possible
SOLID KEEL ⇕ Metal / Wood	Flexible keel (Rubber)
Plantar/Dorsiflexion not possible	Plantar/Dorsiflexion possible
Inversion/Eversion not possible	Inversion/Eversion possible
Irregular surface walking not possible	Irregular surface walking possible

SAFE FOOT → Solid Ankle Flexible Endoskeletal foot

AMPUTATION PROTOCOLS

1) Longer post flap
Smaller Ant. flap.
So that suture Line lies anterior to midline in coronal plane

2) **MYODESIS**
Should be done in children ← Trauma / Tumour

3) Avoided in I infection / ischaemia

3) **NERVES**
↳ double ligated & gentle traction is applied. & cut in single shot to allow prox. cut end to retract as max. as possible to avoid Post Amputation NEUROMA

4) **A/K Amputation**: Musculotendinous junc" of Quad. Femoris.

5) **B/K Amputation** = Musculotendinous Junc' of Gastrocnemius

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

KNEE JOINT

LIGAMENTS OF KNEE

* MENISCI
  Cushions / shock absorber

MEDIAL MENISCUS

C-shaped
more elliptical
Wider than LM
peripherally attached to MCL
Less mobile
Can't escape twisting injury
More injured

VALGUS Injury (more common)

LATERAL MENISCUS

Semicircular shape
free from L.C.L
(LM) (Popliteus) (LCL)
↓
Intra-articular tendon.
More mobile
can escape twisting Injury
Less injured.

VARUS Injury (Less common)

MODE OF INJURY

Clinical Tests

Apley's Grinding Test
Mc Murray's Test

Mx

CLINICAL TESTS

- IOC: MRI
- Gold Std Ix: Most Reliable Ix: ARTHROSCOPY

Prone - Apley's
Supine - Thompson's
ER + flexion
IR + flex

supine
↓
(L) hand - medial jt.
(R) Grab distal end of leg

Med. collateral lig damage ↓
excessive valgus can be done
↓
undue opening of medial Jt. space
↓
VALGUS STRESS test
(+ve)

Ant. Drawer Test

Supine → knee flexed 90°
hold tibia ↓
fingers on post part
↓
extend (ant. draw)
↓
Pain excessive

Lachman - 30° flexion + ant. drawer test

Pivot shift test

valgus + IR + flex
↓
tibia pops out

R_x = Authroscopic Partial menisectomy

* Menisci move ↑ knee movements.
  They move forward → Knee extension
  They " backward → " flexion.

* Mc ligament to degenerate = Medial Meniscus

* Post Partial Menisectomy
  LM degenerate > MM remnants

* M/c Meniscal Tear:-
  Overall = M.M
  ↑ Acute ACL tear = L.M.
  ↑ Chronic ACL " = M.M

COLLATERALS

Coronal plane stability

M.C.L.		L.C.L
attached to M.M		free from L.M.
More fixed		less fixed
Less mobile		more mobile
Can't escape	Twisting Injury	escapes
More injured		Less injured

VALGUS Injury — **Mech. of Injury** — VARUS Injury

VALGUS STRESS test — **Clinical Tests** — VARUS STRESS Test

Mx

If clinical Test ⊕

Ioc
MRI

Rx

Isolated collateral ligaments are best managed conservatively (Rest/ cold pack/ Elevation/ Knee Brace)

M/c Ligament to injured = M.C.L.

CRUCIATES

Sagittal plane stability

A.C.L.

Intracapsular
Intraarticular
Extrasynovial

P.C.L

Intracapsular
Intraarticular
Extrasynovial

1.5 time broader
better visualised on MRI

ACL prevents excess ant. translation of tibia over femur

PCL prevents excess post-sagging of tibia over femur

Downhill/ Downstair — Uphill/upstair

Mid substance — M/c site of tear — Femoral attachment

Hyperextension injury > MOI > Hyperflexion injury

Clinical Tests

ANT. DRAWER's TEST (Knee 90° flexion) — POST. DRAWER's TEST

LACHMANN's TEST
Best for ACL acute. (Knee 30° flexion)

PIVOT SHIFT TEST
Most Specific Test/ Gold std. test for ACL

Mx

If clinical Test (+)

IOC
MRI

Gold Std. Ix
Most Reliable Ix
Arthroscopy

Rx = ARTHROSCOPIC ACL/ PCL RECONSTRUCTION
(M/c Donor tendon Graft = Semitendinosus + Gracilis

ACL ← middle Genicular artery (Br. of popliteal A)

PCL ← post. articular artery (Br. of Tibial N).

M/c common surgically operated leg (knee) = ACL

M/c cause of Haemarthrosis = ACL

ACL

AIIMS **

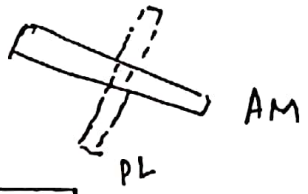
ANTEROMEDIAL

taut in Knee 90° flexion

POSTEROLATERAL

taut in complete knee extension

Knee 90° flexion.



Knee complete extension

Most pain sensitive structure in joint = capsule

Least " " " " = Articular cartilage

Meniscal Cyst :-

appear as swelling along post. joint line & disappear in jt on knee flexion. (PISANI SIGN)

Meniscal Tear — MM > LM.

Meniscal Cyst / Discoid Meniscus — LM > MM

* LOCKING OF KNEE

Medial rotation of femur over tibia

Knee extension

Standing posture

UNLOCKING OF KNEE

Lateral rotation of femur over tibia

Knee flexion

Sitting posture

Popliteus

* Portals in Arthroscopy :-

Superolateral = patellofemoral Jt visualization

Anterolateral = VISION

Anteromedial = Instrumentation.

ACL / PCL Tear = ♀ athlete > ♂ athlete

↓

Narrow intercondylar notch

Hormonal influence

Leg. Laxity ↑

IOC

- Knee leg injury = MRI [Gold Std Ix Asopy]
- Knee Cartilage injury = Arthroscopy

Multiligament knee injury
Injury to atleast 2 out of 4 (except meniscus)

PLICA SYNDROME

Embryonal remnants of synovium

4 types
- MEDIAL
- LATERAL
- SUPRAPATELLAR
- INFRAPATELLAR

C/F :-
→ Ant. Knee Pain
↳ exaggerated on prolonged sitting
→ Locking / catching symptoms

Association - Chondromalacia patellae

Comp^ - Meniscal tear.

IOC - MRI

Gold Std. Ix = A' scopy

Rx = A' scopic plica excision

ONCOLOGY

LIST - 19 MOST COMMON

M/c BONE TUMOUR = Metastasis / 2°

M/c Malignant B.T. = Metastasis / 2°

M/c 1° Malignant B.T. = Multiple Myeloma > osteosarcoma

M/c Benign B.T. - osteochondroma / exostosis

M/c TRUE Benign B.T. = Osteoid osteoma

M/c 1° malignant B.T. =
- ↳ Of 1st decade of life - Ewing's Sarcoma
- ↳ of chest wall = chondrosarcoma

M/c Radiation induced BT = Osteosarcoma

Most Radiosensitant BT = ,,

M/c ~~Benign~~ Bone Tumour of Hand Bone = Enchondroma

M/c Benign B.T. of Hand bones = ,,

M/c 1° malignant BT. of Hand Bone = Chondrosarcoma

M/c malignant Tumour of Hand = SCC

LIST-20

CHONDROBLASTOMA / CODMAN'S TUMOUR

→ Benign Tx case:- (Dost ka nephew)

→ Age < 18yrs.
↳ skeletally immature pts

- centric
- epiphyseal
- expansile — slightly symmetrically

→ Long standing Pain + swelling. (↑ on exertion)

- Mimics Synovitis.

- X-Ray :- well circumscribed
  Regular margins
  Epiphyseal Lesion.
  Stippled calcification.

BIOPSY :- chicken wire calcification.

Mx :- Extended Curettage + Bone Graft/Bone cement

GIANT CELL TUMOUR / OSTEOCLASTOMA

Locally aggresive

5-15% GCTs are malignant

♀ > ♂

M/c Bone = Distal femur epiphysis

U.C.T - ⇒ spine (vertebral Body)

4 E :- Eccentric
Epiphyseal
Expansile → Gross
asymmetrical.
Egg shell crackling

Age Group :- 20-40 yrs (skeletally mature pt.)

X-RAY - (G)eographical destruc"
Soap Bubble appearance

Mx Wide excision ± customised prosthetic
allograft Reconstruc".

MICROSCOPY = GCT ⇒ Giant cell (40-60 nuclei)

GIANT CELL VARIANTS ★★★★★★

(A) neurysmal Bone Cyst (closest)
(B) rown's Tumour
(C) hondroblastoma
(D) esmoblastic fibroma
(E) pulis / Giant Cell Rich Granuloma
(F) ibroma of non-ossifying type (M/c variant)
(G) Giant cell Rich osteosarcoma
(H) istiocytoma

ANEURYSMAL BONE CYST

Locally aggressive B.T

♀ > ♂

M/C site - Metaphysis of Prox. Femur

ABC → spine (post. column)

Age Group - 10-18 yrs

Expansile < Grossly (More pulsatile)
Asymmetrical
Bruit ⊕ on auscultation.

Eccentric

X-RAY multiple blood filled sinusoids
& well defined septate in between

Closest Giant cell variant

Rx Wide excision + Allograft Reconstruction.

OSTEOSARCOMA

Highly highly malignant B.T.

M/C 1° malignant B.T. of non hematopoietic origin.

M/C Radiation induced B.T.

Most Radioresistant Bone Tumour

TYPES	1°	2°
	75%	25%
	2nd Decade	5th/6th decade
	de novo	pre. malignant lesion

M/c - Paget's Ds of Bone (< 1%)
Post Radiation
Chr. OM
p53 mutation
Hereditary survive of Retinoblastoma

M/c Bone : Distal femur (metaphysis)
M/c site of 2° from osteosarcoma - Lung (via blood stream)

Bone to Bone metastasis

X-RAY 2P's → Periosteal Rxn (Sunray / Sun Burst Appearance) along sharpey's fibres
→ Periosteal Elevation (Codman's Δ)

Mx = Neoadjuvent Rx

Pre-op chemo → Radical excision (~10cm) → Megaprosthesis (arthroplasty) → Post-op chemotherapy

↓ size, vascularity, metastatic pot^n

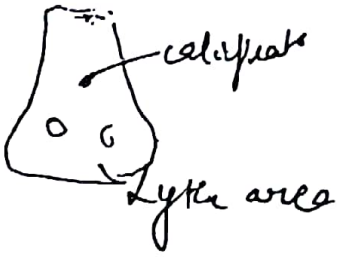
T10 Protocol (Rosenberg Protocol)
High Dose Methotrexate
(cisplatin → substitute)
Bleomycin
Cyclophosphamide / Ifosfamide
Doxorubicin

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Actinomycin
Vincristine

ENCHONDROMA

M/c Benign Bone Tx of Hand Bones
M/c Bone Tx of Hand Bones.
Age Group - (4th - 6th Decade)
♂ > ♀
M/c site :- Hand > Foot
Phalanges > Metacarpal



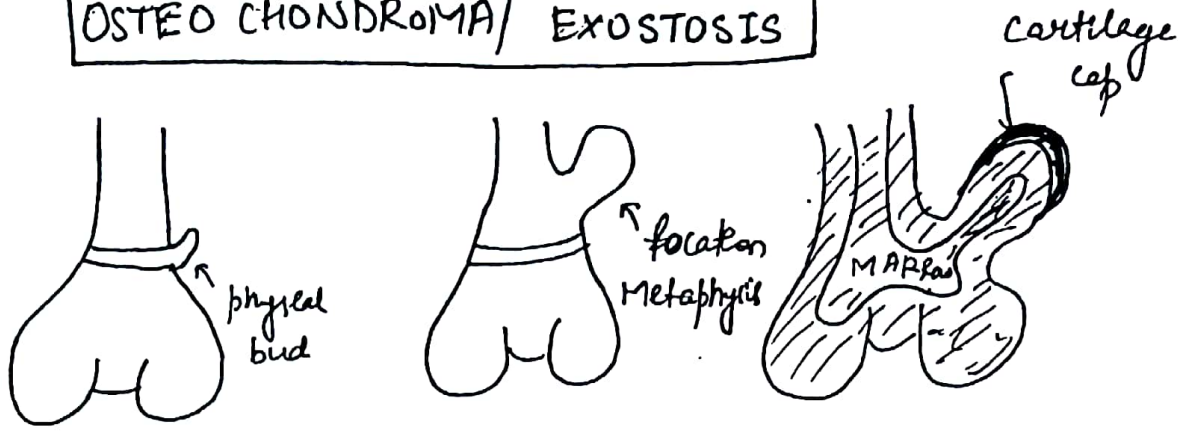
X-RAY well defined lytic lesion with wisps of calcification (Stippled Calcification)

Usually Solitary
Rarely Multiple

OLLIER
multiple enchondromatosis

MAFFUCI
multiple enchondromatosis
+ Phlebolith +
Cavernous Hemangiomas.

OSTEO CHONDROMA/ EXOSTOSIS



M/C Benign B.T.

Not true B.T.

♂ > ♀

M/c site = Metaphysis (Distal Femur)

Age Group = 4-12 yrs

Usually regresses before skeletal maturity

Type

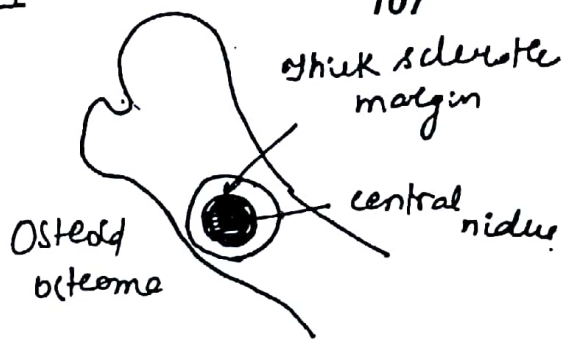
- Sessile ← i.e. out stalk
- Pedunculated → i.e. stalk.

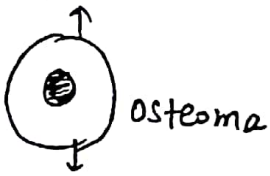
Type

- Solitary → Malignant Potential
- Multiple >
  - MASADA SYNDROME → multiple osteo chondromatosis of forearm
  - HME → Hereditary multiple exostosis

Mx = Surgical excision in toto if symptomatic.

OSTEOID OSTEOMA



OSTEOID OSTEOMA		OSTEOBLASTOMA
M/c True Benign B.T.		Rare B.T. (aggressive than O.O.)
2nd/3rd decade		2nd/3rd decade
♂ > ♀		♂ > ♀
FEMUR	M/c Bone	SPINE (Post. column)
O.O. → spine (post. column)		
Peripheral thick. Reactive Sclerotic Rim 	Structure	Radiolucent Peripheral Rim
Central Radiolucent PG↑↑↑↑ Rich nidus		Central sclerotic PG↑↑ Rich nidus.
OSTEOID		
dia < 2cm		dia > 2cm.
↑↑ ↑↑	Night Pain	↑↑
90%	Aspirin Relief	40-50%
Low Dose Aspirin Radiofrequency Ablation Curettage of nidus	Mx	Marginal excision ± Bone grafting / Bone Cement

EWING'S SARCOMA

5-15 yr ♂

Pain, Swelling] @ Thigh M/c site = Femur (dia)

CBC TLC ↑↑ NT
ESR
CRP ESR ↑ CRP ⊕] Mimics = Osteomyelitis

NSAIDS/ Antibiotics → Temporary Relief

X-Ray - Laminated/ Lamellated Periosteal Reaction (Onion peel appearance)

IOC: MRI

Best = Biopsy

Histopathological
Small round cells ⊕
PAS ⊕
diastase sensitive

Immunohistochemistry
MIC-2 ⊕
CD 99 ⊕
CD 57 ⊕
NSE ⊕
S-100 ⊕

Karyotyping
t(11;22)
Most Asia
t (7;22) ⊕

Bone to Bone Metastasis - Ewing's sarcoma > osteo sarcoma

Most Chemo/Radiosensitive

Mx :- E.C.R.T. (extra Corporeal RadioTherapy) +
- Internal fixation

LIST-20 ONE LINERS (METASTASIS)

1) Bony 2° ♂ → Ca prostate > lung
♀ → Ca Breast > lung
child → Neuroblastoma
overall sequence - Breast > prostate > lung
B PL

2) Bony 2° → Blastic - Prostate + Seminoma
→ Lytic - Ca kidney + Ca thyroid + Ca lung
→ Mixed - Ca Breast

IOC for Occult → Blastic 2° = Bone scan
Lytic 2° = Pet-CT

Pulsatile Bony 2° → Follicular Ca thyroid
→ Renal cell Ca.

M/c Site of 2° from Ca Breast = Thoracic Spine

M/c Cause of path # → Osteoporosis > Bone 2°

M/c Site of path # → overall - Vertebral Body, T_{12}
→ due to Osteoporosis → ,,
→ due to Bone 2° → Neck of femur

MIREL'S SCORE

Calculates Risk of Impending Pathological # in Bony 2°

Parameters	①	②	③
Size of Lesion	$<1/3^{rd}$	$1/3 - 2/3$	$>2/3$
Site of Lesion	UL	LL	around hip
Nature of Lesion	Blastic	Mixed	Lytic
Pain due to Lesion	Mild	Mod.	Severe

Total ≥ 8 ⇒ High Risk of path #

Mx = prophylactic Int. fixation.

TB

POTT'S SPINE

ETIOLOGY - Mycobacterium TB

[Pulmonary TB - $10^7 - 10^9$ bacillary load]

Skeletal TB = 10^5 bacillary load

(Paucibacillary)

PATHOGENESIS

M/c Route - Haematogenous

Site :- Lung > Lymphnode > G.U.T > **Skeleton**

4th M/c site of TB.

M/c site

- U.T.S.
- ↓
- L.T.S.
- ↓
- T.L.J^

M/C SITE

Spine > Hip > knee > Foot > elbow > Hand > shoulder

L/C SITE OF SKELETAL TB

Bursal TB (Amongst Bursa)

↓

M/c Bursitis

[Trochanteric Bursa]

L/C Site of TB in Bone/Joints

Mandible < TMJ.

TYPES OF LESION :-

I) PARADISCAL TB **

M/C Type

Arterial spread

1st part :- V. Body Adjacent to IV. Disc

Kissing Sequestrum.

M/C type / Lesion to complicate into POTT's PARAPLEGIA.

II) CENTRAL

Venous Spread (interosseous venous plexus)

1st part = centre of V. Body

IV. Disc is usually preserved

Later stage :- Whole Body collapses 'CONCERTINA COLLAPSE'

↓

~~1st~~ Flat V. Body (vertebra Plana)

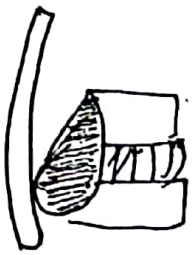
III) ANTERIOR TB

spread ~~subperiosteal~~ subperiosteally beneath A.L.L

Children

Wet / exudative TB

ANEURYSMAL phenomenon (X-Ray)



IV) POSTERIOR / APPENDICEAL TB.

LC type

LC site = Facet Joint

2nd LC site = Spinous Process

CLINICAL SPECTRUM :-

1st / earliest Symptom = Backpain

1st / earliest sign = Paraspenal M/s spasm

↓ R.O.M. @ spine

Cautious Gait

Military Attitude

Constitutional Features of TB (60% of cases)

COLD ABSCESS (tumour +)

No, Rubor / dolor / calor

└ Travel along NV Bundles + muscle sheathe

Deformity :- prominent spinous process due to kyphotic deformity

- Knuckle — 1 v. Body
- Angular Kyphus → 2/3 v. Bodies (Gibbus)
- Rounded Kyphus > 3 v. Bodies

DIAGNOSIS :-

⇒ X-RAY :-

1st X-Ray Sign → ↓ I.V. Disc Space
↓
V. Body destruction / erosions
↓
paravertebral soft tissue shadow
↓
BONY ANKYLOSIS

→ TB of any Bone / Joint ends up in FIBROUS ANKYLOSIS except SPINE (Bony Ankylosis)

→ TB of any Bone never shows periosteal reaction on X-RAY except Tubercular dactylitis / Spina ventosa

⇒ MRI :- IOC for pott's spine

⇒ CT guided Biopsy - Most Reliable / ~~Most~~ Gold Std for Dx

Mx :-

* Chemotherapy (main stay) → A.T.T
* Bed Rest
* TAYLOR'S SPINAL BRACE

Sx

1) Defaulter
2) Relapser
3) Resistance
4) Compression over vital str
5) Late presentation (advanced paraplegia)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Sx

1> HONG KONG OPERATION — Ant. decompression TB cervical spine

2> ANTEROLATERAL DECOMPRESSION ī BONE GRAFTING

→ M/C Sx performed

→ DOTT & ALexander 1947

→ Dr. S.M. Tuli ⇒ Ⓡ Lateral position
Semicircular Incision

Str. to be Removed :-

1) Transverse process
2) part of pedicle
3) v. Body (diseased)
4) post. part of rib
5) I.V. Disc (diseased)

POTT'S PARAPLEGIA

M/C site = U.T.S.

(I)	(II)	(III)	(IV)
Pt unaware of neuro deficit	Pt. aware of neuro deficit ī support ambulatory	Paraplegia in extension	Paraplegia in flexion
O/E: Ankle Clonus	Ⓝ sensory	Sensory Loss < 50%	Sensory loss > 50%
Spasticity	Motor Loss	sensory Loss	Sphincter Loss

PROGNOSTIC MARKERS / FACTORS :-

	GOOD	BAD
Age	young	older
ONSET	Early	Late
DURATION	Shorter	Longer
PROGRESSION	Slow	Rapid
LESION TYPE	Wet / exudative	Dry
SEVERITY	Stage I / II	III / IV
GEN. CONDITION	Good	Poor
KYPHOTIC DEFORMITY	$<60^{\circ}$	$>60^{\circ}$
CORD STATUS IN MRI	(N)	Myelomalacic change

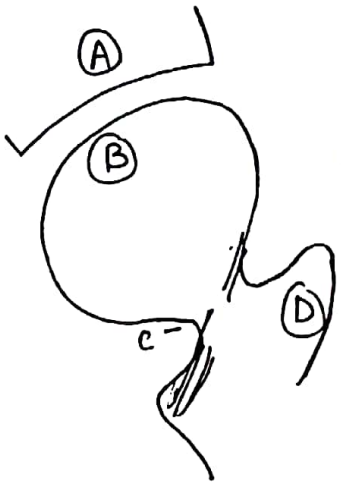
M/C cause of kyphosis in India = TB

TB HIP

Spine TB > Hip TB (15% skeletal TB cases)

Focus of Appearance

- Acetabular roof (M/C) (A)
- Epiphysis of Head (B)
- Metaphysis (area of watershed between (C) femoral & obturator circulation = BABCOCK's Δ
- Greater Trochanter (D)



STAGING OF TB HIP

(I) SYNOVITIS :-

Flexion + Abduction + ER (FABER)

Joint effusion + Capsular distension

X-RAY :- Widened Joint Space

(II) EARLY ARTHRITIS :-

Flexion + Adduction + IR (FADIR)

destruction of Articular Cartilage

True shortening < 1 cm

X-RAY :- Narrowing of Jt. Space

(III) ADVANCED ARTHRITIS / LATE

Flexion + Adduction + IR

further destruction of joint

True shortening >1cm

X-RAY- Complete Destruc° of Jt space/Head/Acetabulum

(IV) LATE ARTHRITIS ~ SUBLAXATION/ DISLOCATION

Flexion + ~~Abduction~~ Adduction + IR

Gross shortening

Upward & Lateral sublaxation/dislocation of Head

False Acetabulum Highere Up

(Wanderling acetabulum / Travelling Acetabulum)

MORTER & PASTLE Appearance

CLINICAL PICTURE:-

5-15 yr

M/c earliest Symptom = Painful Limp

Limping / Antalgic Gait

Muscle wasting

Shortening

Deformities

Constitutional features

Cold Abscess

Late Stage = Fibrous Ankylosis

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

X-RAY:- PHEMISTER 's TRIAD
Juxta articular osteopenia (1st X-Ray Sign)
periarticular erosions
↓ Jt. space

Mx = ACTIVE STAGE → A.T.
→ Skin Traction. , relieves spasm

If pt. doesn't respond to above
WILKINSON 's JOINT CLEARANCE Sx
(Debridement)

HEALED STAGE
Subtrochanteric osteotomy
Girdlestone excisional arthroplasty
Arthrodesis (surgical fusion of a joint) ⇒ M/c ly performed
↳ painless fixed stable Joint

Arthroplasty → painless mobile stable Joint
(THR)

OSTEOARTHRITIS

Misnomer

Degenerative Joint Disorder [D.J.D.]

Non Inflammatory

~~Wear~~ ~~tear~~ wear tear joint Disorder/

R/F:- ♀ > ♂

Age > 65yrs

BMI > 30

Sedentary Life Style

Occupational Hazard

Previous Trauma

Joints:-

Knee

Hip

Spine

1st C.M.C. Jt.

1st M.T.P. Jt

PIP jt

DIP jt

M.C.P. Jt
Wrist
→ Rheumatoid arthritis

OA Knee

M/c Bone = Patella

M/c compartment = Medical

M/c muscle = VMO
Vastus medialis obliquus.

PATHOGENESIS

1st Layer = Articular Cartilage

OUTERBRIDGE STAGING

(I) - Articular Cartilage water content ↑↑ softening of articular cartilage

(II) fissures / cracks / fragmentation

(III) partial detachment

(IV) complete detachment ~ exposed subchondral Bone

CLINICAL

60 + ♀

1st Earliest Symptom - Pain

Tenderness

Swelling

Crepitus

Deformity → Knee = Genu Varum

→ Bouchard's node - PIP Jt

→ Heberden's node - DIP Jt

↓ walking distance

X-RAY :-

1st Earliest X Ray Sign = Asymmetric Reduction in jt space

↓

Osteophytes.

↓

Loose Bodies.

↓

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

↓

Subchondral Sclerosis

↓

Absolute destruc^{n} of jt. space

Mx :-

CONSERVATIVE

1) Walking crutch/stick
   ↳ opposite hand

2) Hinged knee Braces
   ↳ offloading devices.

3) NSAIDS
   Safest → Acetaminophen.

4) COX-2 Inhibitors
   → Etoricoxibs (60/90/120/mg)
   → No GI S/E

5) Topical Liniments

6) Isometric Quadriceps strengthening exercise

7) Precautions

8) Intra-articular viscosupplementation
   ↳ Hyaluronic Acid derivatives
   ↳ Viscosity of synovial fluid

SURGICAL

1) **ARTHROSCOPY**
   Initial phase of disease
   * Remove inflamed tissue
   * Remove loose Body
   * Arthrolysis

2) TOTAL KNEE REPLACEMENT
   Absolute Indication
   ↳ Pain.

*** Glucosamine
Diacerein
Chondroitin sulfate
S-adenosyl methionine
(PLACEBO & EFFECT)
} ⇒ OA

ADVANCED TRAUMA LIFE SUPPORT

POLYTRAUMA
Injury to ≥ 2 systems

TRIAGE

SEQUENCE OF 1° SURVEY (ATLS)

* Cervical Spine Control — Hard cervical collar
Philadelphia collar
log roll position

* Airway → suction
→ Endotracheal Intubation

* Breathing – Rule out :-
Tension Pneumothorax
Hemothorax
Flail chest

* Circulation – Hemodynamic parameters

Pulse ← BP → Urine output

Tachycardia + Hypotension + oliguria

Hypovolemic shock

Stop Bleeding > IV fluid / BT.

* massive catastrophic H'g
  ↳ circulation is a priority even before

* Disability
  GCS < Eye / Verbal / Motor

* Exposure
  to rule out occult Injurie

TRAUMA AROUND HIP. (A) # PELVIS

TILE'S CLASSIFICATION

TYPE (A)	TYPE (B)	TYPE (C)
Horizontally + Vertically stable	Horizontally unstable + Vertically stable	Horizontally + Vertically unstable
(1) # not involving Ring Avulsion # # Iliac crest	B_1 = open Book # pubic symphysis diastasis / disruption	C_1 = U/L
(2) # of Ring (stable) M_X, conservative	B_2 = Lateral compression ~ I/L pubic rami # B_3 = Lateral compression ~ C/L pubic # (Bucket Handle #)	C_2 = B/L C_3 = ~ Acetabular #

M/c presentation / complication (Type C)

↓

Hypovolemic Shock

(Avg Blood Loss = 2 L

pelvic venous plexus

Hypotension + Tachycardia)

Mx of Type C

Immediate pelvic external fixator.

(to ↓ pelvic volume creates pelvic tamponade effect create. pelvic hemostasis.

MOREL - LAVALLEE LESION

→ Post- traumatic closed degloving soft tissue injury in skin + subcutaneous tissue

→ Vessels + Lymphatics perforate + fill the potential space c blood, serosanguinous fluid + necrotic fat

→ Pt presents c enlarging painful mass in anterolateral thigh + close to greater Trochanter

Rx = Aspiration. + Tube Drainage

(B) HIP DISLOCATION

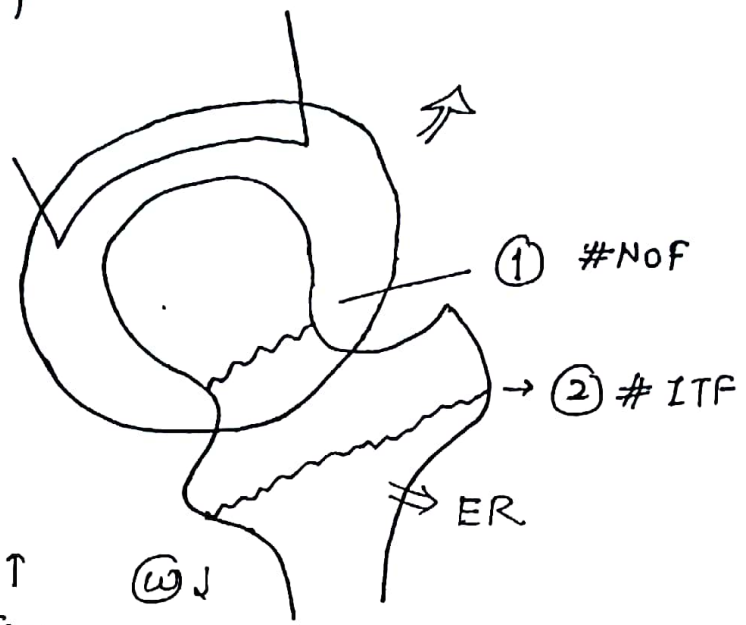
	Post. H.D.	Ant. H.D.	Central # Dislocation of Hip
	90%	7-8%	1-2%
	P.H.D	AHD	CHD
Mech. of Injury	Flexion Adduc IR	Flexion Abduc ER	Flexion / Flexion Abd / Adduc ER / IR
Clinical Attitude	F Ad. IR	F Ab IR	
MC Complication	AVN of Head of Femur		
M/c N/V Injury	Sciatic N/V	Femoral N/V	

Mx Closed Reduction ↓ Gen. Anaesthesia

Method of CR →

1) Stimsons Gravity Method
2) Kast Baltimore left
3) Modified Allis method (of choice)

ⓒ # of PROXIMAL FEMUR

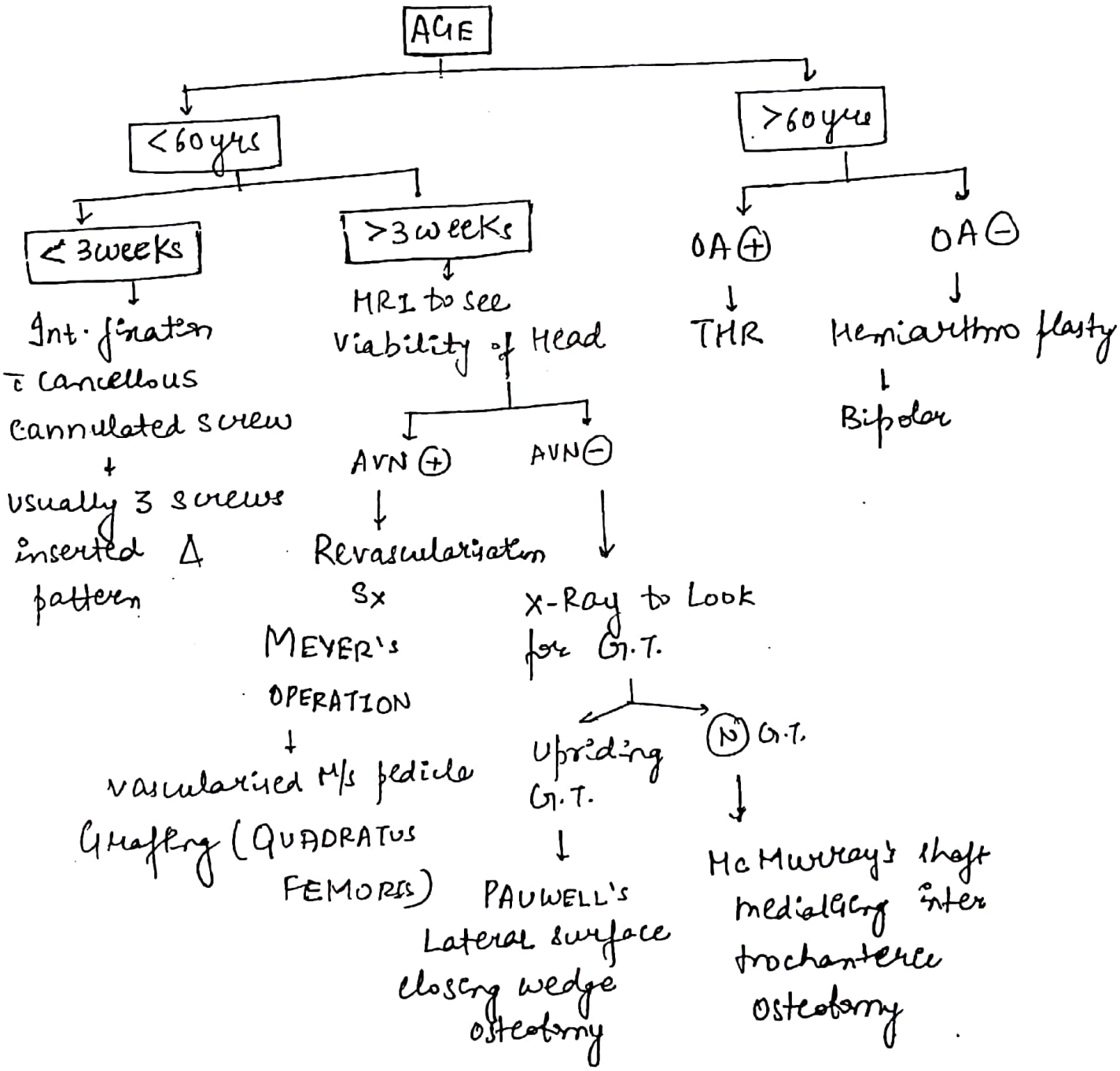


NOF		ITF
Intracapsular		Extra capsular
5th/6th decade		7th/8th decade
Trivial Trauma (low energy fall)		Mod-severe Trauma
Mod-severe Pain in Scarpa's Δ		severe pain, swelling, ecchymosis around G.T.
<1 inch	Shortening	>1 inch
0-45°	E.R. Deformity	45-90°
AVN of Head ↓ Non-union.	M/c Complication	Malunion
ANATOMICAL PAUWEL's GARDEN's	Classification	EVANS BOYD & GRIFFTHS

Mx Internal fixation =
DHS / DCS / PFN

- Dynamic Hip screw
- Dynamic condylar screw
- Proximal femoral Nail.

AO PROTOCOL FOR Mx of # NOF (Speed ↓ Unsolved #)



Shaft of Femur

Young adults

20 - 30yrs

♂ > ♀

associated :- Severe Trauma

Classification

- Prox 1/3rd
- Middle 1/3rd (M/c)
- Distal 1/3rd (supracondylar # femur)

COMPLICATIONS:-

1) Hypovolemic shock
   Avg Blood Loss = 1-1.5 L or 2-4 units.
2) fat embolism syndrome
3) Infection
4) knee stiffness
5) malunion
6) delayed/ Non-union.

Mx

Age Wise

< 6 months	6 mth - 5yrs	5-10yrs	> 10yrs
PAULIK HARNESS	HIP SPICA CAST / GALLOW's / BRYANT's TRACTION	TEN Titanium Elastic Nailing	Intramedullary Interlocking Nailing

FAT EMBOLISM SYNDROME

Young ♂ (20s - 30s)

SOF - >48-72 hrs

BERGMANN'S TRIAD

3C

- **CEREBRAL**
  - Delirium
  - Confusion
  - Convulsions
  - disorientation
  - Stupor
  - Coma
- **CUTANEOUS**
  - petechial
  - Rashes on chest
- **CARDIO PULMONARY**
  - Dyspnoea
  - Tachypnoea
  - Tachycardia
  - cyanosis
  - Hypoxia
  - Hypoxemia

Mx :
1) O_2
2) I.V. fluids
3) Forced alkaline diuresis
4) I.V. steroids to counter chemical pneumonitis
5) Pulmonary embolectomy
6) Heparin (Double edged sword)
   - ↓ Lipase
   - used for limited pts
   - 10μ
   - 2×5μ

WADDELL'S TRIAD

Femur # + Head Injury + Intrathoracic/ Intra-abdominal Injury

Sequence of Cond" presenting ⊂ shortening :· AIIMs May 2015

P.H.D. > #SOF > Subtrochanteric # > #IIT·F > #NOF

LIST-21 ANGLES IN ORTHO

Cobb's ∠ :- Scoliosis

K ∠ - Dickson's / kyphosis ∠ = Pott's Spine

Q ∠ - Quadriceps ∠ = Recurrent patellar Dislocation

Pauwel's ∠ - } NOF #
Garden's ∠ -

Baumann's ∠ → Supracondylar # Humerus

Bohler's ∠ } # calcaneum
Lissane's ∠

Meary's ∠ → pes cavus

Kite's ∠ CTEV / clubfoot

LIST - 22 X-RAY VIEWS

Judet view- # Acetabulum

Zanca view- AC Joint

Stryker Notch view- Hillsachs Lesion

West point Axillary view- Bankart's Lesion

oblique / PA view with in Ulnar deviation
- Scaphoid

Von Rosen view = DDH

Merchant's View = Patellar Subluxation

Mortise view = Ankle AP view in 15° Internal Rotation
↓
Syndesmotic Injury
↓
(Inf. Tibiofibular Jt)

Canale view- # of Talar Neck

Harris · Broden view - # Calcaneum

Serendipity view - Sterno clavicular Jt

Baw Catcher's view - Erosions of in RA

Swimmer's view - Lower cervical spine

LIST-23 SPLINTS IN ORTHO

Cock up splint → Radial N/V Palsy

Knuckle Bender splint- Ulnar N/V Palsy

Aeroplane splint- Brachial Plexus Palsy

Turn Buckle splint- V.I.C. (Mild) Volkmann's Ischaemic contracture

Coaptation splint – # shaft of ~~femur~~ Humerus

Pavlek Harness } DDH
Von Rosen splint }

Ankle Foot orthoses- Foot Drop

Taylor's Brace- Thoracic Spine

Trauma ← | → Tumour.
TB

LIST-24 CASTS IN ORTHO

Hand Shake Colle's #

Glass Holding # scaphoid

Cylinder / Tube # Patella

PTB (patellar Tendon Bearing) # shaft of Tibia

Minerva Cx Spine Injury

Risser's Scoliosis

U/ Hanging cast- # Shaft of Humerus

Turn Buckle cast → Scoliosis

LIST- 25

TRACTIONS

Dunlop - Supracondylar #Humerus

Smith's "

Crutch Field Tongs, Garden well } → Cx spine injury

Gallow's, Bryant's } → #SOF in age < 2yrs

Perkin's - #SOF in adults

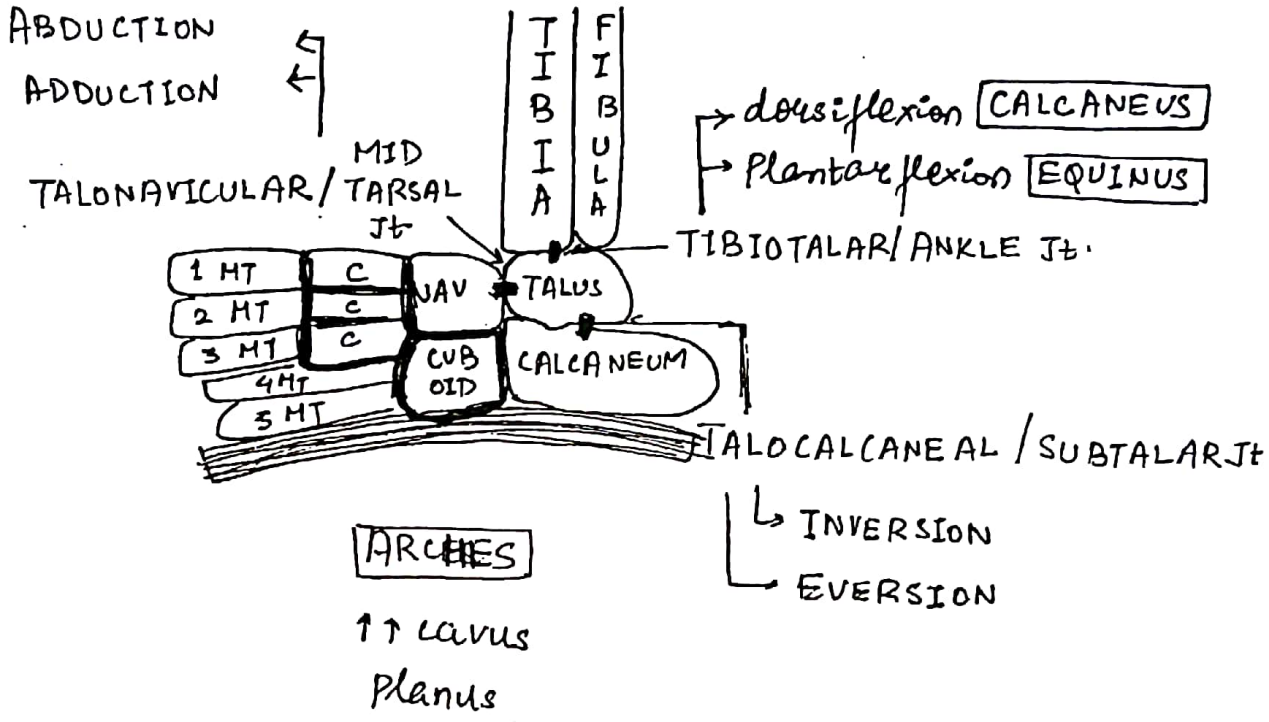
Buck's - Modified skin Traction ✱ for LBP

Agnes, Hunt - Flexion deformity of hip.

ANATOMY

ADD^{N} + INV^{N} ⟶ VARUS

ABD^{N} + EV^{N} ⟶ VALGUS



ARCHES

↑↑ cavus

Planus

C.T.E.V. / CLUB FOOT

Def^n:- Congenital malformation of Ankle, Leg & foot complex characterised by

varus < Cavus (↑arches of foot)
Adduc^n (@ Talonavicular Jt)
Inversion (Talocalcaneal Jt)
Equinus (Tibiotalar Jt)

Statistics:-

Incidence - 1/1000

♂:♀ = 2:1

M/C cause = Idiopathic

M/C association = Neural Tube Defect (Spina Bifida occulta S$_1$)

B/L - 50%

Asian: = Western.

(PITX-1).(TBX-4) gene pathway

PATHOGENESIS

Theories

Developmental arrest Theory
Myofibroblastic theory
1° germplasm defect theory

Bony Pathology — TALUS — small + hypoplastic

↓

Talonavicular Jt - Subluxation / dislocation

↓

overcontracture

↓

Tendo achilis → Plantare flexion → EQUINUS

Tibialis Posterior → Addn + Inversion → VARUS

CLINICAL SPECTRUM → Dorsiflexion Test (+)

Inability to approximate the dorsum of foot to anteromedial border of leg

X-RAY - KITE'S ANGLE / Talocalcaneal Angle

(N) 30-55°

Δ stk - <25°

Mx (I) At Birth – Infancy (0–1yr)

PONSETTI TECHNIQUE

Dr. IGNACIO PONSETI → Date of Birth
3rd June
Club foot day

MANIPULATION & CASTING

By Doctor
Not by mother
Reversal of deformity
Started as soon as possible after birth

By Doctor
1st Cast
L Lanugo / umbilical stump shedi off
5–7 Casts
Serial weekly Basis

FULCRUM – Head of Talus

AIM – Talonavicular Jt. Reduction

SEQUENCE:-
CAVUS → VARUS → EQUINUS

PONSETI's TECHNIQUE

(+) Immobilisation
- DAY
  - CTEV shoes
  - No heel → Equinus
  - Straight Inner Border → Addu
  - Outer shoe Raise → Inversion
- NIGHT
  - Denni Brown Abduc" Splint

(-) (II) Age 1–5yrs
PMSTR
Posteromedial Soft tissue Release
TURCO's operation
McKay's Release

(+)

(-)

(−)

↓

(III) Age > 3years

Bony Surgeries

Lateral column shortening Procedures

Dwyer's Osteotomy

Dillwyn Evans Sx

Lichtblau's Sx

(+) ← → (−)

(IV) Age > 10yrs

TRIPLE ARTHRODESIS

Surgical fusion of three joints.

Talonavicular Jt

Talocalcaneal Jt.

~~Talo~~ Calcaneocuboid Jt

M/C Comp^{n} :- Talonavicular Jt pseudoarthrosis

LIST - 26 # 's INJURIES & EPONYMS

1) ODONOGHUE'S UNHAPPY TRIAD

Injury to ← A.C.L
MCL
MM

2) JUMPER's #

(H) shaped sacral # due to fall from height

3) JUMPER's KNEE

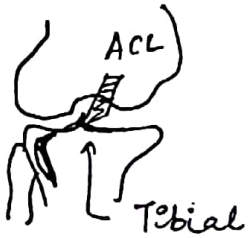
Tendinitis of patellar Lig (Lig Patellae)

4) SINDING LARSEN JOHANSSON SYNDROME

Partial rupture/avulsion of patellar Tendon from lower pole of patella — Traction Tendinitis in lig. patellae

5) BUMPER's #

Lateral condyle of Tibia



6) SEGOND's #

Tibial condyle extending into Tibial spine → ACL tear

7) TODDLER's # / CAST # ★

Children
fall from height
Spiral #
Tebia

8) AVIATOR's #

Neck of Talus

TALUS

1) Retrograde blood flow
2) Max. wt bearing bone of Body (Kg/cm^2)
3) NO m/s attachments
4) SQUATTING FACETS ★

NECK of Talus

AVN appears in 4-6 wk → disappears

M/C Comp^n - Subtalar arthritis

Body of Talus

HAWKIN's SIGN

Good X-Ray sign = Revascularisation

9) LOVER's # / DONJUAN's #

Intra articular # of calcaneum due to fall from height

Usually B/L

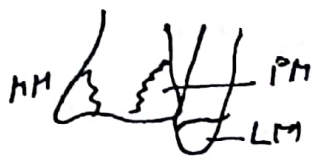
M/c complication = Malunion

X-RAY → Bohler's ∠ Ⓝ · 20-40° ↓

Crucial angle of Gissane Ⓝ 100 - 145° ↑

10) POTT's #

Medial & Lateral malleolus #



11) COTTON's #

Medial Malleolus + LM + PM

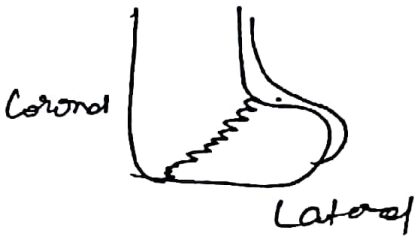
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

12) PILON's #

Intraarticular # of distal tibial plafond (distal tibial articular surface) ± metaphyseal comminution

13) HOFFA's

Coronal plane # of one or (B) femoral condyles



14) NUTCRACKER's #

Intraarticular # of cuboid

15) LISFRANC's # DISLOCATION (T.M.T.)

Tarsometatarsal Jt. # Dislocation

16) CHOPART's # DISLOCATION (I.T.)

IntraTarsal Jt. # dislocation.

17) RUNNER's #

Spiral # of distal Fibula (hairline)

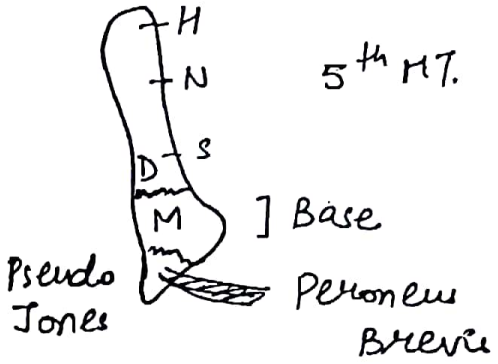
18) JONES #

# of 5th Metatarsal @ metaphyseodiaphyseal Jn.

JMD - Jone Mete

19) PSEUDO JONES #/ DANCER'S #/ TENNIS #

# of 5th Metatarsal @ tuberosity / tip of due to violent pull of Peroneus Brevis



TENNIS ELBOW

Lateral Epicondylitis

M/C ⇒ E.C.R.B.

Extensor Carpi Radialis Brevis

GOLFER'S ELBOW = Medial Epicondylitis.

In Golfer Tennis Elbow > Golfers Elbow

TENNIS LEG → Rupture of medial Head of Gastrocnemius

20) STRADDLE #

B/L Sup- & Inf ~~pubi~~ pubic rami #

21) DUVERNEY'S #

Crescent Shaped Iliac Wing #

22) MARCH # Shaft

Stress # of 2nd Metatarsal

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

PSYCHIATRY

Handwritten Note

MBBS Help

http://mbbshelp.com

http://www.youtube.com/mbbshelp

http://www.facebook.com/mbbshelp.com

Name: _____

Subject: **Psychiatry**

Blank

Psychiatry - Termed by Johann Riel
↳ [Treating the soul]

Modern Psychiatry - Father is Philippe Pinel

History → Diagnosis → [criteria]
↓ ↓
[Most important] Course of disease
↓
Prognosis
↓
Treatment plan.

Investigations
↓
not required

Symptom + Duration
↓
Dysfunction

Anhedonia → Loss of intrest in previously enjoyable activities/life.
(Sadness)

Most commenest criteria of Schizophrenia - Psychomotor Retardation

Dysthymia ≥ 2 years

Dysfunction → impaired or abnormal functioning

Conflict alone or Social deviance is not a diagnosis of a mental disorder.

H/o marriage → Good Prognosis

Mental Status Examination

- Appearance behaviour
- Motor Activity
- Speech
- Mood/Attention
- Thought
- Perception/- Cognition (Thinking process
  [Abstract reasoning
  ↓
  Judgment
  ↓
  Insight]

Not exclusive.
2 or more elements may co exist together

Insight ⇒ awareness of illness

4 levels
- Level I – Patient does n't agree about illness
- Level II – (+/–)
- Level III – Medical illness (agree)
- Level IV – Intellectual insight
- Level V – Emotional insight → fully agrees & executes treatment

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Thought - an idea or opinion produced by thinking, or occuring suddenly, in mind [concentration, attention, care or regard]

Perception ⇒ becoming aware of the environment by the sensation comming from sensory organs.

Thought - Normal thinking [By KURT SCHNEIDER]

Include Clarity ✗
- Constancy ✓
- Continuity ✓
- Organisation ✓

Thought is divided into :-

① Form — A → (associated) → → (direction) → B (goal)

② Content

③ Possession ⇒ own possession/control

④ Stream → Tempo → Flow
→ Continuity →

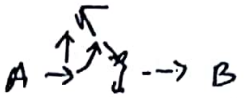
Form (association, direction ⇒ Thus logical sequence)

↳ Formal Thought Disorder. (FTD) (In Schizophrenia)

⇓

Individual process are not connected by meaning such that overall speech output is not understandable.

DISORGANISED SPEECH



loss of association → Incoherence, Incohorrent talking.

Derailment → A ⇢ B [direction is lost]

Tangentiality → ○→ [Touching the answer but not what was required]

Neologism → creating ones own language.

Verbigeration → Senseless Repeation of words or phrase

[Neologism is one of the specific sign of Schizophrenia & Psychosis]

(2) Content

[Delusion is disorder of thought & content]

Delusion →
- False belief
- Firm / fixed
- out keeping educational + Cultural background
- Morbid origin - (Illogical)

↓

Morbid Jealosy → Othelo Syndrome
- ↓ Alcohol
- ↓ Impotence
- → D- Infedility

Types

Delusion of Reference → Important person is me.

People are planning conspiracy against me → Persecution

] Part of Schizophrenia

Supremacy → Grandiosity] Part of Mania

Guilt + Sin

Denial of existence → Nihilism] Part of Depression

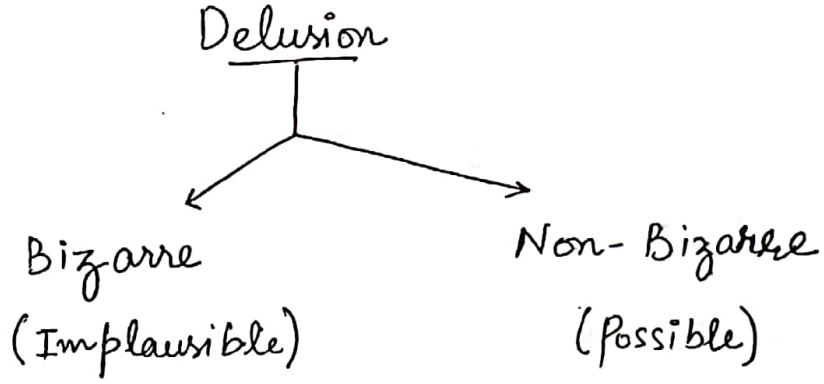
↓

Denial of existance

[COTARD SYNDROME]

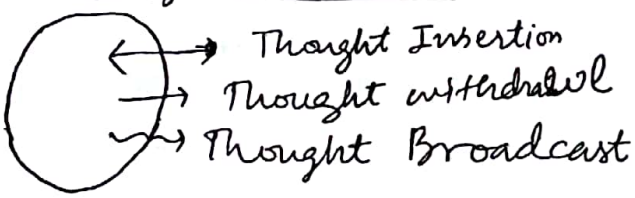
[ENORMITY] → Small actions causing a big catastroply.

↳ Not included in Nihilism.



e.g Person thinks that his thoughts are taken away by his neighbours by a device

Thought alienation



Delusional Mis identification Syndrome

Capgras → Family persons → unknown

Fregolli → Strangers → familiar (delusion of double)

Inter meta morphosis → Thought of Swaping the identity to damage the patient

Mirror self misidentification → Mirror self disidentification

Reduplicational Paramnesia → [Living at home but denies that fact]

(3) Possession of Thought disorder ⇒
- → Insertion
- → Withdrawal
- → Broadcast

OCD

Obsession

Mc - dirt & contamination

Pathological doubt

⇓

Thought disorder

Compulsion disorder

Mc → Checking

washing, touching, counting

⇓

Behaviour disorder

Least common is

Intrussive thought

Aggressive Sexual

OBSESSION

Own thoughts, Irrational,

ego dystonic (egoalien) (unwelcome)

↓

ego syntonic (welcome)

- Repeat,
- Patient resists the thoughts
- Distress - ≥ 1 hour - 2 weeks
- Not enjoyable

If Thoughts are syntonic → patient does not come for Treatment
↓
Personality disorder

Magical thinking

Actions & words assume power.
⇓
[Schizotypal personality disorder.]

Ambitendency

Not being able to complete an action
→ 2 step forward
2 steps ← backward.

Ambivalency → Thought process for ambitendency.

OCD can cause - Anxiety
- Depression (2/3rd)

℞ for **obsession** → Medication
- SSRI (Fluoxitine) (Fluvoxamine)
- TCA (Clomipramine)

compulsion → Behavioural Therapy.
- ERP

Fluoxitine → t½ 3-4 days
↓
Less serotinin withdrawal is seen.

No results
↓
Resperidone (Augmentation)
↓
ECT
↓
Psycho Surgery (Last Rx)
(Anterior [Cingulotomy or Capsulotomy.

ERP → Exposure + Response Prevention

D/O (disorder of)

STREAM OF Thoughts

① Tempo → Flight of ideas → Mania
↑ Prolixity → Hypomania
↓ Retardation/Inhibition → depression

Circumstantiality (over inclusion of unnecessary details & answer is reached)

② Continuity → Thought block.
Preservation

~~Thought block~~
~~Perseveration~~

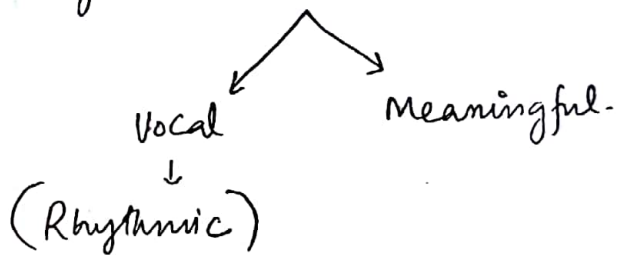
Thought block A ⟶ ⊗ B

Perseveration → Ist answer is relevant
& the same answer is repeated
for different other questions. (Irrelevent).

[Persistance of mental process beyond the point of relevance.]

Tempo/Flow

↑↑ , Rapidly , Changing association



Prolixity

Speaking Rapidly (N) associations

Circumstantiality

Person will make you reach the goal but by over inclusion of unnecessary details.

Perception disorders

Illusion

False
↳ Independent of will

Misinterpretation of a stimuli

Hallucination

Perception
↳ out presence of object or stimuli.

Types of Hallucination

(MC) Auditory
- (MC) Functional

Visual
- ↓ organic

Tactile
- ↓ Cocaine bugs
  - ↓ Cocaine also causes delusion of persecution

Olfactory, Gustatory
- ↓ Temporal lobe epilepsy

Pseudo hallucination

Insight is Present

Unreal

Subjective

[Thought will have a will but Pseudo hallucination has no will]

True hallucination

Insight is absent

Real
Objective
] [Patient terms]

Phantom limb is an example of True organic Hallucination

Special Hallucination types

① Reflex

Different modality
↓
Synaesthesia

LSD (colours → speak)
↑ Stimulus ↓ False Perception

⇒ [Stimulus & false perception are of different modalities.]

e.g one person says the the colours are speaking very well, auditory stimuli perceived as itching.

Functional

Same modality
↓
⇒ [Stimulus & false perception belong to the same modality]
(e.g both are auditory)

② Extra campine Hallucinations
Boutside the units of sensory field.

Extra Campine :→ Beyond sensory organ limitation

Autoscopy :→

Internal Autoscopy

e.g. Person perceives images of the food degluted & which is traveling through ailimentary Canal.

Negative Autoscopy

⇓

Unable to see yourself in mirror.

(visual hallucination of image of one's body)

Types of auditory hallucination

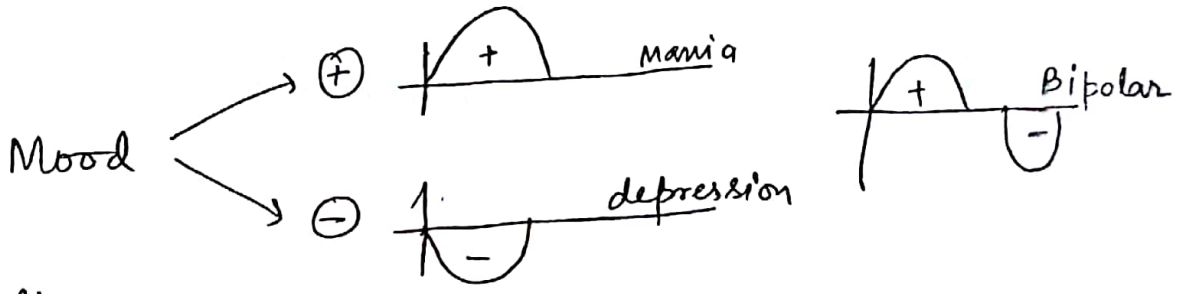
1st person Hallucination → Own thoughts as voices from outside ⇓ Thought ECHO / Audible thoughts

2nd person H. → Person speaking in ~~ear~~ ears ⇓ Command Hallucination

3rd person. H. → ≥ 2 persons speaking in ears → Running Commentatory

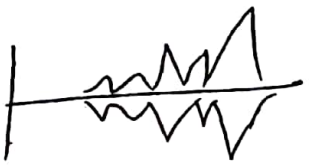
Mood	Affect
⇒ Pervassive, Persistant state of mind	⇒ Emotional Response to a stimuli
⇒ Inner, subjective	⇒ outer, objective

Adjustment disorder
↳ Stress due to out come. [Students suiciding after bad results]



Emotion

AFFECTIVE REACTIVITY — Emotional reaction to a stimulus



Labile effect — Rapid urge of emotions

Affective flattening — Schizophrenia

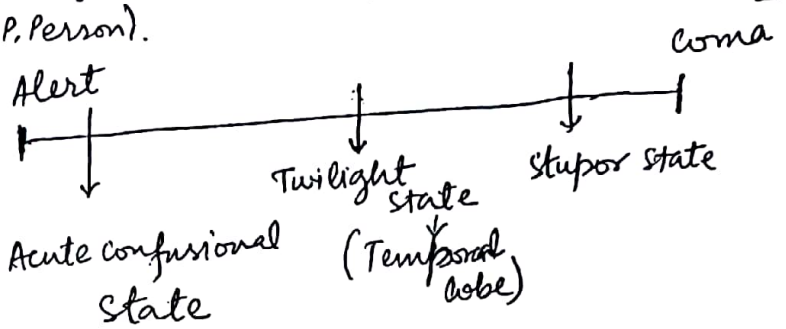
Alexithyomia — Inability to express emotions

BEHAVIOUR

Cognition [Higher mental function & abilities]

① Orientation (T. P. Person).

1) Alertness



② A/c ⇒ 100 - 7 = 93

(Attention/concentration)

Attention maintained for period of time

⇓

Concentration

③ Memory

Immediate	Recent	Remote
For Seconds	For minutes	Months – years
↓	↓	↓
Delirium	Amnestic syndrome	Dementia
[Registration & Recall]	Korsakoff Psychosis	↓
	Question about recent meals	Has both Recent & old memory components e.g School Teachers.
	Remote memory is also affected	

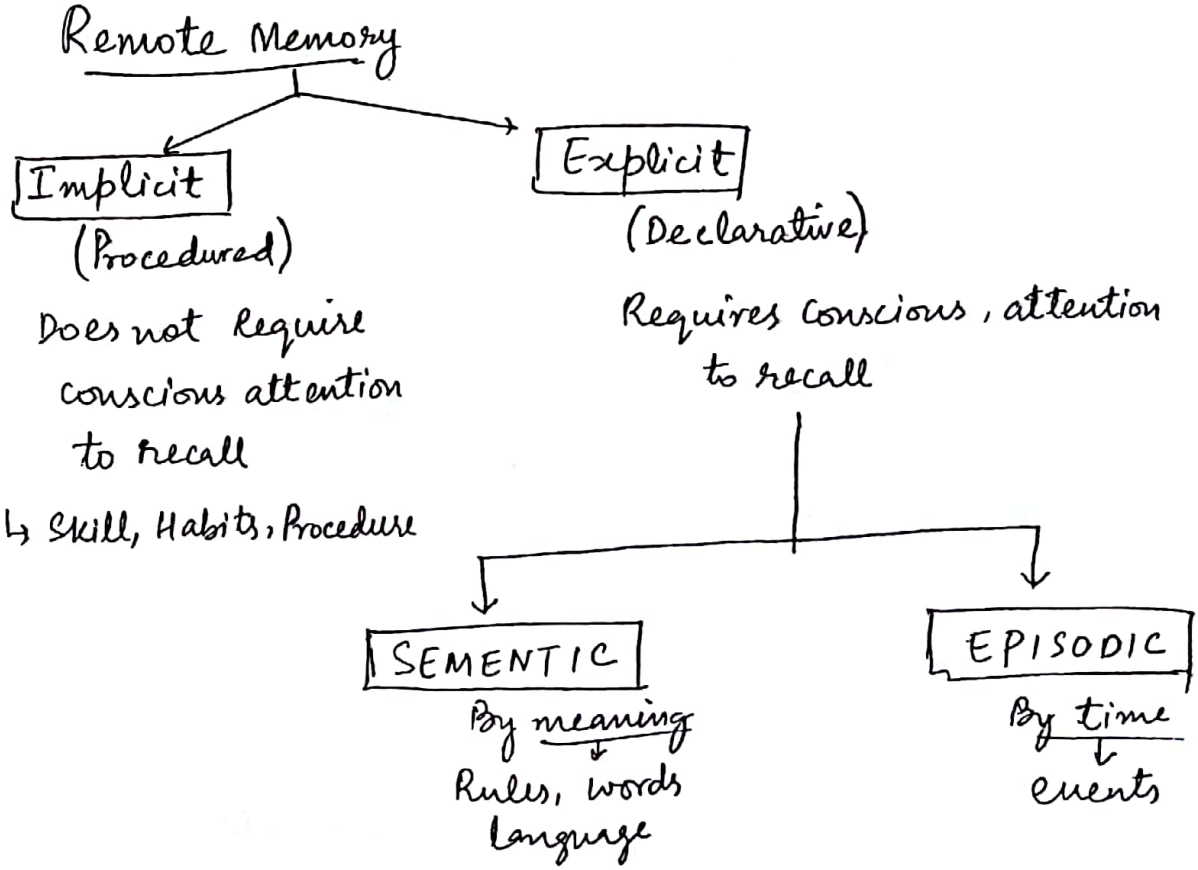
Abstract

Asking patient
⇒ Indepth meaning (Proverbs)
⇒ Moral of the story
⇒ Similarity ⊕
e.g Table/chair
Cow/buffalow

Concrete

Literal meaning.

In dementia and Schizophrenia patient goes from Abstract to Concrete thinking.



Behaviour disorders

Psychosis

Dellusion

Hallucination

Disoranised behaviour

Insight is absent

Neurosis

Anxiety

OCD

Phobia - Irrational fear

Insight is present

Organic disorder

Etiology is present

visual hallucination

Functional disorder

Etiology not clear.

↳ Purely on diagnostic criteria

Auditory hallucination

Onset

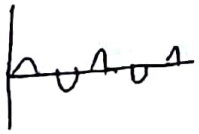
Sudden or abrupt (< 48 hours)

Psychotic disorders may be

Continuous

Dementia (Schizophrenia)

Episodic



Maniac depressive disorder (Bipolar disorder

Schizophrenia

Term = Demence Precoce — BENEDICT MOREL

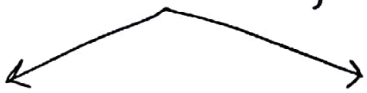
↓

[detoriation of Personality in adolesence]

Emil Krapelin → Psychotic patients

↓

Course of illness.



Continuous — Episodic

Dementia Precox — MDP (Maniac Depressive Psychosis)

[Remission & Exacerbation type of course in Schizophrenia].

Age of onset

13 years - very early onset

18 years - Early onset

10-25 years - Male > Females

25-35 - Females > Males

>45 years - Late onset

Schizophrenia - females good prognosis

Dementia onset ⇒ 65 years.

Eugen Blauler → Termed Schizophrenia

↓

Primary Symptoms of schizophrenia.

4 As

- Ambivalence
- Loss of Association
- Affective disturbance
- Autistic behaviour

Ambivalence ⇒ It is inability to decide in favour or against. (A or B)

Affective disturbance

Inappropriate Affect

Thought ⟶✗ Effect [NO correspondence]

Behaviour ⟶✗ emotions

e.g. Crying on a ~~good~~ good moment

or Laughing on Sad moment.

Autistic behaviour

Autism
↓
Leo Kanner 1943

[< 3 years age]

Communication (language)

Social Interation (eye-eye contact)

Sterotyp , mannerism , Repeatitive

Kurt schneider → SFRS

[Schneider's First Rank Symptoms]

Total 11 symptoms

① Thought insertion
② Thought withdrawl
③ Thought Broadcast
→ THOUGHT Alienatation

⇒ Auditory hallucination
↓
④ Thought echo/audible thought
⑤ Running Commentary (3rd person hall.)
⑥ Arguing/discussing

(7) - Somatic Passivity
↓
Body activity controlled by someone (who is active)

(8) - Delusional Perception
↓
illogical meaning to normal Perception
e.g hearing of march past of army – pt thinks they are comming to kill him.

(9) - Control/made phenomenon
Thought of - "someone" making to do me ⇒

(6) (9) Affect → emotion

(10) Volition (Action) [controlled by others]

(11) Impulse

Diagnostic criteria of schizophrenia

(1) Delusion
(2) Hallucinations
(3) Disorganised Speech
(4) Disorganised behaviour
(5) Negative symptoms.

Symptoms

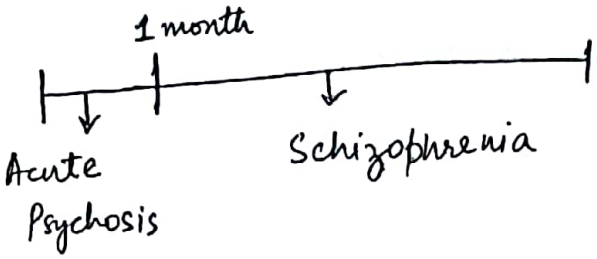
(+) Added due to illness
e.g Delusion
Hallucination

(−) Subtracted due to illness
eg: Anhedonia
Affective flattening

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Diagnosis

ICD-10 (WHO)



No. of chapters in ICD10 - (22)

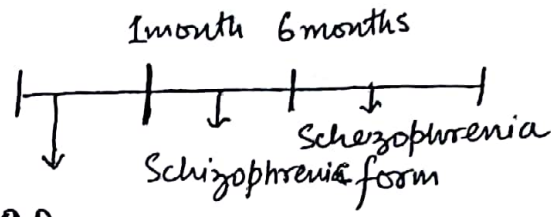
Chapter for mental illness - (V)

No. of Axis in ICD10 - (3)

Alphabet for psychiatric illness - (F)

F = Functional

DSM 5/IV (APA)

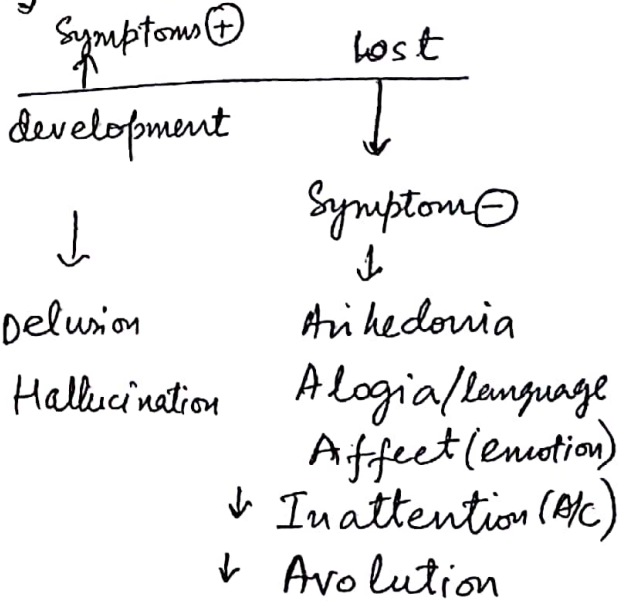


BPD
(Brief Psychotic Disorder)

If a patient is suffering from

- delusion, → (Bizarre)
- Hallucination → (Auditory)
- disorganised behaviour (catatonia)
- disorganised speech (Neologism)
- Negative symptoms

TJ crow

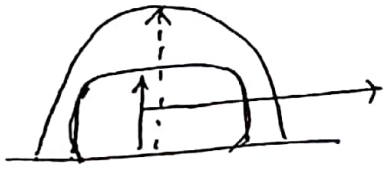


Emotion

Flat (affective flatning)

No Response
(Stony face)

Blunted / Restricted affect



Blunted &
Restricted.
affect.

Types of Schizophrenia

Paranoid

D + H

Commonest

Late onset

Good Prognosis

Personality intact

Hebaphrenic

↓

Disorganised Personality

(Mood)

(giggling / gramising)

early onset

early / Poor Prognosis

Inappropriate effect, Mirror effect

⇓

Personality deterioration is maximum

Catatonia

Motor

Rx

BZD (Lorazepam)

ECT

Best Prognosis

Anti psychotics not given.

Simple

-ve Symptoms

1 year

Worst Prognosis

Catatonia (abnormal motor symptoms)

Signs Depression ⊕

Waxy flexibility] doctor does it
Catalepsy] and patient maintains it.

Rigidity] Patient did it himself & retains for > 1min
Posturing]

Echolalia → Repetition of action (Bizarre position) → Rep. of words.
Echopraxia → Repetation of action.

Sterotypy] → Autism
Mannerism]

Negativism → Not obeying the commands

Gegenhalten → Proportionate Resistance

Mutism

Stupor → Only Responds to painfull stimulus.

Sterotypy → Repeation of non goal directed.

Mannerism → Repeation of goal directed.
↓
But Repeation makes it senseless

1st line of Rx → Lorazepam → ECT.
Antipsychotics – Not Required

Onset period → Dream like

Vongogh Syndrome → Self mutilating in schizophrenia.
↳ cut his one ear.

Genetics

Incidence
0.5 to 5/10000

Prevalance
General population – 1%
Sibling → 8%
Dizygotic twin → 12%
Single parent → 12%
Both Parent → 40%
Monozygotic → 47%

↳ A Heritable psychotic disorder.

Biochemical

Neurotransmitter Responsible → Dopamine ↑ (+ve symptoms)

Meso limbic
↓
Responsible for delusion Hallucination

Serotonin ↑ (+ve/-ve)

↓ NE → Anhedonia

↓ GABA, ↓ ACH, ↓ Nicotine

Substance use → 90% → Tobacco → improves cognition
40% → Alcohol ↓
↓ +ve Symptoms.

Mc Premature cause of death in schizophrenia is Suicide

20-50% attempts | 10-30% (command hallucination) | 5-6% (DSM-5)

Command hallucination

Depression ↑

Clozapine is an antisuicidal, antipsychotic

2/3 patients → visit ℰ in < 72 hrs.

Delusional disorder

Single
Delusion (non Bizarre)

apart from belief
pt. is functionally (N).

Schizophrenia

Multiple (delusions + Hallucination)
Bizarre +/-

DSM 5 — 1 month
ICD10 — 3 month.

Morbid Jealousy

Grandiosity

Persecutory

Erotomania → De Clerambault syndrome
↳[delusion of love]

Somatic → Halitosis → Bromosis

Paratosis (Wooth) [Ekbom syndrome]

Body Dysmorphophobia

Post partum Psychosis

Baby Blue	Depression	Psychosis
30–75%	10–15%	
Commonest	>2 weeks	
Mood swings	Guilt & suicidal	Suicidal 5%
		Infanticide -4%
Recovers < 2 weeks		Relapse = 50-60% (in subsequent pregnancy)
Reassurance		

- **Baby** — Separation of baby before treating mother.
- **Mother** — Recovers in 2-4 weeks; Rx antipsychotics
- **Family** — Psycho Education

Rx

Atypical - Resperidone, olanzapine

Typical - Haloperidol

↓

Clozapine - Most effective, treatment Resistant schizophrenia

↳ Antisuicidal

↳ II line Rx : It causes Agranulocytosis
-Seizures (Rx ↓ in valporate)
SIALORRHOEA

Clozapine + Antipsychotics

↓

ECT

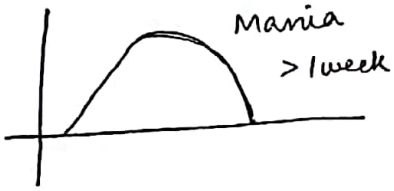
Psychotherapy cognitive Remidiation

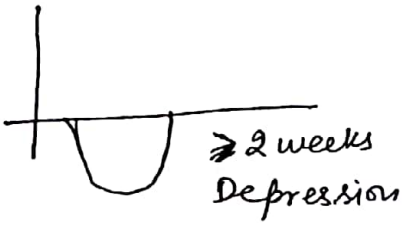
Family oriented therapy

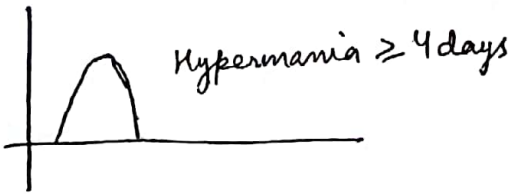
Social skill training

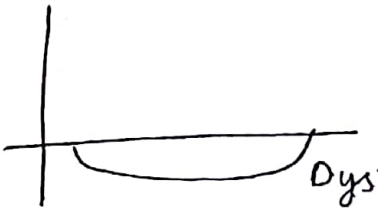
Psycho. education

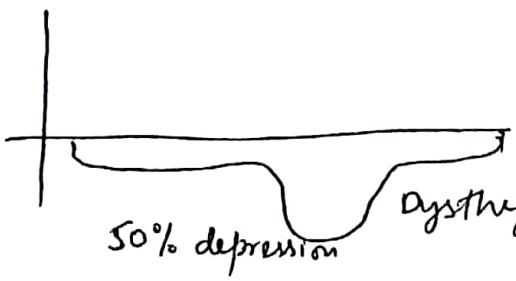
Mood Disorders



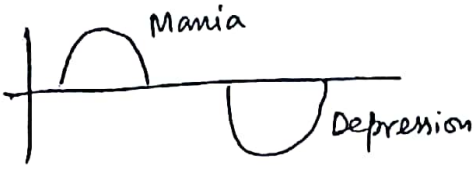




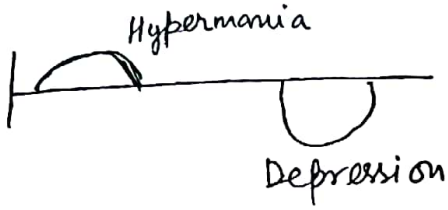




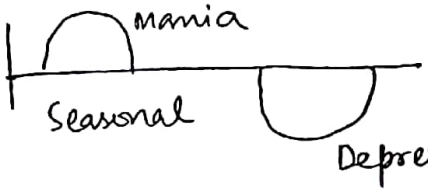
BIPOLAR



BPAD I (Bipolar polar Affective disorder)



BPAD II

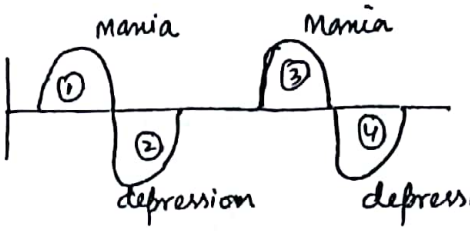


SAD (Seasonal Affective Disorder)

R_x – Light therapy
1,500 to 10,000 LUX.
(1–2 hrs) (DAWN)

Cyclothymia

Patient is moody
interpersonal difficulties
↓
Difficulty in maintaining
job, marriage, friendship



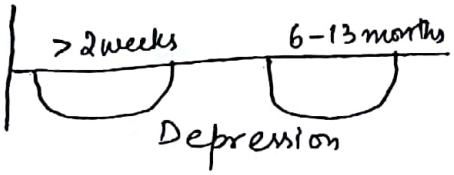
Rapid cycling

for ≥ 4 years

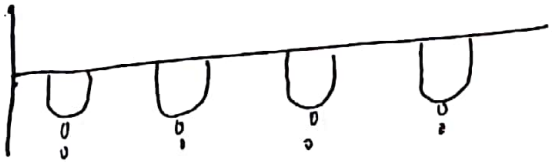
℞ Sodium valporate (TOC)

Carbemezepine

Lithium.



Unipolar depression



Female

PMDD

Pre Menstural Dysphoric Disorder

10-15 %

Menarche - Menopause

Ⓝ Hormonal

4-5 weeks

℞ of choice - SSRIs

Manic

Mania → Mood stabilisers (MS)

Mania + Psychosis → MS + Antipsychotics

Bipolar depression → MS + Antidepressents

Bipolar depression + Psychosis → MS + Antidepressants + Antipsychotics.

Female + Pregnant → Antipsychotics

Mood Stablisers

Lithium

T.O.C. for - Euphoric mania (Happy)

Prophylaxis - 0.6 - 1.2 meq/L
Therapeutic - 0.8 - 1.2 mEq/L
Haemodialysis - 2 meq/L

Valporate

ToC for Dysphoric mania (Anger)

↳ Acute mania
↳ Alcohol
↳ Rapid cycling
↳ Anxiety.

Pre lithium Investigations (Check) ⇒ TLC, DLC, (∵ it can cause Thyroid disorder Leucocytosis)
RFT, Cardiac profile

Schizo - Affective disorder.

Mania

D I G × A S T

D → Distractibility

I → Involvement in pleasurable activities (Food, money, sex, religion)

G → Grandiose mood (very Happy)

A → ↑ Activity

S → Sleeping less & Feeling Fresh

T → Talkativeness

Depression

S I G E C A P S

S → Sadness of mood

I → ↓ Interest

G → Guilt

E → ↓ Energy (weakness/ Tiredness)

C → Concentration lost

A → Apetite ↑↓

P → Psycho-motor activity ↑↓ (MC)

S → -Sleep ↑↓ -Suicide

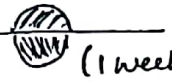
1 out of 8 males

1 out of 6 females

Middle age.

Why depression is common in Females (♀)?

- Hormonal cause
- Child birth related
- Social status
- Learned helplessness.

Mixed  (1 week)

Seasonal

Psychosis

Peripartum

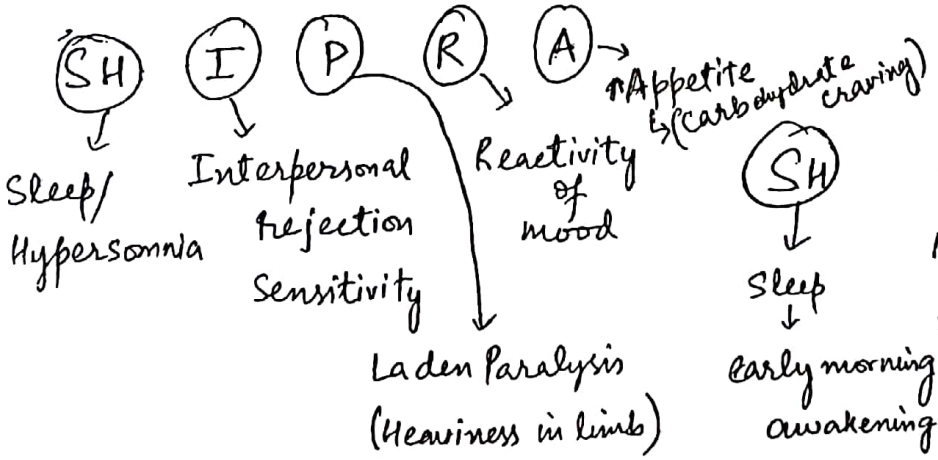
Catatonia - (MC in depression)

Mood congruent / In congruent (delusional reference)

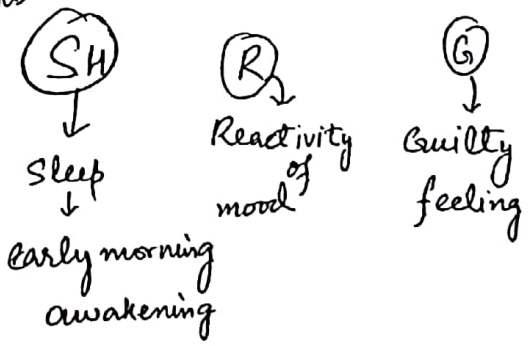
Atypical

Melancholic (endogenous)

Atypical Depression



Melancholic Depression.



Cognitive Triad of depression. (A.T. Beck) A.T. BECK

Negative Thinking of :→

- Hopelessness :- Future ——→ Suicide
- Helplessness :- Environment, world
- Worthlessness :→ Self

Cognitive Therapy → A.T. Beck.

Cognitive Distortion

- Magnification (Mal adaptive assumptions)
- Minimization
- Personalization
- Arbitary Influence
- Selective abstractions
- Over generalisation
- Dichotomous Thinking or Abolutist.

Suicide

10.4 / 1,00,000

Commenest method - Hanging

Neurotransmiter - 5 HT

Biochemical marker - CSF - ↓5 HIAA

Paradoxical suicide

Para suicide → Cutting (Boderline Personality Disorder)

Depression ē Suicidal tendency ⟶ "ECT"

Risk factors

- Males - (4:1)
- > 45 years
- Unemployement
- Past H/o suicide
- Helplessness, Alcohol
- Chronic illness

Patients commiting suicide have Psychiatric illness

M/C Cause of suicide → 80% - Depression
25 % - Alcohol
10 % - Schizophrenia
5 % - Delirium + Dementia

Defence mechanism of depression is Introjection of departed object

Neurotransmiter → ↓ 5HT, ↓ DA, ↓ NE

(Triminogenic Therapy)

↑ ACH

↑ Glutamate

Rx of depression – Antipsychotics

DOC – SSRI

M effective TCA

Psychotherapy – CBT

Somatic modality

Invasive

DBS → Deep Brain Stimulation

VNS → Vagal Nerve Stimulation

CBS → Cortical Brain Stimulation.

Non Invasive

ECT → Gold Standard.

RTMS → Repetitive Trans Magnetic Stimulation

MST → Magnetic Seizure Therapy

CNS → Cranial Nerve Stimulation

ECT

Electro Convulsive Therapy (1938

Started by Cerletti BINI

MECT (Modified ECT) → Muscle Relaxant is added

e.g Succinyl choline

↓ G.A. [Propofol]

Electric current → Seizure of ≥ 25 sec if ≥ 180 sec

↓ I/V

Diazepam.

Mechanism → BDNF Brain derived Neurotropic Factor

Gold Std, More effective ≥ 90% 60–70%

No absolute CI

Relative CI → ↑ ICT, MI, HTN.

Safe in Pregnant females.

Indication :→ Depression ± suicidal

Catatonia, mania, Schizophrenia

NMS, Parkinsonism & rigidity

Treatment Resistant epilepsy

Not effective in ⇒ Somalization
Personality D/o (Boderline)
Anxiety D/o

Sign of depression ⇒ Otto ve.reguth
Omega Sign

Neurotic disorders

- Anxiety disorder ← Phobia, Panic, GAD (Generalized Anxiety D/o)
- OCD & related disorders
- Conversion Hysteria
- Dissociative disorders
- Trauma & stress related disorders
- Somatic symptoms & related D/o

Neurotransmitters involved

GABA → Rx BZD

NE → β-blockers

GABA → Anxiety
Nervousness

NE → Palpitation
SOB
Heeviness of chest

Phobia

Specific
↓
↳ Claustrophobia
↳ Closed Space
Acrophobia (heights)
e.g. MRI/CT room
Lift

Social
↓
Scrunity

Agora phobia
↓
Means market place
Fear of
↳ Open spaces
Crowded Spaces
(where escape is difficult)
Enchored spaces
(eg Metro, Bus, plane)

Irrational fear of a stimuli, object, situation or a person.

Rx Avoidance [of normally logical fearfull situations]

And Exposure Therapy

- Flooding [over exposure]
- Systemic Desensitization
  - Hirarchy
  - Relaxation
  - Joseph Wolphe

⇓

Graded Exposure (TOC)

Specific TOC is Behaviour Therapy.

Agoraphobia ⟶ SSRIs (TOC)

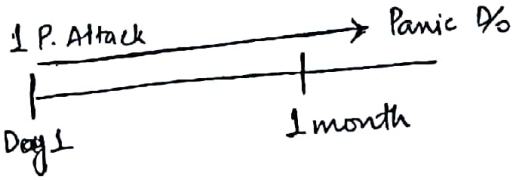
Social ⟶ SSRIs + Psychotherapy.

All phobias are diagnosed in 6 months

Displacement → Putting blame on wrong things
↳(a defence mechanism) (Egg → Hygenie)
↳ Problem
↑
Blaming

Panic D/o

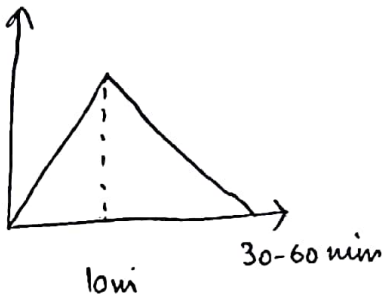
Panic D/o



Panic attack

↓

(alprazolam)



Symptoms of palpitation

Stimuli is absent ⇒ [out of blues]
[Impending of doom]

↳ SOB
Heavyness of Chest

MC. Comorbidity is Agarophobia

DOC for Acute anxiety → BZD

DOC for Chronic anxiety → SSRI

Generalised Anxiety Disorder. (GAD) (Day to day worries)

Symptoms
Apprehensions

Fatigue, ↓ Concentration, Sleep, Anxious,.

Muscular tension

Diagnosis made after 6 months

Rx of Choice → SSRI + Psychotherapy.
(CBT or supportive)

Phobia - Related to Stimuli

Panic - Out of blue (No stimuli)

GAD - Day to day worries.

Bradycardia is seen in
fear of Blood/Needles

Inv ECG, TSH, Hb, Blood Sugar.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Psychology [Study of mind]

Sigmund Freed → Neurosis → Unconscious Conflict

Dream analysis

[Father of Psychoanalysis]

Defence mechanism

Theory of mind.

Psychosexual stages of development.

Dream analysis

Dreams are the Royal Road to Unconscious mind.

In 1900 → [Interpretation of dreams] book

Primary process of dreams.

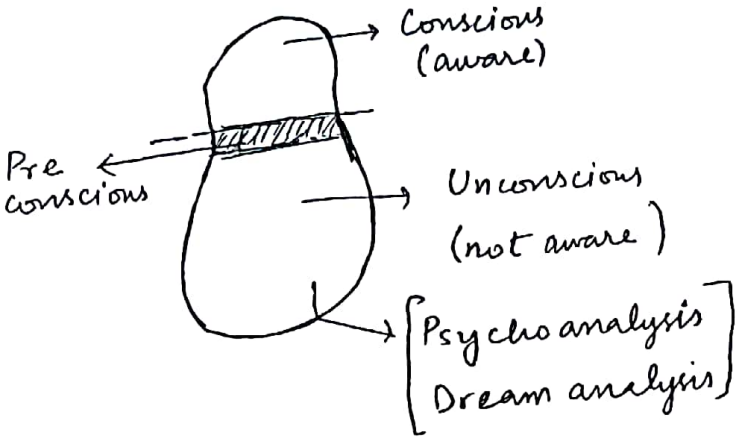
↳ Displacement

↳ Symbolic Representation

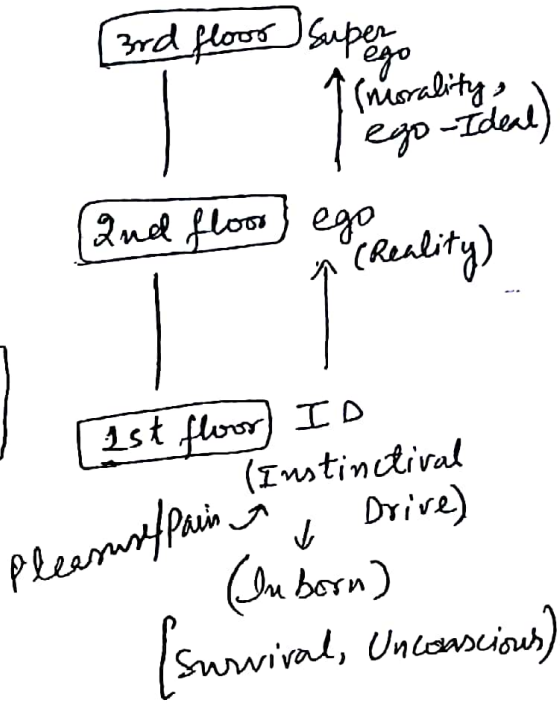
↳ Condensation

Theories of mind

Topographical Theory

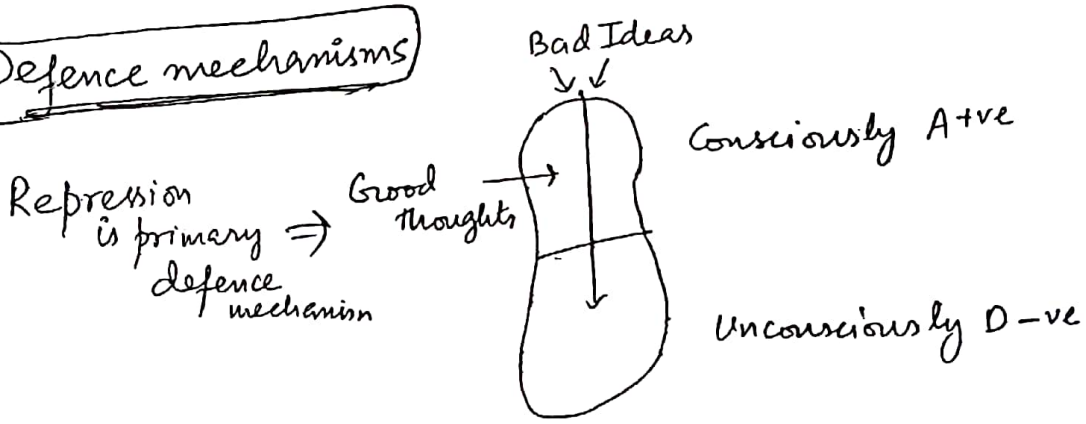


Structural Theory



Defence mechanisms

Repression is primary ⇒ defence mechanism



Repression [Unconscious forgetting]

By George Valiant

- Mature
  - S – Sublimation
  - S – Suppression
  - A – Alturism
  - Anticipation, Ascertism
  - H – Humor
- Immature
- Neurotic
- Psychotic or Narcis

Suppression → waiting of right moment.

Altruism → Helping others

Anticipation → Anxious-ness helps to perform better.

Ascertism → Doing good things but no expected return
(No praise required)

Immature defence mechanism

Fantasy

Regression
(Things which were normal at a span is not normal anymore)

Passive aggression
e.g harming any person who was harming you in indirect way.
to get satisfaction.

Somatisation (expressing emotions via physical complaints)

Interogection/Identification
copying others

Acting out
↳ No patience

Neurotic

Repression

Displacement → anger reaction on someone else.

Undoing → non productive activity making comfortable feeling.

Isolation of Affect → Making conversation lengthy while expressing

Reaction formation → Action ⟹ Reaction.

Rationalization → Blaming others

Conversion → (Hysteria)

Dissociation

Conversion (Hysteria)

↳ Primary gain

↳ Secondary gain

La bille Indifference

treatment

[Cut secondary gain]

[Aversion Therapy]
↳ (Painfull stimulus)

Narco analysis
or
Drug Induced Interview

(BZD, Barbiturate) – Thiopentone Na
↓
(Truth serum)

↓
Diazepam
Lorazepam
Midazolam

Dissociation

(dissociative amnesia) → [Skipping the uncomfortable feelings]

F → Fugue → Amnesia + Travel

Travel / Amnesia

Reaches a new place & assumes a new identity

I → Identity → Multiple Personality disorder or Split Person disorder

D → Depersonalisation → Derealisation → "As if Phenomenon"

Depends on environment

A → Amnesia (selective / Patchy)

Pachy loss of auto biographical memory.

Malingering (Manchausen Factitious)

	c/o/s	Factitious	Malingering
Symptoms	Unconscious	Consciously Faking	Consciously
Gain	Unconscious	Unconscious	Conscious

↓

abnormal sick role

Iron grid abdomen

Pseudologia Fantastica

↳ Fatastic lie which people believe

Due to

⇓

Sexual abuse

Physical abuse

or

Isolisation

Ganser Syndrome

Approximate answering (Paralogia)

↓

2 + 2 = 5

⇓

grass = Blue

Psychotic or Narcisstic analysis

Denial ⇒ No convience / Deny the Reality

Distortion ⇒ Body Image distortion. (Anorexia Nervosa)

Projection ⇒

Elisabeth Kobler Ross

Denial → Anger → Bargaining

↓

Depression

↓

Acceptance

disease → Not ready to accept

↓

"Not me"

Projection

In Rationalisation there is acceptance

Projective Personality Test

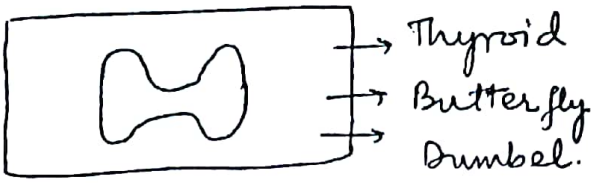
→ Rorschach Inkblot Test (Red & black ink) [Symmetrical]

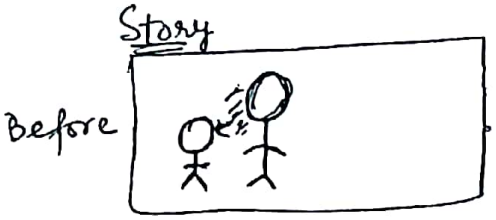
→ Thematic apperception Test

→ Sentence completion Test

→ Draw a person Test

→ Word-association





"The story defined depends on the state of mind of patient"

Psychoanalysis

Childhood Repressed Memory

[Unconscious conflict]

Transference ⟶ Patient D/o

Counter transference ⟶ Doctor (not acceptable)
↳ over caring towards patients

Free association ⟶ Method of taking information from patient freely.

Behaviour Therapy

Classical

↓

Ivan Pavlov

Stimulus
+
combination.

Operant conditioning

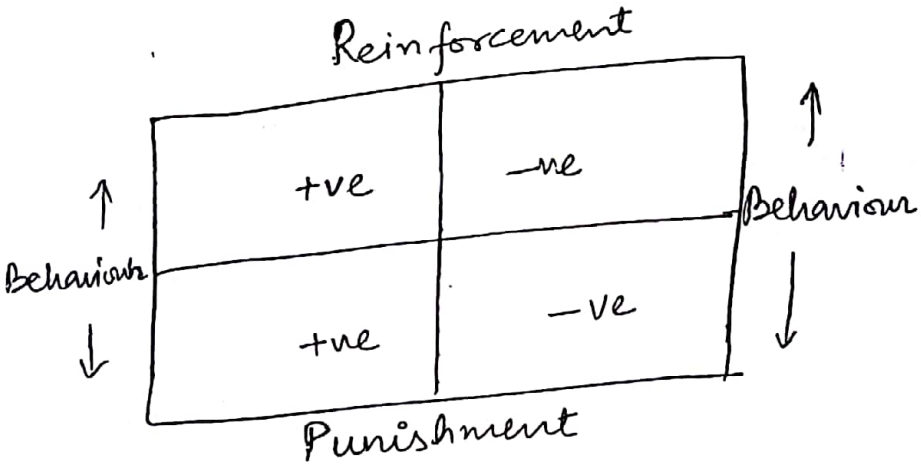
or

Instrumental

⇓

B.F. Spinner

Response
+
Consequences



Contegency

Psychosexual stages of development

Oral 0-18 months

anal 18-36 months

Phallic 3-5 years

Latency 5-12 years

Genital > 12 years

Libido → Sexual drive

Oedepus Complex (Fear of Castration)

3-5y boy → mother + father

Electra complex - Female ⇒ Envy of penis

Identification by idealising

Latency ⇒ Boy → Father

Girl → Mother

OCD & Related disorders

Trichotillomania → Pulling of hair

Hoarding → emotional value of useless things

Excoriation → Skin Picking (e.g Acne picking)

Body dysmorphic disorder - feeling of body part/appendage being disfigured
↓
goes for treatment
- MC - Hair
- Nose

Trauma & Stress Related D/o

- Expected
  - Life events
  - Medical, Relationship
  - Study / Job
- Unexpected
  - Intense
  - Earthquake, Rape, Riots
  - Bomblast, war

Adjustment disorder

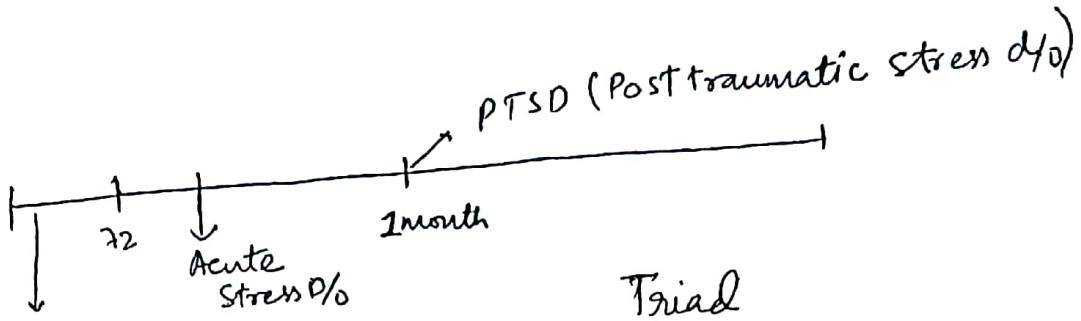
Stress?

ICD 10: 1 month

DSM 5: (3 month)

Symptoms → 6 months

- depressive
- Anxiety
- Conduct



Acute Stress D/o < 1m
PTSD > 1m

Triad
- Hyperarousal
- Intrusiveness
  - Flash back
  - Nightmare
- Avoidance

Negative cognition and mood.

↳ Hallucination not present.

Treatment

Psychotherapy.

PTSD
—— Rx Pharmacotherapy (SSRI) + CBT

EMDR (eye movement Desensitisation Reprocessing)

Debreifing

Somatic Symptom Related D/o (DMS 5)

Illness anxiety D/o (Anxiousness due to fear of illness)

Somatic symptom D/o (anxiousness due to fear of illness)

Symptoms +ve
↓
Diagnosis (←)
↓
Investigations (←)
↓
Reassurance → Hypochondriasis

Pain D/o → due to emotional conflict.

Somatoform D/o (DMS IV)

- Somatization
  - Symptoms: Pain, GI, Sexual, Pseudoneurological
  - Symptoms < 3 organs, > 2 yrs.
  - Somatoform Pain
  - Inv (+)
  - Doctor Shopping
  - ⇓
  - Asks for Pain Relief
- Hypochondriasis
  - Diag
  - ↓
  - Investigation
  - ↓
  - Normal
  - 6 months
  - Somatoform autonomic dysfunction
  - e.g. IBS, Hyperventilation syndrome
  - ↓
  - breathing in a plastic bag.
  - [Asks for Diagnosis confirmation]

Culture bound Syndrome

Dhat syndrome → Semen in urine

Amoke → Running & killing way, Suicide/forget

Koro → Size of Penis is reducing & going in abdomen → die (epidemic)
[GENITAL RETRACTION SYNDROME]

Latah → Screeming, Cursing, dancing
Uncontrolled laughter.

Eating disorders

ANOREXIA NERVOSA

F : M = 10-20 : 1

Underweight (<85% ideal) of (N)

(A) (B) (C)

Anorexia Binge Compensatory

Can eat (300-500 K Cal)

↓

Eg. Vomiting
diarrhoea

BULIMIA NERVOSA

(N)

B C

↓ ↓

Binge Compensatory

BED (MC)

[BINGE Eating DO]

overweight

No compensatory

↓

Anorexia Nervosa

Types → Binge
Types → Restriction

Body Image distortion

≤ 85% (weight loss)

Fear of fat

Amenorrhoea ≥ 3 months

14–18 yrs

Profession – Modelling
Heroin

100% females

Peculiar handling of food. → (Peculiar behaviour)

Clinical signs

↑ Cortisol, ↑ G.H, ↑ Prolactin.

↓ Leutinising hormone, ↓ FSH, ↓ Estrogen.

Sometimes hypercholesterolemia

↳ Anemia, muscle atrophy, bradycardia

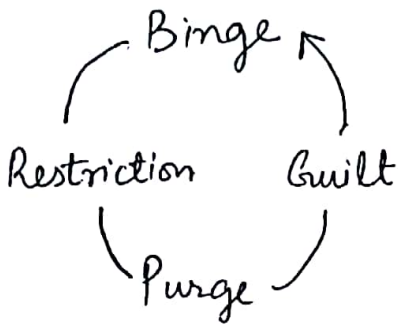
℞

SSRI + Antipsychotic

Hospitalisation (if ≤ 80% fall of weight)

CBT, family therapy.

BINGE Eating disorder



Will eat more
↓
dental caries
↓
enlarged Parotid glands
⇓
Scar mark on hands due to putting hands in mouth regularly
⇓ (RUSSELS SIGN)
BINGE

℞

Fluoxetine

CBT

Sexual disorder

Sexual Identity → Biological sex

Gender Identity → By which the individual recognised himself/herself
⇓
Psycological sex (3years of age)

Gender role →

Sexual orientation → Heterosexuality/Homo/Bisexuality

Gender Identity Disorder ⇒ e.g. Boy wants to be girl
DMS IV
↓
[dissatisfied ∈ the alloted sex]
Gender Dysporia
DMS 5
↙
Hormonal Sex Replacement.

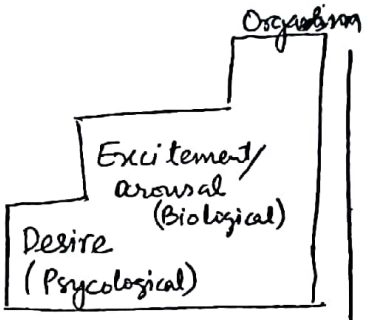
Sex rearangement Sx

[Male trapped in female body
Female trapped in Male body]

Abnormality in Sexual Preference

Gender Dysphoria

Sexual dysfunction



Asexual

Hypo sexual

Hypersexual → Styriasis (♂)

Hypersexual → Nympomania (♀)

Impotence

Middle age

Organic

Psycogenic

Cause
- MC Vascular
- Hormonal
- Drug/medication

- Masturbation ✗
- Morning erection ✗
- REM Spontaneous ✗

50% males have apprehention.

- Masturbate ✓
- Morning erection ✓
- REM Spontaneous ✓

Paraphillia

Paedophilia (MC)

Exhibitionism (only in ~~female~~ males)

Voyerism (males)

Frotheurism (males)

Premature ejaculation
[< 1 min]

(5) (10) 15 - 20 25 min

[2 - 6 min]

orgasm is shortest

R_x

SSRI – S/E (delayed ejaculation)

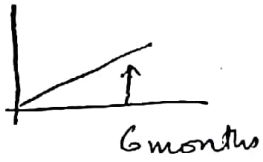
Start stop technique

Sequeze technique (Mester & Johnson)

Dual sex therapy.

Cognitive Disorder

Delirium	Amnestic synd.	Dementia
Immediate memory disorder	Recent memory disorder	Remote memory disorder.
Global disfunction	Memory	Global disfunction
Psy (Illusion/Hallusination) Visual	NO	Psychiatric
Altered Sensorium [acute confusional state] ↓ disorientation to time place & person.		Progressive loss of memory c consciousness Intact



Delirium

(P) Psychomotor activity.

(C) ↓ Clouding, consciousness
Illusion/Hallucination
Transient delusion

(A) Attention

(S) ↓ Sleep

(E) ↓ Emotion

→ onset sudden
Consciousness fluctuating
Recover or die

Etiology

Common in old age male → Polypharmacy

In middle age → Substance abuse / alcohol

In young ag → Poisoning

Flocci llation — Aimless plucking on bed sheet

↓

Sundowner Syndrome (seen in ICU Patients)

R_x

Anti Psychotics - Respesidone (DOC)

B≥D - Lorazepam (DOC)

Amnestic Syndrome

IRReversible 85%

100% Reversible

B_1 + glucose 100-300mg/day

Wernecke encephalopathy

Korsakoff Psychosis

Ophthalmoplegia

Global Confusion

Ataxia

Short term Memory problem

Confabulation (filling memory gaps & Imagining information)

Damage due to bleeding in brain

Dementia

- **Irreversible (85%)**
  - Alz. Disease (65%) MC
  - Multi infarct (15%)
    - Stepladder Patter
- **Reversible (15%)**
  - Depression (Pseudodementia)
  - Post encephalitis
  - Hypothyroidism
  - B_{12} deficiency

Dementia is characterised by

Loss of memory

Apraxia → (motor symptoms)

Agnosia — Not able to remember familiar faces (Prog Prosopagnosia)

Aphasia → (language)

Executive functions (S – O – A – P)
- S: Sequence
- O: organising
- A: Abstract
- P: Planning

(2/4) indicative,

Pick disease → Frontal dementia

↓

Personality dysfunction

⇓

Precedes loss of memory.

Sleep disorders

(S) (H) (I) (P)

Sleep awake cycle 6-9/24hours

Hypersomnia >9

Insomnia <6 hours for 1 month

Parasomnia

Night - drivers, Police, doctors, etc.

Hypersomnia

- Sleep paralysis - REM, ↓Tone. - ⩾30sec
- Sleep attack (MC)
- Hypnopompic/Hypnogogic hallucination
- Cataplexy - Sudden loss of tone in Response to an emotional Stimuli

℞ Modafinil ↓ REM Latency

Hypno → Sleep. Hypnogogic
↓
Hallucinations during sleep.

Cataplexy - Loss of tone on emotional events.

℞ Modafinil.
[α1 adregenic Receptor antagonist]

Parasomnia

↳ Amnesia

Symptoms

Broxism → grinding of teeth.
→ Rx mouth gag.

Somanbulism → Sleep walking

Somnilef. Somiloquy → Talking

Periodic limb movement.

Enuresis (< 5years)

Night terror & night mare

Night terror
(Pavor Nocturnus)
Screaming
Confused
Sleep
Amnesia

Night mares (Night mares)
REM
Bad dream
Recall ⊕

℞
BZD - diazepam

Child Psychiatry

Tic disorder

Sudden, rapid, non-rythmic sterotypical

motor or vocalisation

↓ ↓

e.g. Blinking eyes — e.g. cough or clearing throat continously.

Copolalia ⟶ Repeation of obscence words

Motor tic + Vocal Tic + Copprolalia + Palilalia ⇒ [Gille de la tourette syndrome]

℞ Clonidine — ↓ S/E → Prefer during emergency.

Anti psychotic - Haloperidol (DOC)

Risperidone.

ADHD

[Attention Deficit and Hyperactivity d/o].

Hyperactivity

Impulsivity

Inattention / ↓ concentration / decline in school performance

DSM IV → < 7 years

DSM 5 → ≤ 12 years. &

ADHD is serious disorder ∈ social, academic effects.

℞

STIMULANTS ⟶ METHYLPHENIDATE

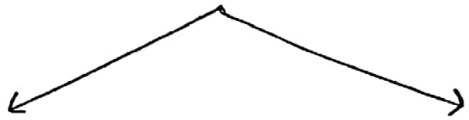
Follow up for → Substance abuse.

NON STIMULANTS ⟶ ATOMOXETINE, BUPROPION
CLONIDINE

Autisim Spectrum disorder

↳ Social interaction, Repeatitive

DSM IV PDD Pervasive Development D/o



Autism	Asperger Syndrome
Leo kanner	HANS
Communication	Communication (N)
Social Interaction	Social Interaction (N)
Repetetive behaviour	Repetetive behaviour *

Rett's

♀ only

(N) → 6–48 months

Regression milestone

Microcephaly
↓ Head circumference

Midline ~~wringing~~ wringing movements of hand
~~Spasticity~~

Complications
- Breath holding spells
- Pneumonia/Pulmonary complications.
- Seizures
- Arrhythmias (cause of death)

Childhood disintegration D/o

♂ : ♀

20 : 1

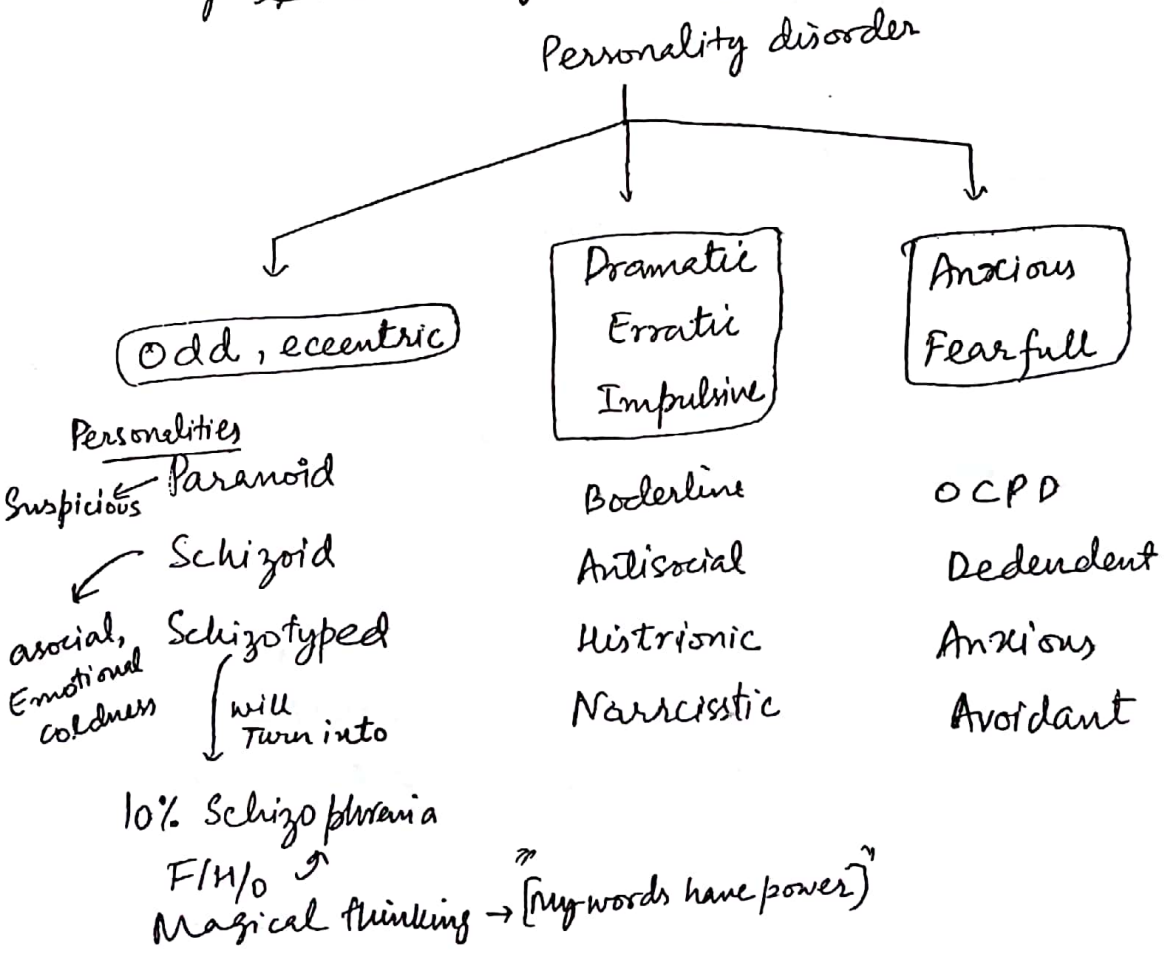
Develop language
will play
Bowel control
} Lost

Personality disorder

≥ 18yrs adolescent or young adult

Antisocial	Conduct	ODD → Child psychiatry (opposition deficient)
– They Like to break law	Behaviour	Verbally abusive
– No feel of guilt	Voilence	
– Lack of Remorse	Cruelty animal	
– Conning	Theft	
	Bullying	
	Truancy.	

ego syntonic rarely

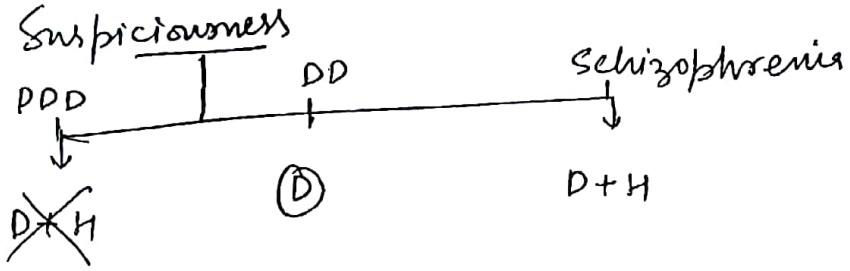


Psychotherapy

Paranoid ⟶ Suspiciousness

Suspects → friends, strangers

keep grudges, attack Reputation of others.



Boderline (cyclothymia) → [Emotionally Unstable]

Parasuicide

Mood Swings

Idealization/ Devaluation

Identity crisis

* Defence mechanism ⇒ Projective Identification

Splitting.

Rx of Choice → Dialectical Behaviour Therapy

Mentalization Based Therapy

Histrionic

More prone to Somatisation.

↳ attention seeking

Talk, walk, drink → seductive

Shallow emotions

Narcisstic

self love

Sense of entitlement

Grandiose sense of self importance

Fantasies of unlimited success

Avoidant

(Social phobia)

↳ fear criticism, feel inferior.

Preoccupied by Rejection.

℞ "Assertiness Training"

Dependent

Difficulty in making everyday decision

↳ they want others to take responsibility

OCPD [Obsessive Compulsive Personality Disorder.]

Anakastic Personality disorder.

Perfectionist

Donot complete on time

Make lists / Rules

They are Rigid.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Substance use disorder

Abuse → Alcohol (mc)

Illicit / Illegal → Cannabis

Dependance → Tobacco (mc Substance of dependence)

Stimulant → caffeine

Physical

Tolerance

Withdrawl

Psychological

Craving (ICD-10)

Stop → but not able to

Health ×

Social life ↓

Amount, Time ↑

↳ Not able to control

Tolerance

↳ Same dose not giving same pleasure

Withdrawl

↳ Substance specific withdrawl.

Withdraw peaks ~ in 2-3 days

Tobacco — No diagnosis of Abuse or Intoxication DSM 5

Dependence (+)

Withdrawl Symptoms
- Bradycardia
- Constipation
- Paradoxical Sleep
- ↓ Concentration
- ⇧ weight

℞ Nicotine Replacement Therapy
- Patches
- Gums
- Lozenges
- Spray

- BUPROPION (DNRI)

- VARENICLINE (α4β2 Nicotinic Ach Receptor partial agonist)

Alcohol

Withdrawal Symptoms

Tremors (6-8 hrs) (First sign)

Psychotic/Perceptional symptoms (c in 8-12 hrs)

Seizures (c in 12-24 hours) RUM FITS.

DT (Delirium tremors)

℞ Oral Chlordiazepoxide (Tremors)

IV diazepam (seizures)

IV Lorazepam (for delirium tremors)

Alcoholic hallucinations → Auditory

Clear consciousness

12-24 hours

(1-2 months)

Anticraving

FDA - Acamprosate

Naltraxone

Topiramate, Baclofen

Deterent

↓

Disulfiram rxns.

e.g metronidazole

(12 hours

Intoxication –

20 – 30 mg/dl → (↓ thinking)

80 – 200 mg/dl → Ataxia

200 – 300 mg/dl → Black out

300 mg/dl — death

Opioids

Withdrawal

Pain

Yawning

↑ secreations

Mydriasis

Heroin

Brow Sugar

Smack

Morphine

Pentazocine

Propoxyphene

Codeine

Intoxication → Respiratory depression

Pin point pupil.

Maintanence programme → Buprenophine, Methadone

Detoxification → clonidine

Antagonist → Intoxication → Nalaxone

Prevention relapse → Naltraxone

MC withdrawl of caffeine → Headache, fatigue

Cannabis

Bhang 1% | Charas 10-15% | Ganga, M, H 4-5% | 40%

Intoxication - Redness of eyes (conjunctival congestion)
Tachycardia / Restlessness
↑ Thirst / ↑ Sweat

Withdrawl → Anxiety, nervousness, Insomnia, vivid dreams.

→ Amok
→ Flashback
→ Anxiety
→ Psychosis
→ Amotivational syndrome.
→ HEMP insanity

Cocaine

[Amphetamine]
↓
Schizophrenia

LSD

Reflex

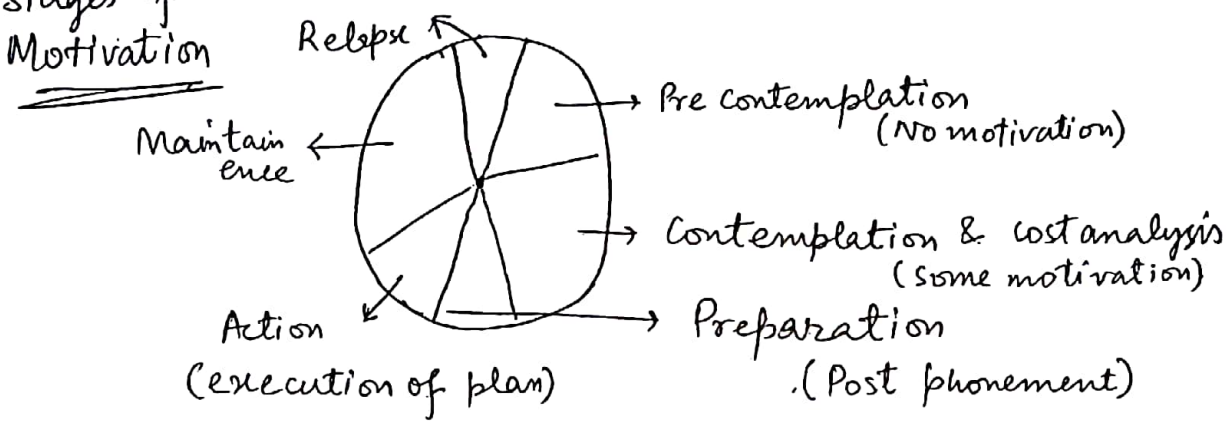
Flashback

Prochaska & Diclemente (1983)

↓

Studied alcohol patients

Stages of Motivation



Date Rape drugs

- Ketamine
- GHB (gamma Hexene butyrate)
- Roofie (Flunitrazepam)

Alcohol

Rave/club

Methamphetamine → MC drug for Hospitalisation

Radiology

Handwritten Note

MBBS Help

http://mbbshelp.com

http://www.youtube.com/mbbshelp

http://www.facebook.com/mbbshelp.com

Name: _____

Subject: **Radiology**

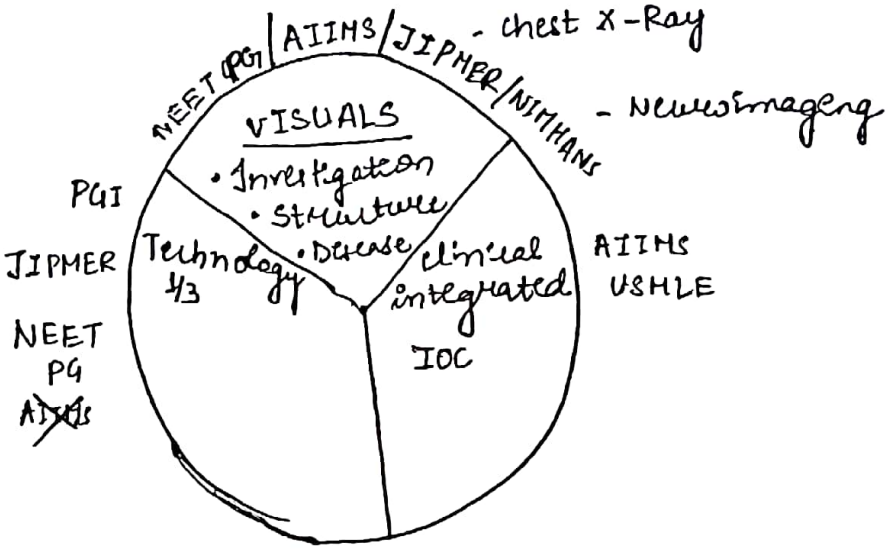
Q What kind of Radiotherapy do you use in Skull Base Chordoma

(a) x rays (c) protons.

(b) UV rays (d)

Q Kernohan notch. phenomenon is seen in? Uncal Herniation

(a)



CT SCAN

Sir Godfreey Hounsfield

1972

Novel Prize → 1979

ENGLAND

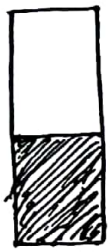
He was working for EMI (Electrical Musical Instruments)

↓ sold

they also ~~made~~ BEATLES

Computed Tomography

X-Ray



Attenuation. - ∝ x-ray stopping power of tissue.

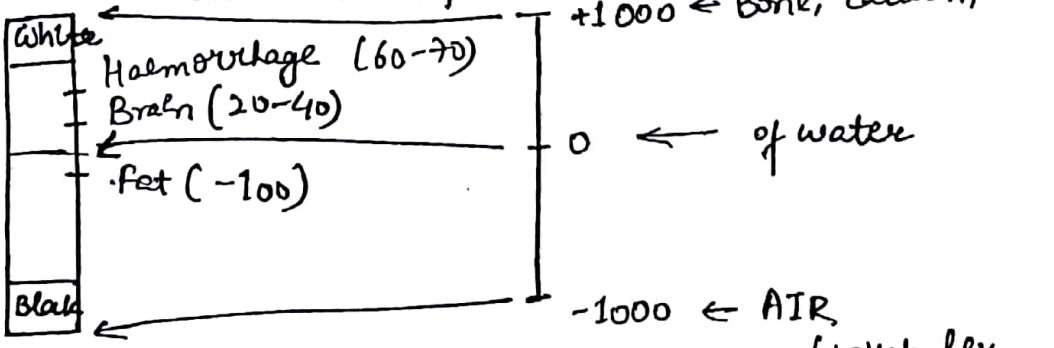
If tissue doesn't stop x-Ray

↓

Black

Computer screen has expanded grey scale.

Housefield created a scale of attenuation values of each tissue



Hounsfield Scale

Housefield value of fat = -100

more Black than H_2O

Less " " are

Brain = 20-40

Hyperdense ← white

BRAIN

Hypodense ← Dark

] For Brain CT

according to the target organ

Q. -100 HU on CT — RECALL

a) Fat b) Water

c) Brain d) Bone

Q. AIIMS child → c B/L Renal Tumour — CT Scan ⇒ -100 Hu.

What is the mode of inheritance of the disease

Angiomyolipoma → Tuberous sclerosis → AD inheritance

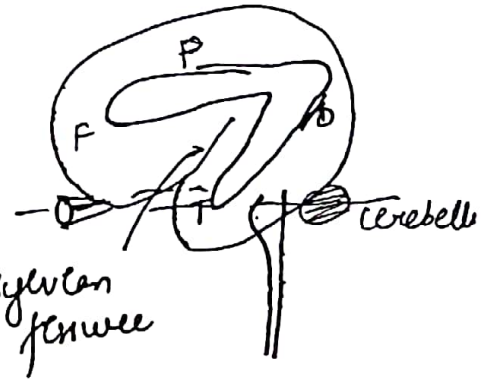
Supero-Inferior Dimension Appreciation

~~OBBS~~

1) Orbit

2) Sylvian fissure.

3) A & P Horn of Lateral ventricle



At Level of Orbit-

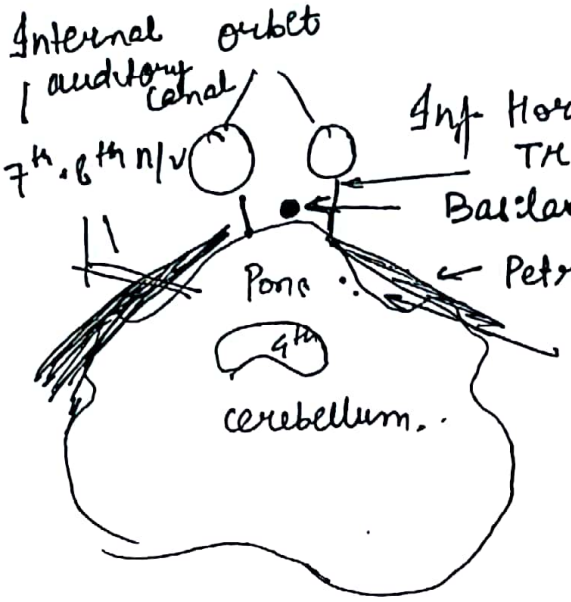
orbit → Temporal Lobe — Brainstem

Cerebellum

Lateral v. → caudate

P.No-14

3rd v → thalamus



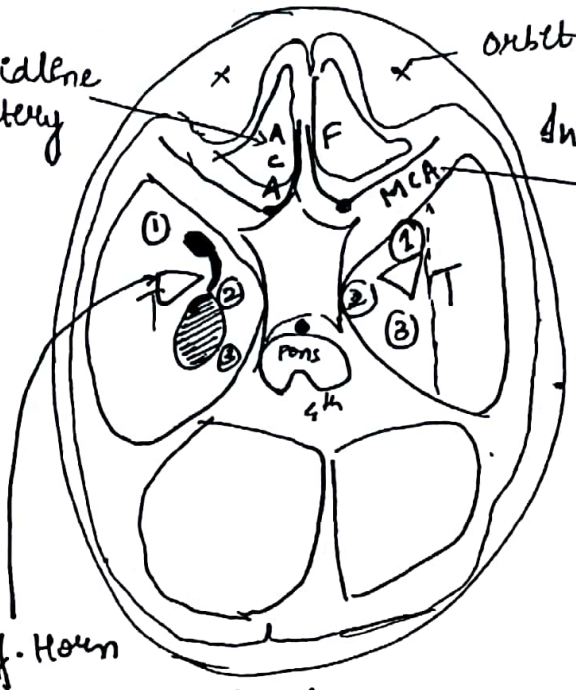
cerebellopontene angle — cisterm
(vestibular schanoma)
↳ never midline
but Laterally

N/v arising in front of Pons towards cavernous sinus
↳ Trigeminal n/v.

← Trigeminal n/v

Basilar artery

⇒ ē ageing
Due to atherosclerosis of
Branch of Basilar artery
pulsating on Trigeminal n/v
⇓
Trigeminal Neuralgia
Rx → Carbamazepene



↓

Dense MCA

Earliest sign of CT. of infarct.

Inf. Horn of Lateral ventricle.

↓

In early Hydrocephalus Inf. horn is 1st part to be ballooned out.

① Amygdala
Ant to the medial (medial) Temporal Lobe.

② Uncus
Hook like structure.
Most medial.

③ Hippocampus
1st part to degenerate in. Alzeihmer's Disease

craniel pharyngioma → suprasellar cistern

↓

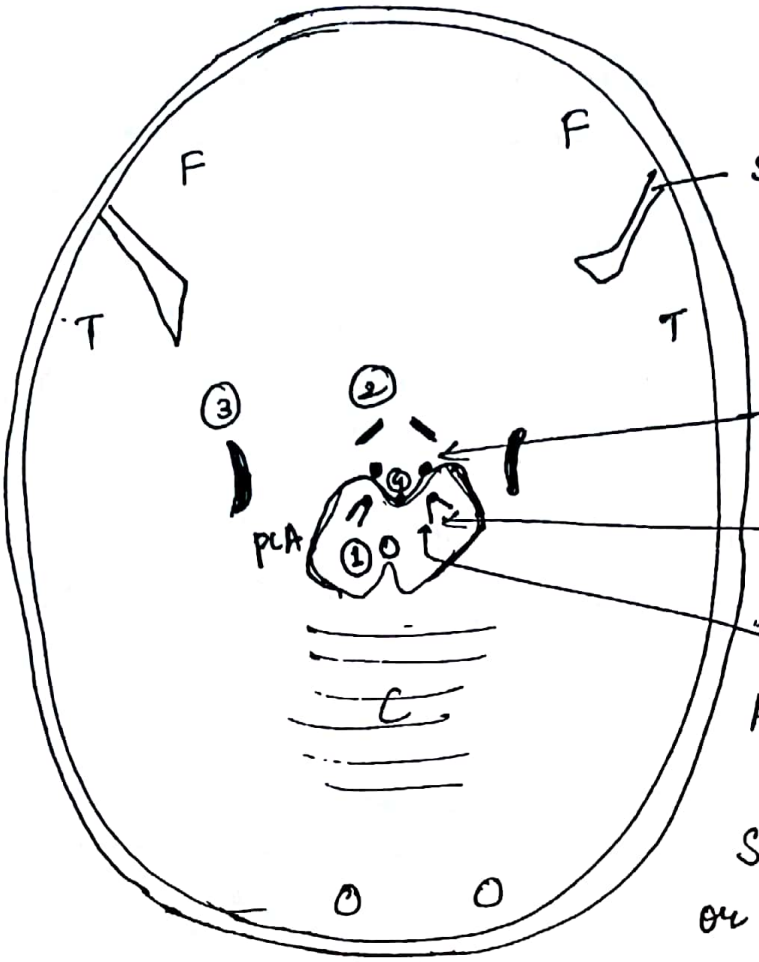
Below it pituitary is present

Infundibulum of pituitary

Pharyngeal part of Rathke's Pouch. ⇒ remnant form Tx **Craniopharyngioma**

Pituitary Development — cranial / Pharyngeal.

Above the Level of Orbit

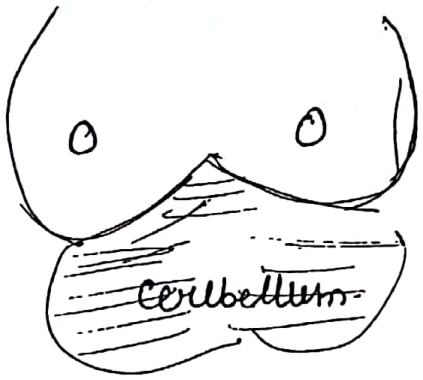


Sylvian fissure
& MCA goes to sylvian fissure

Mamillary Body — Wernicke's encephalopathy
Thymine dependent metabolism

Mid Brain.
(Heart shaped)

Substantia Nigra
Anterior part of mid brain
↓
Site for Parkinsonism or Paralysis agitans or Shaking Palsy.



① Aqueduct of sylvius.

② Optic tracts

③ Uncus
↳ Uncal Herniation
⇓
Leads to compression of mid Brain

④ Basilar artery
In interpeduncular fossa → it devides to form Post. cerebral artery & terminates here
Uncal Herniation may compress this → leading to ~~bleeding~~ blindness

UNCAL HERNIATION

Uncul Herniation this side

Tentorium

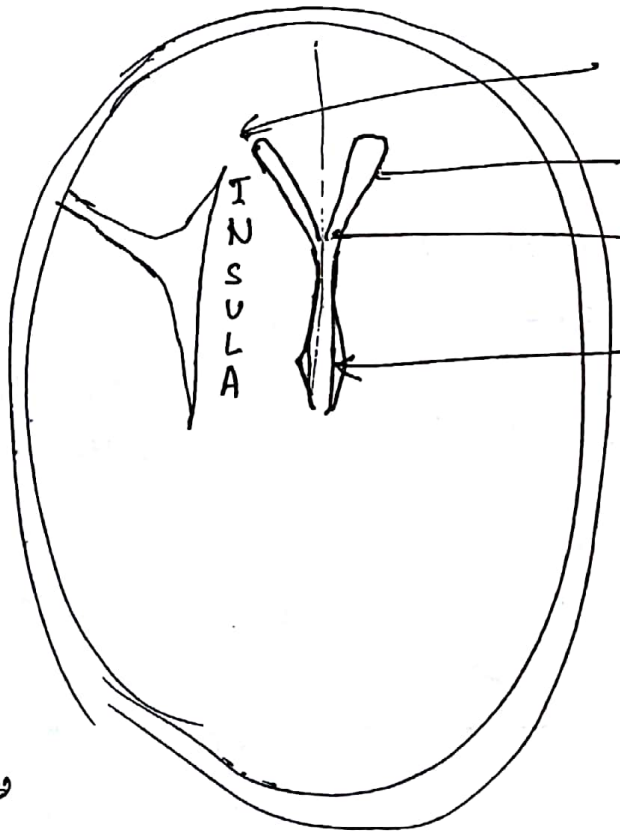
Kernohan's notch.

↓

tnt opposite to the side of Lesion (uncal Herniation)

FALSE LOCALISING SIGN

Weakness tnt on. ipsilateral side

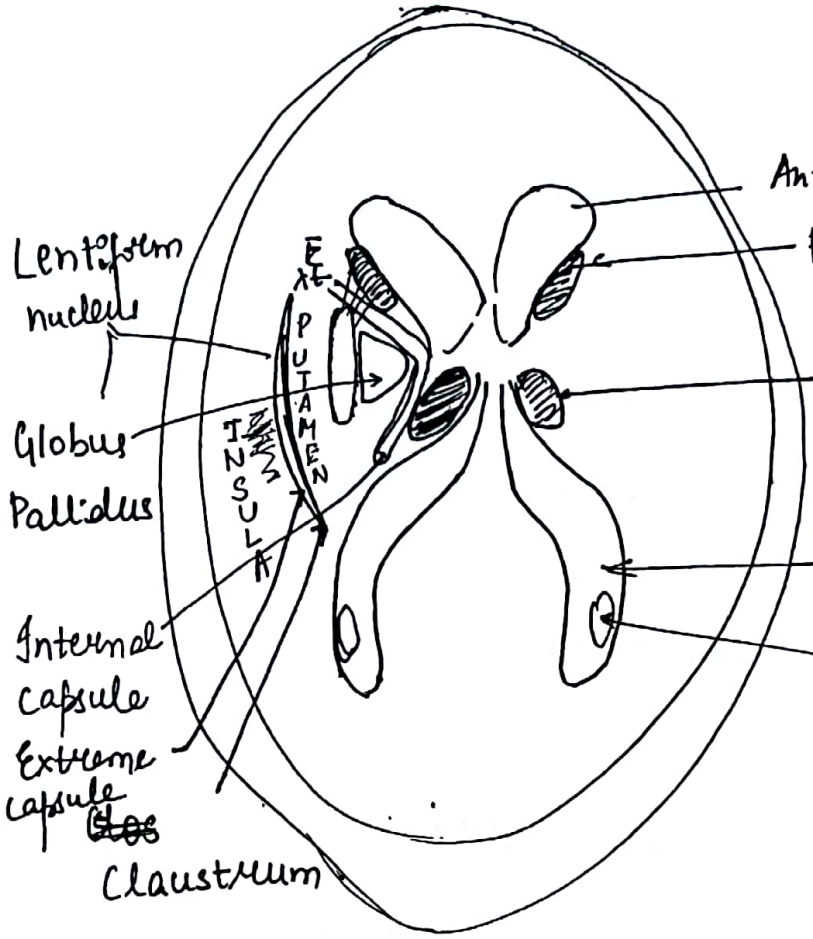


deep to sylvian fenure

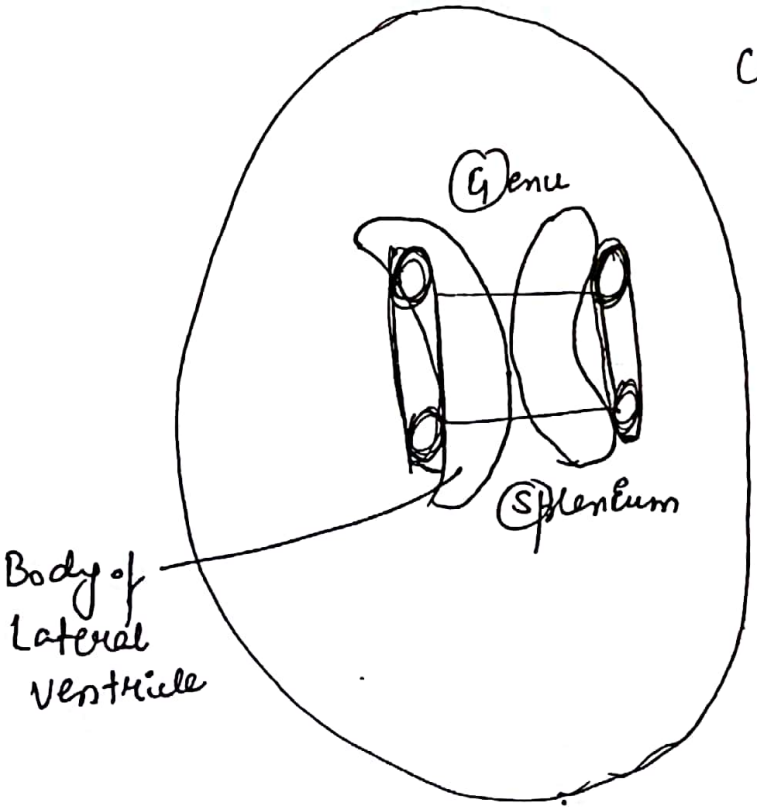
ant Horn of Lateral ventricle

Foramen of Monro

3rd ventricle



Putamen is **M/c Site** for HTN haemorrhage in Brain.



Corpus callosum separates the Lateral ventricles.

↓

In case of Agenesis of corpus callosum

↓

Parallel Lat. ventricle

"RACING CAR APPEARANCE

(Small Body + Big wheel)

SAH

Endovascular ~~clipping~~ coiling → by radiologist

↓

If coiling can't be done

↓

endovascular clipping by neuro s.x

VENOUS THROMBOSIS

Venous Thrombosis is found in Hypercoagulable state

↓

1) ♀

2) Nephrotic syndrome

Sup. Sagittal sinus Thrombosis

↓

cause B/L venous infarcts.

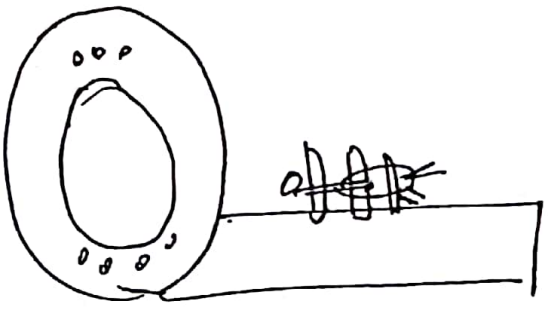
Venous infarcts are red infarcts. (Haemorrhagic)

arterial " are ~~white~~ pale infarcts.

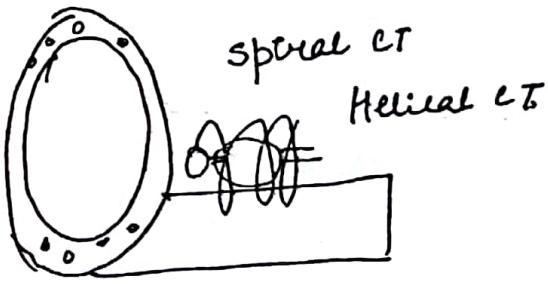
Internal cerebral vein thrombosis

↳ infarct of thalamus. (red infarct)

Sup. sagittal sinus is midline posteriorly placed



discontinuous data



continuous data

SLIP RINGS

CT Scan only can Axial (Transverse) Sections.

* Cardiac CT → done for coronary calcium scoring
"AGATSON's SCORE"

used for screening of atherosclerosis

~ 130 - cut off atherosclerosis

~ 400 - SEVERE

IOC for: Anomalous coronary origin.

ALCAPA - anomalous (L) coronary artery Pulmonary artery

⇓

MI in childhood

IOC: cardiac CT.

PYI
June 2015

Ionising Radiations:-

(1) α.
(2) β
(3) v
(4) x-ray
(5) IR
(6) light
(7) Sound

α - RAYS

→ made up of Helium nuclei He_4^{+2} – 2 protons → Heavy
2 neutrons → charged

→ LEAST PENETRATION
→ Maximum ionisation potential
→ ,, Biological Damage

β - RAYS

- made up of electron particles
- used in systemic radiotherapy

Iodine → thyroid.
phosphorus → Bone

γ - RAYS

High Energy High frequency electromagnetic waves "intranuclear".
Max. PENETRATION.

Tc 99M
Low energy
⇓
used in diagnosis

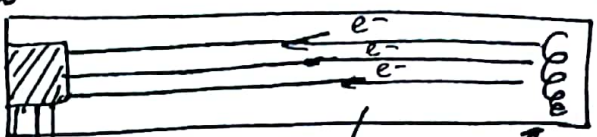
Co 60
High Energy
⇓
used in therapy

X - RAYS

High Energy, High frequency electromagnetic waves
" EXTRANUCLEAR " in origin
Not produced by Radioactive Decay

velocity of X-rays = 3×10^8 m/s

Wavelength of diagnostic x-rays. 0.1 to 1 Å.



Addison's effect
electron emitted through
Cathode

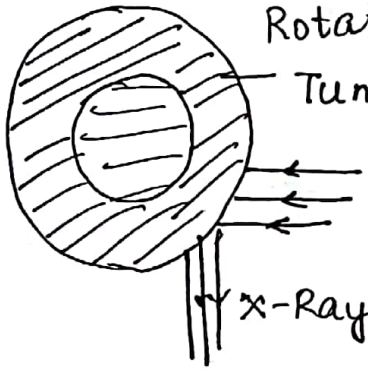
melting pt. = >3000°

* X-Rays are produced when rapidly moving electrons are halted. → kinetic energy is converted to X-Ray

BREHMSTRLANG X-Ray

↓

means ~~breaking~~ - BRAKING



Rotating anode.

Tungsten + 10% Rhenium.

X-Rays [continuous spectrum of energy].

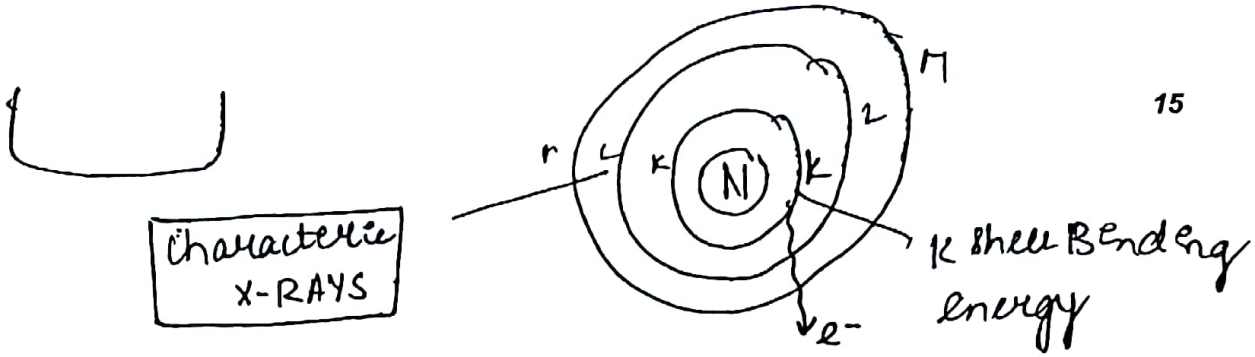
Mech. of heat loss in modern X-Ray = RADIATION.

R → Rotating anode
Rhenium
Radiation.

10^{-10} m = 1 Å

↓

diameter of atom.



Characteric X-RAYS

Low energy X-Rays → no imaging

Intermediate → cause ejection of electron from K

↓

e⁻ from L shell to K shell

↓

Energy released

[characteric X-Rays]

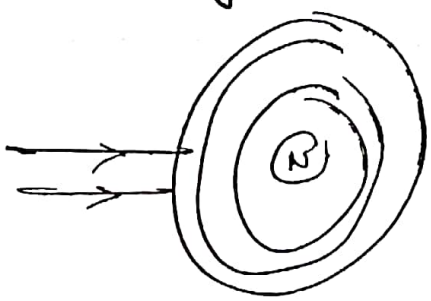
Photoelectric effect [occuring on K shell]

Leading to formation of characteristic image on film.

↓

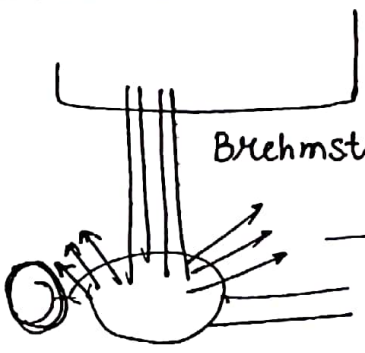
Image formed is Latent Image

High Energy X-rays —



Random scattering of electrons from outer shell due to high energy X-Rays

COMPTON EFFECT



→ these lead to exposure

Thickness of Pb apron = 0.5mm thick

Badge on chest - TLD Badge

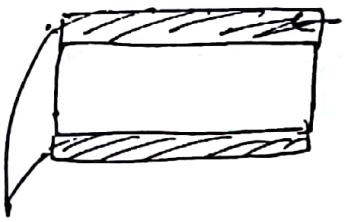
↓ for Radiation Dose Monitoring

Thermoluminescient Dosimetry

check every 3 months

Max. permissible dose of radiation for occupational diseases.

20 msV / Annum.



Photosensitive emulsion

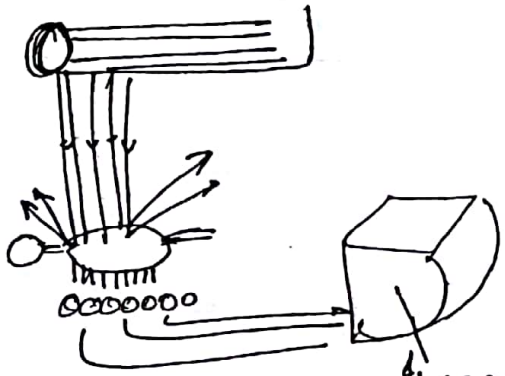
↳ AgBr + Iodide

Double Coated film.

Most sensitive to → Blue Light

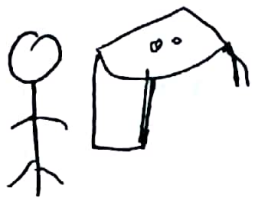
Least " " → Red Light

In Dark room, safe Light = Red Colour



Digital

Image can be processed → post



KVP

Kilovolt Peak

K = contrast

V = voltage

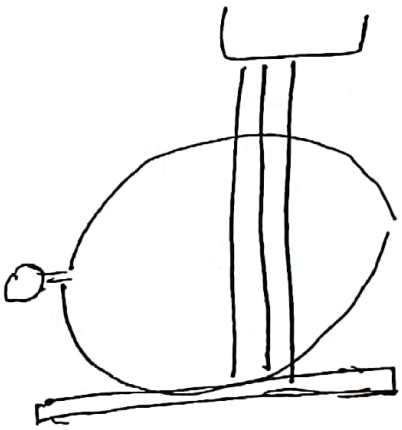
P = Penetrating power

MAS

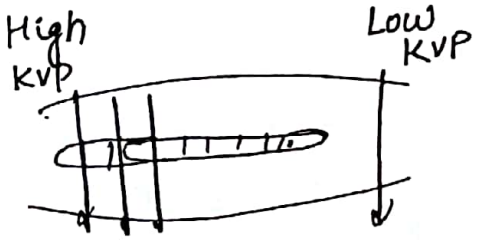
Miliampere second

Blackening seen in the ~~melk~~ film.

Radiation Dose received by patient



Obese → KVP have to be ↑

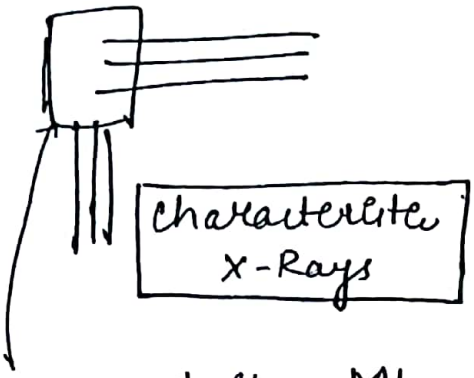


Contrast $\alpha \frac{1}{KVP}$

Penetration α KVP

Mammography

~~Made~~ → Target is made up of Molybednum.



When e^- strike Mb → they enter Mb

↓

release of e^- from inner shell → characteristic rays

Low voltage

Routine mammography → CC [craniocaudal]
MLO [Mediolateral oblique]

Single Most Imp. X-Ray in Breast
= MLO

Mammography films = Single coated

Radiation exposure in mammography = More than CXR.

~~ROOT~~

Routine Screening for Ductal carcinoma in situ
= Mammography

ACR = 40 yrs - annual mammogram

American Cancer Society = 45 yrs (Better)

IOC for High Risk Screening DCIS ⇒ MRI

MRI → DCIS = microcalcification ⇒ False

↳ Ductal enhancement.

↓

Also seen in Perimenstrual ♀ - Physiology.

↳ False ⊕

Breast MRI ⇒ Done in 2nd Week.

Most sensitive Inv for DCIS ⇒ MRI

IOC for Breast Implant → MRI evaluating

IOC for Breast Abscess → USG.

IOC for Scar vs recurrence - MRI.

IOC for Solid vs cystic - USG

IOC → Lump young ♀ = USG

USG has poor sensitivity for DCIS.

capsule formed → Implant

If Both ruptured

↓

Implant would go in Breast parenchyma

↓

Inflammation

↓

♀ presents ⊕ inflamed Breast

Intracapsular Implant rupture in USG.

↓

STEP LADDER PATTERN

↳ step ladder pattern in abd → Small Bowel Obstruction.

BIRADS

Breast Imaging Reporting & Data system.

↳ By american college of Radiology

PIRADS → Prostate

TIRADS → Thyroid.

LIRADS → Liver

BIRADS	0	Inadequate for opinion. Advise - USG. Mammography	
BIRADS	1	Normal	Continue routine screening.
BIRADS	2	Benign	
BIRADS	3	probably Benign. ↓ Short term 6 month follow up	< 2% chance of malignancy
BIRADS	4	Suspicious of malignancy	

a = low

b = intermediate

c = high

BIRADS 5 s/o malignancy } > 95%

BIRADS 6 K/c/o Biopsy proven malignancy

BIRADS –

a) mammo

b) USG

c) ~~MRI~~ MRI

d) all of above

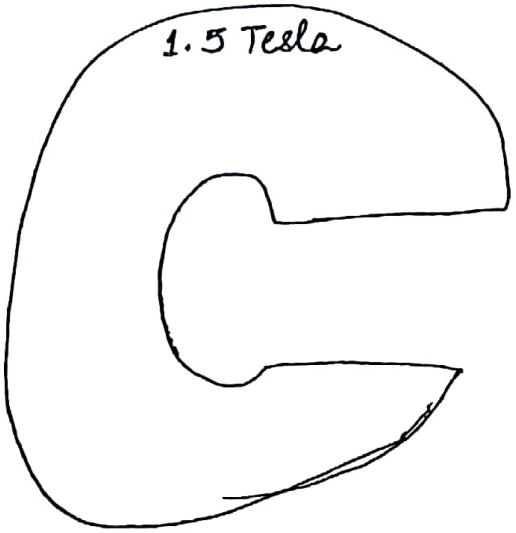
Q ♀ multiple Breast Lesions –
one – benign.
other – malignant

BIRADS –?
↳ Single impression based on most malignant lesion.

BIRADS used in (MRI) different from mammography.
↓
Each Breast given separate BIRADS

MRI

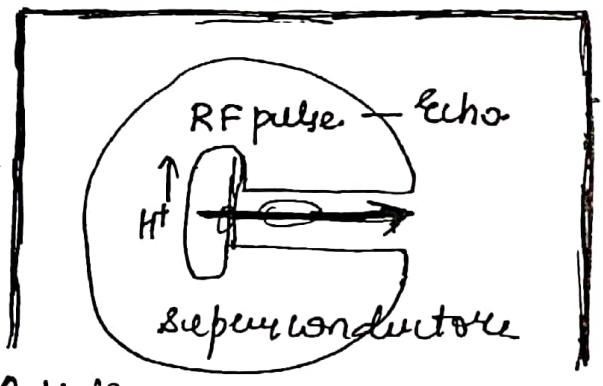
Q. MRI magnet is switched off in bet" study ?-
↳ False. ↓ always on.



Mg. field strength = 1.5 Tesla
" " " of Earth
= 50 mT.

In 3T MRI ⇒ twice Mg field
⇒ Better Image Quality

7 Tesla & 0.5 Tesla are also in research..



MRI room setting :-
copper meshwork
⊖ FARADAY'S CAGE

⊖ Helium Liquid

H^+ protons → "DIPOLE"

H^+ ions get alligned in our body according to Magnetic field

RF pulse when introduced — H^+ ion will go towards RF pulse

When RF pulse switched off → H^+ comes back to its normal position.

Spin lattice Relaxation Time-

↳ Time required by H+ to return to (N) position

T_1

Spin lattice relaxation Time

T_2

Spin spin relaxation time

T_1-WI → Based on spin-lattice relaxation time

T_2 WI → Based on spin-spin relaxation time

T_E Echo time — short — T_E = Long

T_R Repetition Time — short — T_R = Long

Relative C/I

↳ Claustrophobic

MRI- safe in ♀,

	T_1 WI	T_2 WI
① CSF	Dark	White
	Hypointense	Hyperintense
② FAT	White	Less white

Equally Hyperintense on ③

③ Cortical Bone Ca^{2+}	Dark	Dark
④ AIR	Dark	Dark
⑤ Tendon Ligament Meniscus	Dark	Dark
⑥ Hemosiderin.	Dark	Dark
⑦ Flowing Blood	Dark	Dark. Flow void. ⑧

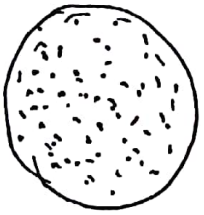
⑧ if loss of flow void → Thrombosis

⑧ Calcification & Hemosiderin.

~~not~~ ~~visualised~~ in MRI.
can't be differentiated

↓

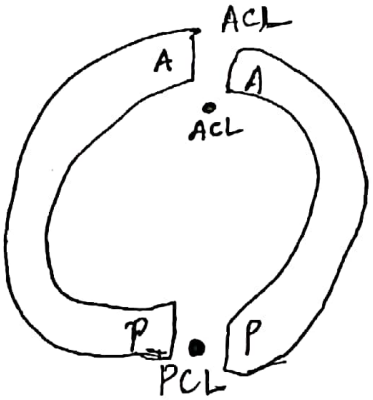
To differentiate them
Susceptibility weighted Imaging (SWI)



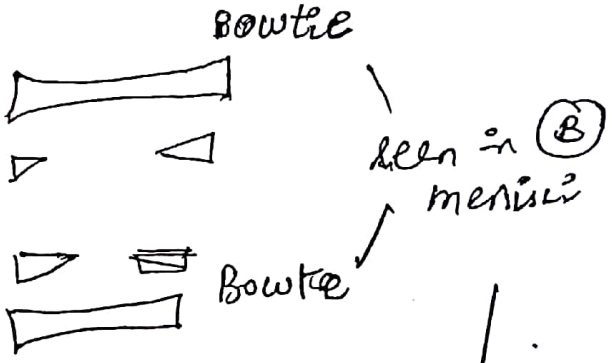
salt & pepper appearance on MRI ⇒ GLOMUS TUMOUR.

↑
Vascularity.

	T_1 WI	T_2 WI	FLAIR
CSF	Dark	white.	Dark (free water)
Oedema	Dark	white (preferred in Brain pathology)	white ★
Melanoma (Melanin) (Magnete)	white	Dark	



When A & P Horn are same
↳ Lateral Bow Tie



absence of Bow Tie
= Meniscal Tear.

Cartilage is seen on HRI.

ACL → from intercondyle to Ant. Tibia.

Cinema Hall Pain-
due to Chondromalacia patella
↓
seen- Behind the patella → patellar cartilage softening up.

PATELLA ALTA :-

Patella Higher than the (N) position

PATELLA - BAJA :-

Patella Lower than the (N) position

STIR MRI → for Bone oedema.

↳ Short Tall Inversion Recovery

	T_1 WI	T_2 WI	STIR
Marrow →	White	White	Dark
oedema →	Dark	White	White

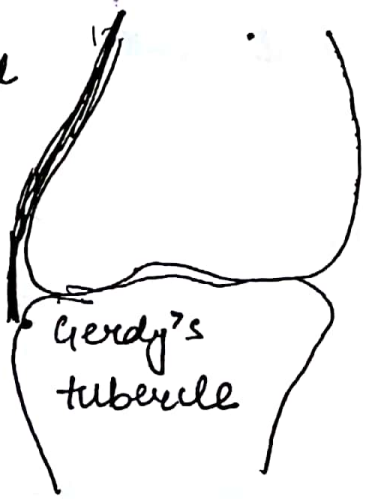
Suppress the signal of marrow fat

Injury to medio-collateral Ligament ⇒ conservative Management

More commonly injured

Degenerated tendon of adductor Magnus

Iliotibial Tract



Bankart's Lesion
↳ Seen in antero-inf. glenoid labrum.

Hillsach's Lesion
↳ seen in postero lateral Humerus

Reverse Hillsach → antero-medial
In post-Dislocation

Hatchet Defect → In. Ankylosing Spondylitis

Supraglenoid labrum ⊕ → related to Long Head of Biceps.

1st Inv to be done in rotator cuff tear = USG
IOC for rotator cuff tear = MRI
Gold Std " " " = Arthroscopy

CT
Ac. Head Injury
Ac. Brain H'ge
Calcification
IOC

Neurological
↳ MRI

Cortex of Bone → Seen better in CT Scan
So, for # → CT,
for Marrow → MRI.

Stress # → may or may not be cortical #
So, Better seen in MRI

B/L multiple stress # → Bone Scan

IOC for Acute OM ⇒ MRI.

Intraosseous Bone Tumours ⇒ MRI

AVN ⇒ MRI

Q. Chronic alcoholic taking Italian Red wine developed necrosis of corpus callosum. ∴ Syndrome?

"MARCHIFAVA BIGNAMI"

LIPOMA in Brain? Yes

↓

only congenital

M/c Site of Lipoma in Brain = **Pericallosal**

( ) → Bracket shaped calcification

M/c Pineal Gland Tx = Germinoma

Pinealoblastoma → associated ∵ Retinoblastoma

Pineal is located in post. part of 3rd ventricle

↓

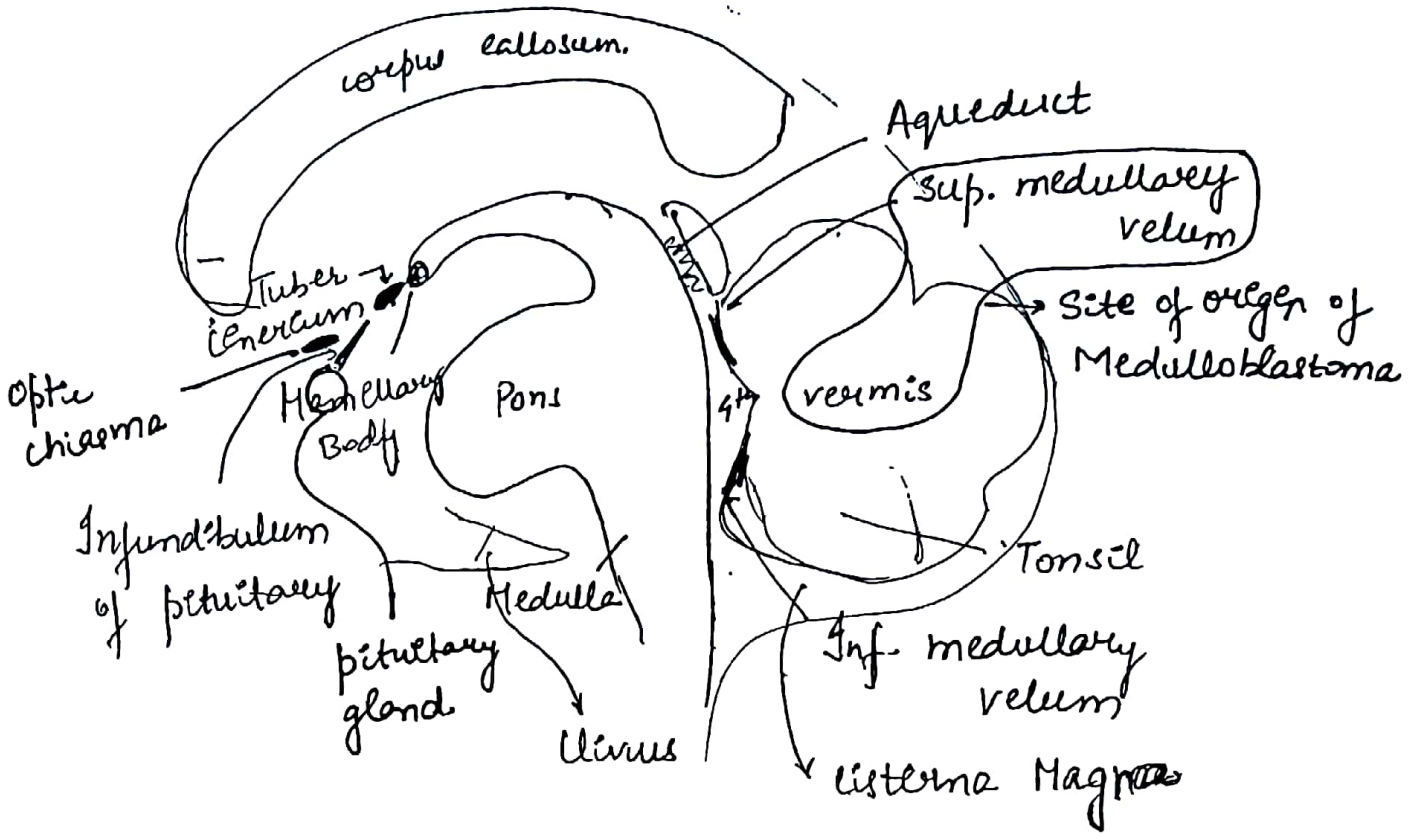
Compress Sup. colliculus ∴ is required for vertical gaze

↓

So, in pineal enlarge, compress Sup. colliculus

↓

PERINAUD Sx (upward Gaze Palsy)



Tuber cinereum

↳ ant to mamillary Body

↓

Hypothalamic Hamartoma → ① Present ⊼ Precocious Puberty

② Gelastic seizure.

↳ Bouts of Laughter.

On MRI

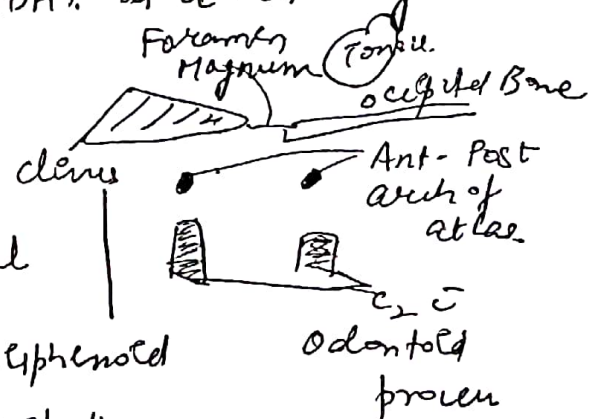
( ) ↳ white spot

pituitary gland ↳ Post-Pituitary

↳ appears white due to vasopressin (ADH). as it has magnetic properties.

CV Jun" (Cranio Vertebral)

Clivus + Vertebra + occipital



Btw basisphenoid & basiocciput

Tonsil is above the level of foramen magnum

* Small Posterioure Fossa

Tonsil goes below foramen magnum
↓
Tonsillar Herniaton.

Chiari - I Malformaton.
+
Spina Bifida / myelomenengocele

Arnold chiari malformaton
Chiari - II Malformaton

Q. Y ? When chiari I malformaton will present to hospital ?

ans 2nd Decade → SYRINGOMYELIA

↓

CAUSES

Tx | Trauma | TB.

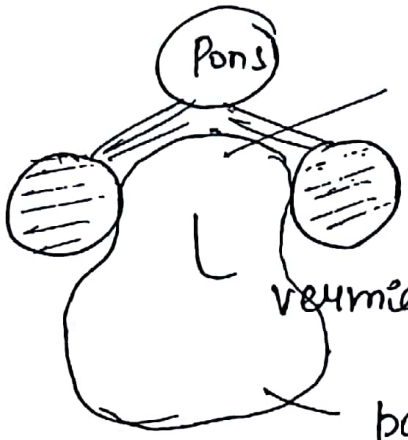
Arnold chiari malformaton.

↳ LEMON SIGN } in antenatal USG
BANANA SIGN }

TECTAL BEAKING →

LUSCHKANDEL SKULL → learner skull

DANDY WALKER



4th ventricle freely communicate ⊂ CSF filled space behind cerebellum

vermian agenesis

post. fossa cyst

♀ presents. quadriparesis.

CONG. C-V Junc" Ab(N)

* Rheumatoid arthritis → inflammation of synovium in C_1-C_2 region.

↓

Distance Bet" atlas & axis ↑

[atlanto-axial Dislocation].

↓

pressing on spinal cord

* Upward migration of odontoid process into foramen magnum → BASILAR INVAGINATION

* DOWN'S SYNDROME

CV Junc" abnormalities (+)

So, before Operating → X-Ray Neck is imp. in Down's syndrome

↓

to look for CV Junc" Abnormalities

MORQUI Syndrome
Mucopolysaccharidosis
↓ Jun" ab (N) (+)

OSTEO-MALACIA
Softening of Skull Base

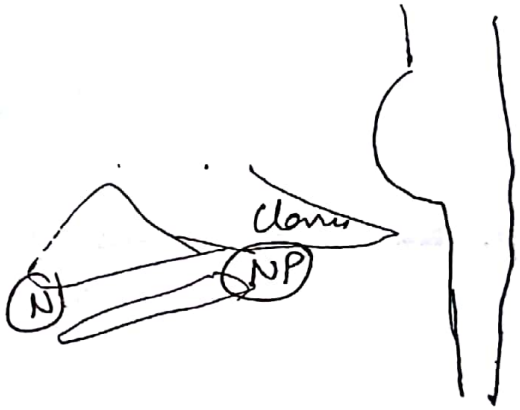
Osteogenesis Imperfecta

Paget's Disease

Clivus [Skull Base Ab (N)]

CHORDOMA

① Remnant of notochord may form Tx
② M/C → Sacrococcygeal area
③ also seen in clivus
④ Physalliferous cells
↳ cell of notochord

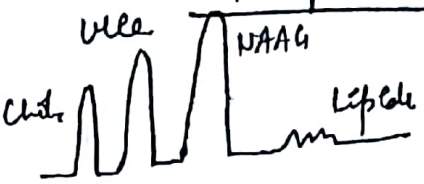


Radiotherapy

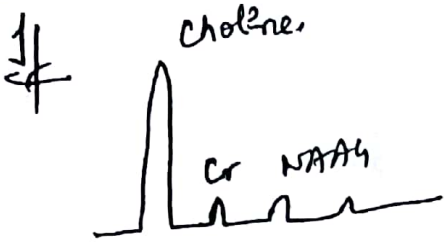
Congenital Midline Cyst / Thornwaldt Cyst
↓
Pharyngeal endoderm comes & to join notochord

MR Spectroscopy

(N)



(I)

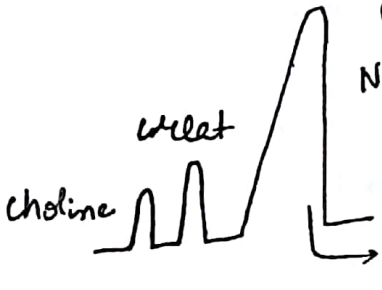


choline ↑ → ↑ cell membrane ⇒ Malignancy

Creatinine ↓ → metabolism ↑

NAAG → glioma as no neuron tht

(II)



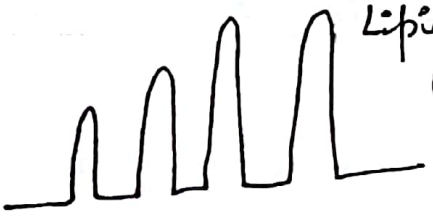
→ elevated levels of NAAG

NAAG is metabolised by Asparatocyclase

So ↑ NAAG → ⊖ of asparatoacylase

. CANAVAN'S Sx

(III)



Lipid ↑ ⇒ TUBERCULOMA.

↳ necrosis

Alanine Peak on HR spectroscopy ⇒ MENINGIOMA

DW- MRI

Based on Brownian ~~Imaging~~ Moton →

Ischaemia → ATP ↓ → Na^+/K^+ ATPase stop working

↓

neuron swelling

(cytotoxic oedema)

↓

Endothelial cells damage

↓

Vasogenic oedema ← on routine CT/MRI

appears on 6-24 hrs

3-30 min. of onset → ↓ by DW-MRI.

use of thrombolysis can be done

Functional MRI

MRCP

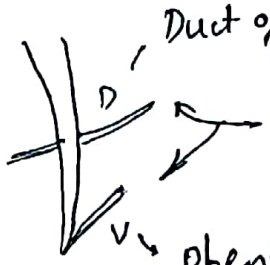
IOC for choledochal cyst → MRCP.

Chain of ~~them~~ Lake appearance → on chr. Pancreatitis

Linear filling Defect in Bile Duct = Worm

↓

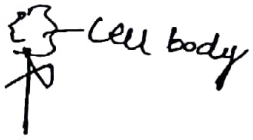
Biliary Ascariasis



- Minor papilla is ~~small~~ narrow, so there is not much space for drainage
  ↓
  presents ~~chronic~~ recurrent Pancreatitis

Diffusion Tensor Imaging

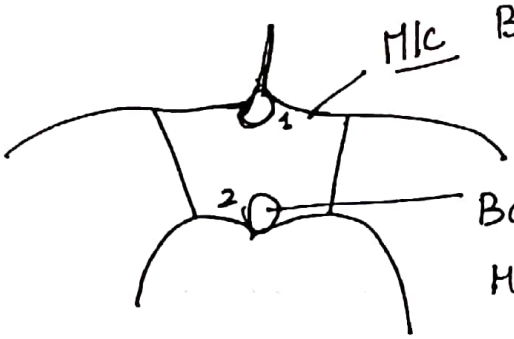
Pt. underwent RTA 1 month back, since then he is comatose → CT scan looks (N)



↳ Diffuse Axonal Injury

M/c site → Grey-white Junction

By Diffusion Tensor Imaging → can be Δ



MR angiography is used to screen cerebral ~~angiography~~ aneurysm

IOC for cerebral aneurysm → CT scan.

ADPCKD → have more chance of Berry aneurysm
MR angiography for screening

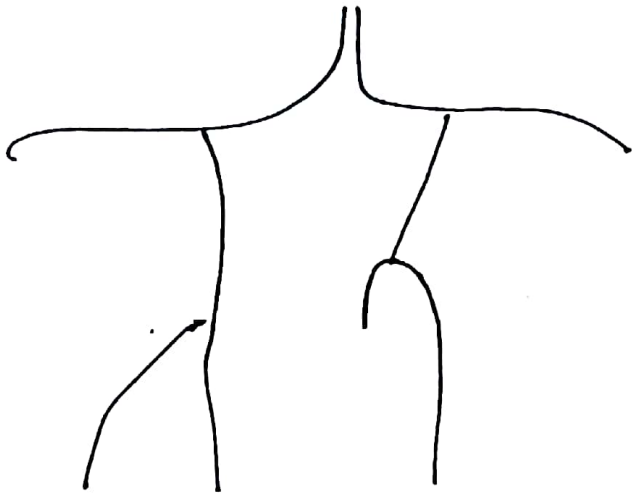
Single ACA → Azygous ACA

↓

If thrombosis occurs

↓

B/L infarction [B/L infarct seen in venous thrombosis]



Fetal PCA

↓

Blood supply from Int carotid artery

Thalamus derives blood supply from PCA

In case of fetal PCA

↓

If thrombosis occurs

↓

B/L thalamus infarct.

Artery of Percheron → D/D

Internal venous infarct.

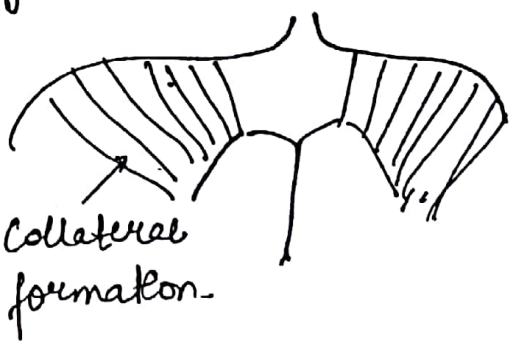
Recurrent artery of Heubner
↓ ↳ Branch of Ant cerebral artery
commonly injured by Sx while clipping ~~Ant~~ Ant. cerebral artery aneurysm.

area supplied by recurrent artery of Heubner

Q Pt develops ~~supraglenoid~~ supraclinoid ICA stenose.
Idiopathic + progressive
↓
collateral formation occurs gradually

MOYA-MOYA DISEASE.

Puff of smoke appearance



MR Venography

* **Veen of Galen malformation**

Congenital AV fistula in mid Brain.

↓

Veen of Galen dilated

↓

Hydrocephalus

↓

High output Cardiac failure

IOC = MR Venography

Dye

CT Scan ⇒ Iodinated contrast

↳ radio-opaque

~~H/c + Soft tissue F*~~

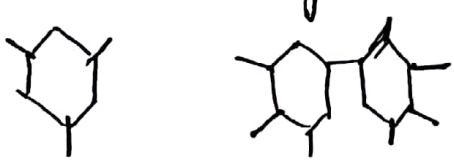
Most radio-~~opaque~~ dense soft tissue of Body

= THYROID

Iodinated contrast

- Ionic
  - Monomer
  - Dimer
- Non-Ionic
  - Monomer
  - Dimer

Depending on Benzene Ring ← Monomer / Dimer



Iodine : Particle ratio ⇒ 3:2 (Monomers) 1400-6600 mosm

" " ⇒ 6:1 (Dimers) 600-800 mosm.

not used nowadays due to ↑ osmolality → Anticoagulant Property (Desirable)

Monomer

Urografin, Gastrografin → Diatrizoate

Conray → Iothalmate

Dimer

Ioxaglate

Used for long angiographic procedure (Low osmolality + anticoagulants)

Non-Ionic

Monomer

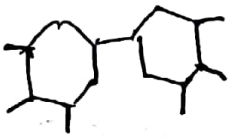
Iodine : Particle ratio

3:1

eg

- Iohexol
- Ioversol
- Iopamidol

Dimer



Iodine : Particle ratio

6:1

300 mosm (isosmolar)

- Iodixanol
- Iotralan

Idiosyncratic

Direct ↑ Histamine release

Anaphylactoid Rxn.

Non - IgE

Adrenaline - life saving

Test Dose prediction → No

Tubulointerstitial Injury

Non-allergic Nephropathy

Transient

Contrast Nephropathy ↑ ,

Rise in S. creatinine at least 0.5mg or 25% baseline measured after 48 hrs.

Prevention → Hydration

use non-ionic dye

[N-acetyl cystein] ~~drugs~~
[Sod. bicarbonate]

Preserve Trial

2018 → No role of N. acetyl cystein & Sod. Bicarbonate.

GODOLINIUM -

used in MRI

Lanthanide

Para - Magnetic substance → Unpaired electron in outer shell ⊕

Reduces T_1

CE MR → ~~①~~ T_1 wt . ② T_2 wt ③ FLAIR

It is used as chelated form → Gd-DTPA

Gadolinium in itself is toxic substance.

Crosses placental Barrier →

Teratogenic

↓

Should be "avoided in ♀."

Gd-DTPA

↓

Renal Excretion.

If eGFR. < 30 mL/min in CRF

↓

Gd accumulate

↓

Painful, multisystem febrotic

FATAL

↓

Nephrogenic Systemic Fibrosis

In case of renal failure → plain MRI., CT.

Gd-DTPA → doesn't cross BBB

If there is inflammation in Brain or aggressive neoplasm.

↓

they take up dye

Determinant of enhancement in Brain → BBB

* other tissues → vascularity

CXR

28/3/18

True or False

1) CXR-(PA) view is mandatory in RTA ⇒ FALSE.

↓

CXR-AP view - True

2) AP-CXR.

a) Erect

b) Supine

c) Both.

AP & PA views are according to rays.

Lateral & Oblique views are according to films kept

(R) side → Rt lateral

By default if side not mentioned ⇒ Left Lateral

Steeple Sign on Neck X-Ray = CROUP

Measure the Dist Bet" spinous procen and medial end of clavicle · should be equidistant

↓

If not, called ROTATION

Rotaton of on CXR –

a) Asymmetry in lung lucency & can be mistaken as pathology

b) Asymmetry – HILAR

c) Apparent cardiomegaly

Apparent cardiomegaly in CXR is due to

1) supine view
2) expiration view
3) Rotation

* Hilum = Bif. of Pulmonary artery + upper lobe vein

↓

L.N.
Tx
Dilatation of P. artery

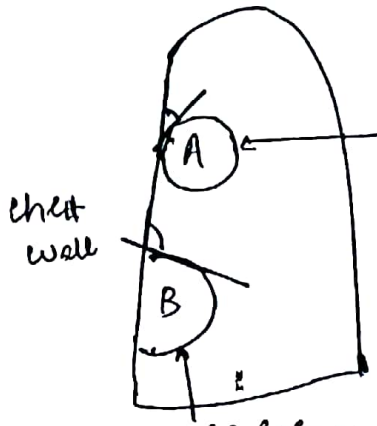
If L.N. +nt → Hilum will not be concave
It will be convex.

Bronchovascular markings are usually not in. Medial 2/3rd of Lung

Plethora = ↑ BVM
= > medial 2/3rd of Lung

Air Bronchogram seen in Pneumonia

Fluid Detected By X Ray =	100 - 200 mL (150 mL)



[obtuse ∠ ē chest wall]

Vanishing Lung :- BULLA.

~~Visceral pleura~~ not ~~coast~~ contour not parallel to chest wall.

Vanishing Pleura Line Sign Absent

* RTA ē Blunt ~~Ad~~ Abd. Trauma → 1st STEP evaluation

FAST → focused Assesment ē Sonography in Trauma

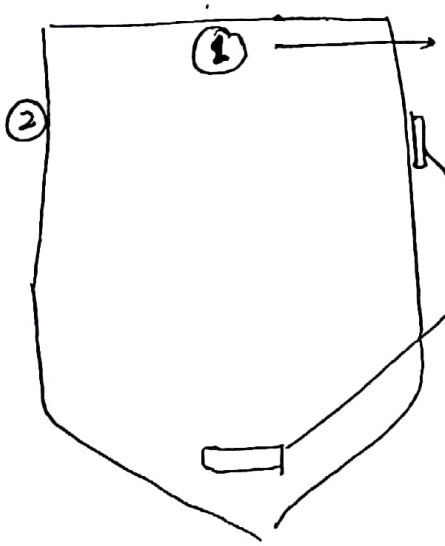
⇓

→ Done By ER. Physician.

→ Take under 5 min.

→ Hemoperitoneum.

↳ How much Blood can be detected by FAST
>200 mL (50-250 mL)



1st - epigastrium - For cardiac Tamponade

2nd → Ⓡ flank = for morrison's pouch.

3rd → Ⓛ flank = for splenic Blood

4th → - for Pelvic collect

ℓ FAST = extended FAST
for thoracic evaluation.

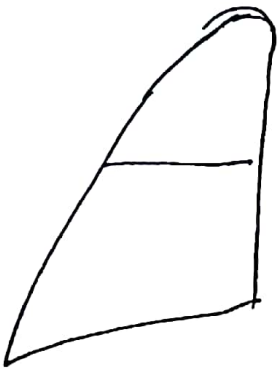
Hemothorax ← → Pneumothorax

IOC for Blunt Abd. Trauma = CECT.

FAST is 1st Inv.

~~USG~~ in.

IOC for Blunt Abd. Trauma, haemodynamically unstable = FAST



COLLAPSE OF LUNG

→ Loss of aeration.

→ Evidence of volume Loss

↓

Trachea

mediastinum.

Fissure

In children. collapse of lung → F.B.

In chronic smoker → Bronchogenic Cancer

SILHOUTTE SIGN

Mediastinal Border can ~~be~~ only be obscured by pathology & are in direct contact anatomically.

Q. Aortic knob is ~~obtd~~ obscured by

(a) LUL - Ant

~~(b)~~ LUL - Post

(c) lingular

(d) LLL.

Aortic knob is in post. part
↳ Application of silhoutte sign.

(.....)- aortic knob[47]
↓
Posteriormost part of aortic arch. from where descending aorta is visible

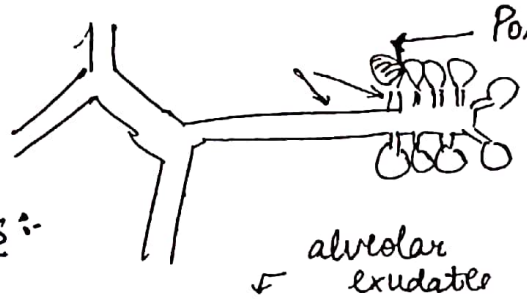
* Lingula is part of (L) upper Lobe

- LUL collapse
oblique fissure go anteriorly
Hyperinflation of lower lobe

LUL-collapse → not easy to see as. hyperinflation of LL obscures collapse of UL

Difference B/t Collapse & Consolidation
↓ ↓
Vol. Loss Vol. maintained

Q. Air Bronchogram is a sign of Alveolar Pathology



Pus spread through pores of Kohn & not by Bronchus.
⇓
So, Disease involving alveoli & not Bronchus

Causes :-
1) Pneumonic consolidation
2) Pulmonary oedema = alveolar fluid
3) Hyaline Membrane Disease
↳ alveoli collapses due to absence of surfactant but bronchus don't ⇒ air Bronchogram

If Bronchus is occluded ⇒ (B) alveole + Bronchus occluded

⇓

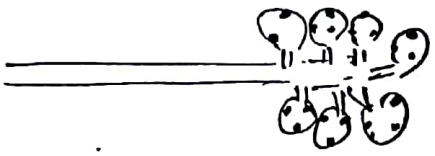
So, no air Bronchogram

⇓

* Air-Bronchogram usually absent in Bronchogenic Cancer exception. (I) adeno Ca in situ (Broncho-alveolar Ca)

Pre-invasive

Adeno Ca in situ



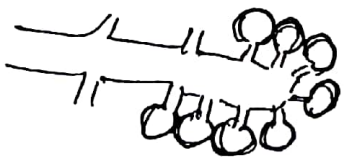
← architexture is maintained only alveole involved

(II) Pulmonary Lymphoma

Interstetial Pneumonia

* Viral Pneumonia
  Mycoplasma
  Pneumocystis carini pneumonia

} ⇒ alveole of wall are thickened
No alveolar exudate



= RETICULAR OPACITIES on CXR

Interstitial Lung Disease

Silicosis
Sarcoidosis

⇒ thickening of alveolar wall is even more

⇓

RETICULONODULAR OPACITIES on CXR

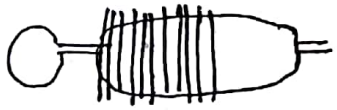
HONEY COMB LUNG - Irreversible changes in ILD.

IOC for ILD = HRCT

Thickness of section = 1-2 mm
These section are widely spaced
Then reconstruct image by Bone Image Reconstruction Algorithm.

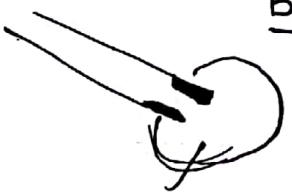
Q. HRCT of Lung Impice
a) Thick slice thickness
b) Large field of view
c) Bone algorithm.

IOC for Bronchiectasis = Volumetric HRCT



Thin contenuous section
↓
It enable 3D reconstruction of image

BALL VALVE MECHANISM



air cyst
(Pneumatocele)

In some Bacterial pneumonia
↓
air gets trapped inside, so air cyst formation occurs

1) Staph. Pneumonia
2) Klebsella
3) Hydrocarbon poisoning
4) Lung injury.

(5) Pneumocystis Jirovecii

Pneumocystis Jerovecii

= Reticular ~~pattern~~. opacities.

= Pneumatocele

~~LN~~

~~Pl. effusion.~~

ASPERGILLUS

1) Immunocompromised

↳ Angio-invasive aspergillosis

↓

Red infarcts formed around fungal

→ CT = HALO SIGN

Reverse Halo Appearance on CT Scan = ATOLL SIGN

ATOLL

(Reverse Halo)

↑

Cryptogenic organising Pneumonia

(Bronchiolitis obliterans)

Halo

↑

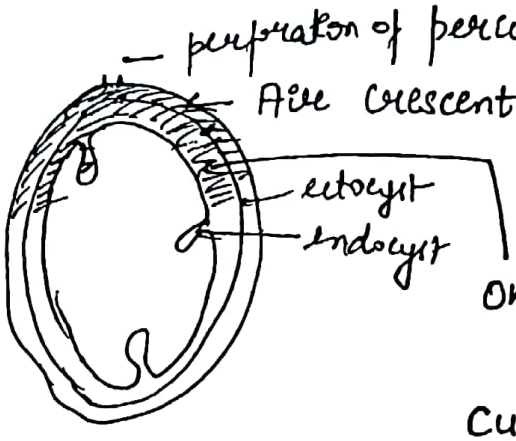
Invasive aspergillus

HYDATID

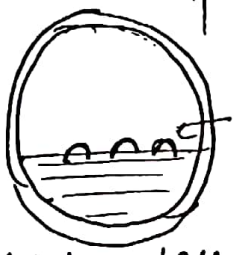
1) IOC = CECT.

2) "GHARBI" classification → USG HYDATID
(egypt endemic for Hydatid)

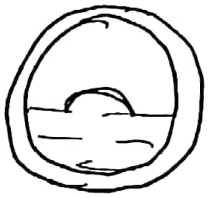
3)



If only endocyst ruptures but outer layers are intact
↳ fluid comes out



Water-Lilly sign = CAMALOTE SIGN



Rising sun sign

SIGNS ON X-RAY DEPENDENT ON ± LAYER PERFORATES

Outer Layer → air crescent sign.

Outer 2 Layers → oncon-peel

Innermost layer → ~~oncon peel~~ water-lilly or camalote sign.

DUPLEX DRAINING SYSTEM

① M/c cong. anomaly of upper urinary tract

② Weigert-Meyer Law = upper moiety drains lower in the UB → hydronephrosis → Paper thin cortex.

③ upper pole is more prone to obstruction & lower pole more prone to reflux. = DROOPING LILLY SIGN // Non-functional upper pole

④ If ureter get fused. ureteral ureteric reflux may occur YO-YO REFLUX.

Q. all these are features of CXR - HYDATID except.

a) water lily

~~b)~~ drooping lily

c) floating lily

d) Rising sign

~~Alveolar~~

Q. 21 yr old male c haemoptysis & X-ray → Canon-Ball

a) TB

~~b)~~ Testicular Tx

adolescents :-
Osteosarcoma

child :- Wilm's Tumour.

Neuroblastoma goes to Bone.

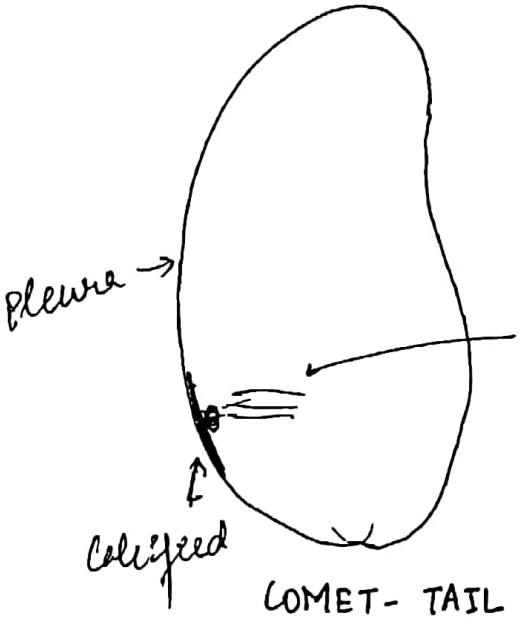
STAGING OF SARCOIDOSIS ON CXR (SCADDING'S)

① LN - 1

② LN + Parenchymal - 2

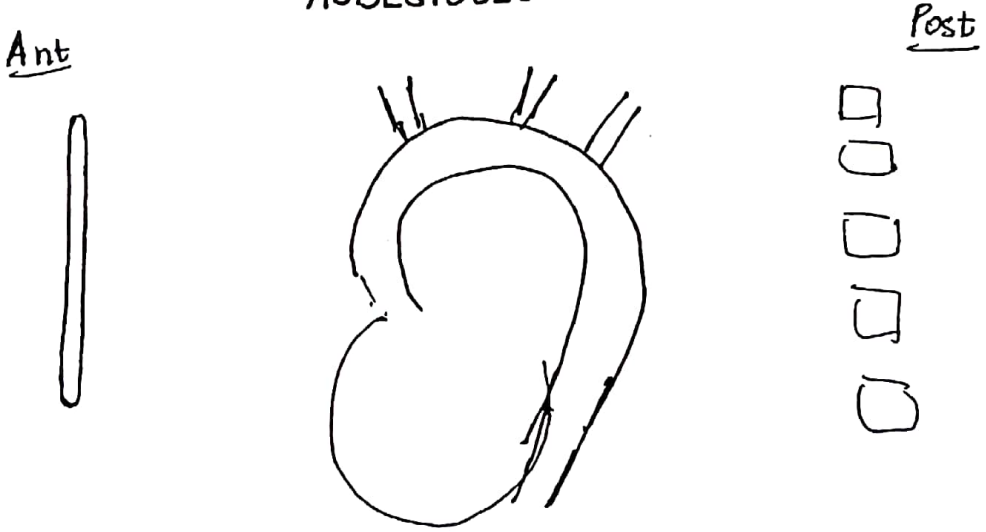
③ " Parenchymal - 3

④ Fibrosis - 4



ROUND 'ATELECTASIS'
Pleural Pathologies

COMET-TAIL SIGN on CT.
↓
ASBESTOSIS



Innominate artery

① Brachiocephalic artery

② common carotid

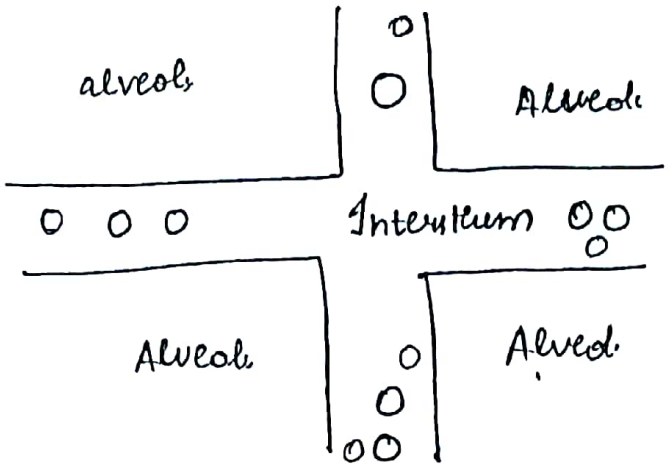
③ L. subclavian

④ Trachea.

⑤ esophagus

LV

LVF



PCWP↑
↓
~~Fluid in alveoli~~

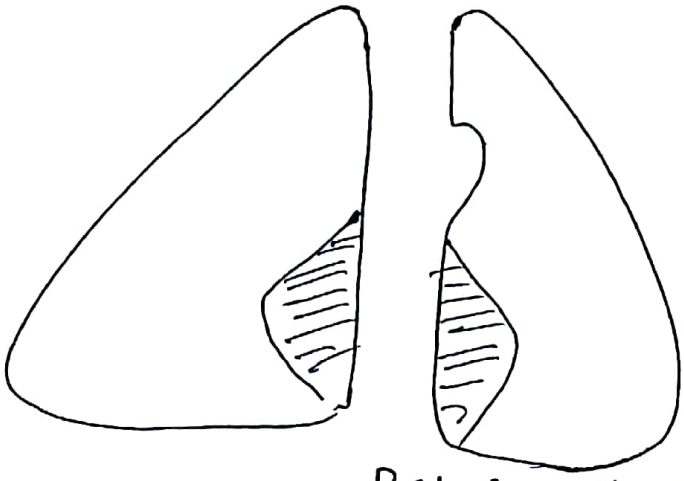
PCWP↑
↓
Fluid around ~~vessels~~ capillaries in lower lobe (LL)
(This ↓ gas exchange)
↓
Hypoxia develops in LL
↓
Vasoconstriction
↓

1st CXR = CEPHALISATION OF BLOOD FLOW

③ KERLEY A Lines

Phantom T_x = Thickening of Horizontal fenure

② LL lymphatics get [Kerley B Lines] = Horizontal lines at lung base ~~from below~~
engorged



Batwing appearance : Alveolar oedema

8-12 mm of Hg = (N) PcWP

13-19 mm Hg = Perivascular cuff → cephalisation of Blood flow
'LOWER LOBE'

20-24 mm Hg = Interstial oedema Kerley B
A
Phantom T×

>25 mm Hg = Alveolar oedema Batwing
Pleural effusion

ARDS

non-cardiogenic Pulmonary oedema

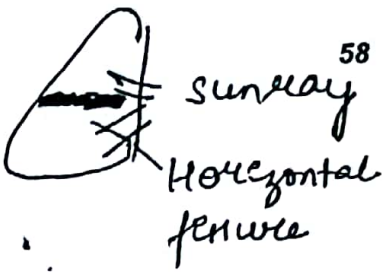
PcWP → (N)

Here, Pulmonary capillaries permeability ↑

⇓

No LL dominance
Here Diffuse Opacity occurs
No cephalisation
Cardiac size - (N)

NewBorn comes ☂ sunray appearance at hilum. + Thickened by Horizontal fissure

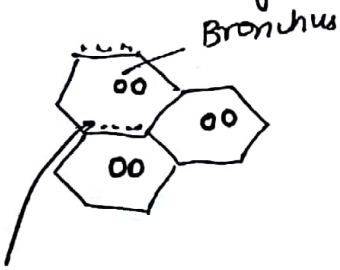


⇓

TRANSIENT TACHYPNOEA OF NEWBORN
upto 48 hrs - CXR

sunray appearance are due to lymphatics engorged

Smallest unit of lung ☂ is CT visible
= 2° Pulmonary Lobule

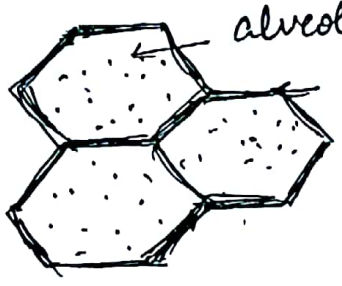


Centrilobular (Ds)
Endobronchial TB

Lymphatic (Any Disease)
Interlobular septa
⇓
Septal Lines on CT
= Kerley B Lines on CXR

KERLEY B LINES CXR. (Septal Lines on CT)

1) LVF
2) Sarcoidosis → nodules are around in lymphatics
3) Lymphangitis Carcinomatosa - cancer spreading through lymphatics of lung
⇓
Lymphatics are involved in all the 3.



alveoli filled ↓ surfactant like lipoprotein
↓
ground glass appearance

Thickened septe

ALVEOLAR PROTEINOSIS

↓

CRAZY PAVEMENT

RHD

Left Atrial enlargement ⇒ straightening of Ⓛ Border

↓

Ⓛ auricle ↓ present below MPA

Q. Earliest - CXR - RHD.

ⓐ straightening of Ⓡ Heart Border

ⓑ Bulge below MPA

)← aorta ①

\ ← MPA ②

\ ← Ⓛ auricle ③

3rd ~~MOGUL~~ MOGUL SIGN on CXR

If Ⓛ atrium gets enlarged due to other disease.

↳ 3rd Mogul sign is absent

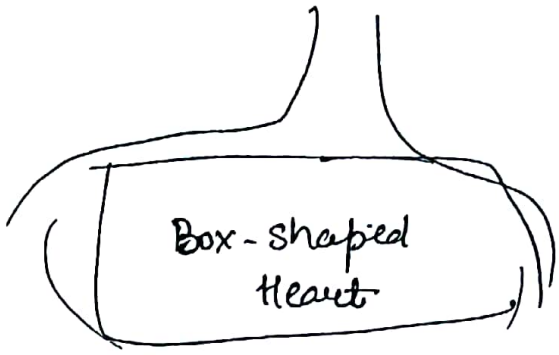
EBSTEIN'S ANOMALY

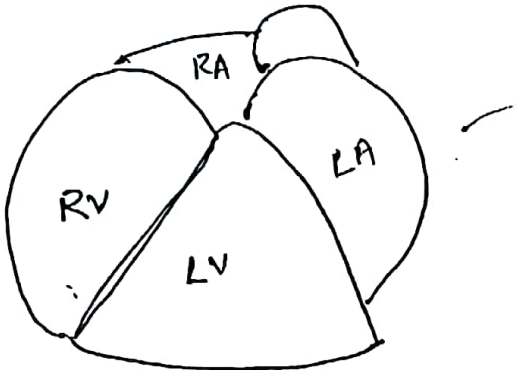
RA enlargement

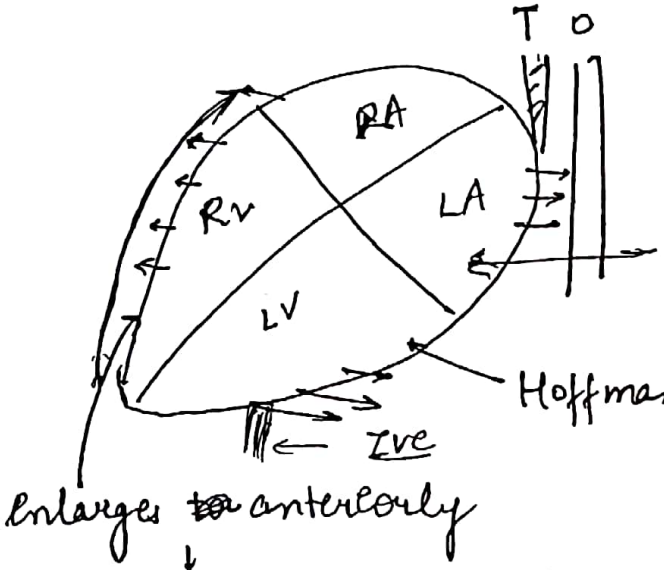
Narrow vascular pedicle as reaches below ⇒ ~~gets~~ widened

→ BOX-SHAPED HEART

→ Pulm. oligaemia







LA enlargement

→ widens carina
pushes oesophagus posteriorly

Hoffman Rigler sign.

Enlarges anteriorly

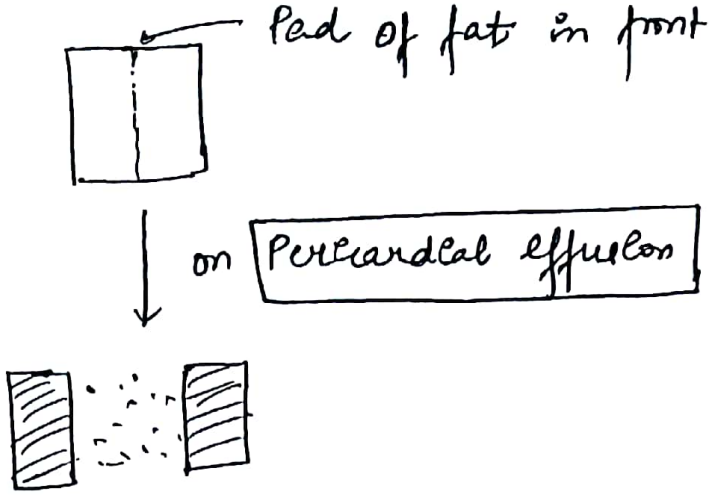
↓

Obliteration of retrosternal space

Retrosternal space widening CXR → EMPHYSEMA
⌐ on lateral chest xR

HOFFMAN RIGLER SIGN ⇒ LV enlarges posteriorly. to IVC

" MILLER SIGN – CT ⇒ ANGIOFIBROMA



Separation Epidural Fat Pads on Lateral view
= OREO COOKIE SIGN

Oligaemia =
+ Box shaped Heart = Ebstein's anomaly
+ Boot " " = TOF

CARDIAC MRI

Most accurate Inv for Ventricular Func^{n} Assesment.
(Gold Std.)

IOC → for Cardiac Tx

IOC → for Pericardial Thickness

Indicated for Myocardial Evaluation.

SCAR ASSESMENT → Delayed Enhancement

Indicated for Iron Deposit → Hemochromatosis

Apical HOCM.

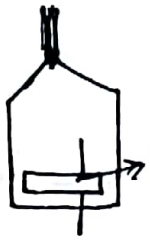
Arrhythmogenic RV Dysplasia (ARVD)

↳ fibrofatty replacement of RV wall

~~MRI~~ PET (CARDIAC)

IOC for Myocardial Vitality.

USG



↓ PIEZOELECTRIC EFFECT

Parameters

1) velocity of sound ∝ Density of medium

AIR = 330 m/s

Human Body = 1540 m/s

2) wavelength depends on thickness

$\lambda = 2T$ T = thickness

$\frac{C}{\lambda}$ = FREQUENCY

3) Frequency ∝ Image Resolution.

$\propto \frac{1}{\text{depth Penetration}}$

Routine abd. or obst. USG

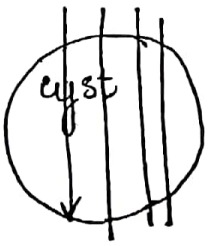
frequency = 3.5 to 5 MHz

TVS/TRUS - 5-7.5 MHz

Superficial { orbit, thyroid, Breast } 8-12 MHz

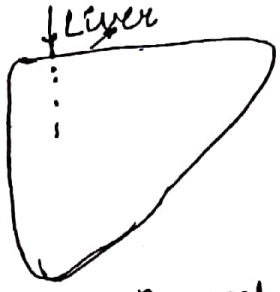
Endoscopic USG 12-20 MHz

Thats y, USG is not a good modality for Pancreas
But Endoscopic USG is a good modality for Pancreas
[Frequency Higher = good Resolution.]



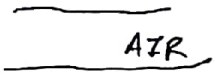
water doesn't reflect sound & let go

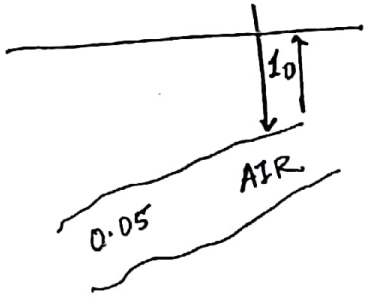
ANECHOIC
[BLACK]



Some amount to reflect & some amount of to transmit

HYPERECHOIC
(white)





→ Air filled structures on USG appears [HYPERECHOIC]

Full Bladder is req for looking at pelvic organs by abd. USG

↓

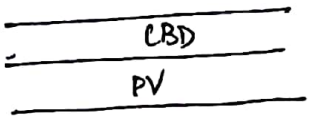
at full bladder → Bowel loops (Hyperechoic) are displaced upwards.

In TVS → empty bladder

Acoustic shadow :- Anything that reflect sound have a shadow

On USG

⇒

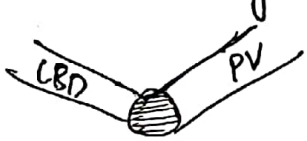


Double Barrel USG

↓

CBD obstruction - surgical

Double Duct Sign → Periampullary Cancer



IOC for Gall Stones = USG

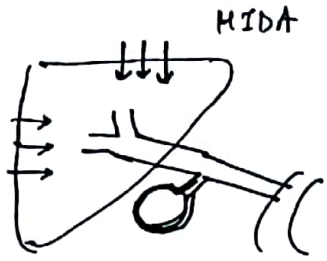
X-ray - 10% gallstones are radio-opaque

IOC for Acute Cholecystitis = USG.

↓

- Distended GB
- Thick oedematous wall
- Pericholecystic Fluid
- Sonographic 'MURPHY' +ve

BEST Inv. for Ac. cholecystitis = Tc HIDA
(Hepato-biliary Imino Di-acetic acid)

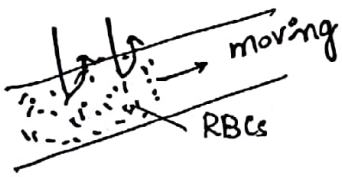


↓
HIDA taken up by liver

(N) HIDA reaches GB in 30min
But in Ac. cholecystitis ⇒ cystic duct is Blocked.
Dye can't reach there

NON-VISUALISATION GB on Tc HIDA = Ac. Cholecystitis

⇒ To differentiate Bet" soled & Cystic ⇒ USG



DOPPLER

Any moving object is producing sound will produce frequency shift

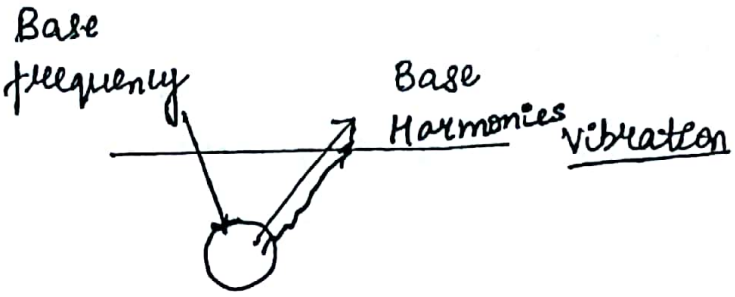
Col. ~~colour~~ Doppler is based on frequency
Colour " " " Direct

DOPPLER

① IOC - DVT

② Carotid stenosis screening

③ Testicular Torsion



Q. Tissue Harmonic Imaging now used in

a) ~~CT~~ c) USG

b) MRI d) PET

US - ELASTOGRAPHY

For Hardness of Tissue

Guide Breast Biopsy

Fibroscan. → LIVER

MRI guided HIFU

High Intensity Focussed USG

Thermocoagulation ⇒ FIBROIDS

PACS (Picture Archiving & Communication System)

Software & connects Radiology & other parts of hospital

Std Digital Format = DICOM.

(Digital Imaging & communication in Medicine)

IOC for Urinary Tract stones = NCCT

Uric Acid X-Ray → Radiolucent

CT → visible

X-Ray ⊖ } → Indinavir

CT ⊖ } → Pure Matrix stone

↓

Diagnosed on Ureteroscopy

IOC for Urinary Tract TB = CECT (Not IVP)

TB ON IVP

Calyceal irregularity = MOTH EATEN CALYCES
FEATHERY APPEARANCE OF CALYCES.

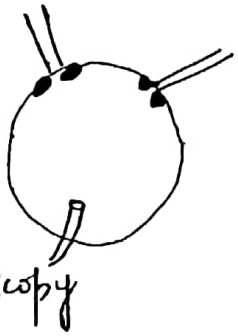
HI KED UP PELVIS

KERR'S KINK Appearance

SAW TOOTH URETER [SAW Tooth colon
↳ Diverticulosis]

Ureter → Pipe stem

Saw Tooth ureter.



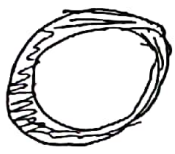
GOLF HOLE URETERIC ORIFICE on cystoscopy

cystoscopy

= THIMBLE BLADDER

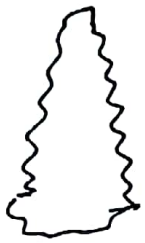
↓

Small low capacity thick walled bladder

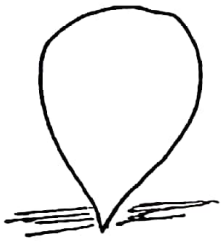


In TB → Kidney calicies
Not the Bladder
⇓
Cement / Putty /
Autonephrectomy

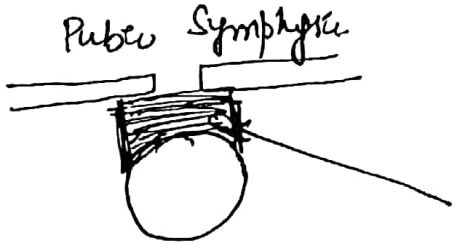
Q. Calicified Bladder, resembling fetal Skull
= SCHISTOSOMIASIS

Q. 

Elongated, Hypertrophied Bladder = Christmas Tree Bladder
Pine Tree
= NEUROGENIC BLADDER

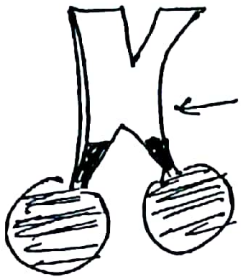
Q. 

Tear Drop or Pear
↳ PELVIC HEAMETOMA
can be seen physiologically in
Pelvic Lipomatosis.



Extraperitoneal Rupture
Dye accumulates in Pre-vesicle space
MOLAR TOOTH SIGN on CT Abdomen

Molar Tooth Sign on MRI Brain = JOUBERT'S SYNDROME
vermis absent
Mid Brain abnormal



← Superior Cerebellar Peduncle

Joubert's Syndrome

PAPILLARY NECROSIS → DM.

← egg in cup on IVP

[egg in cup in CXR
↳ Constrictive Pericarditis]

← Golf Ball on TEE Sign

← Lobster claw sign

RING SIGN

CYST

Kidney Cyst

BOSNIAK CLASSIFICATION

URETEROCELE

Adder Head appearance on IVP.

Simple cyst – 1

Calcification

Thin septa

minimally complicated cyst – 2

} Ignore

Nodular septal calcification

2F → follow up

Thick enhancing Septa

3 → indeterminate

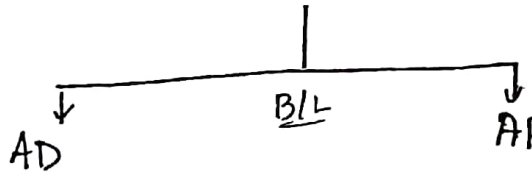
Solid enhancing

4 Clearly Malignant

} Surgical options

PCKD

2 Types



Larger cysts scattered

Dye taken up by kidney tissue not by cyst

SWISS CHEESE NEPHROGRAM

Smaller cysts radiating from hilum

Dye taken by Renal tissue not by cyst

SUNRAY - IVP

STRIATED NEPHROGRAM

SPIDER LEG - IVP

BELL-SHAPED CALYCES

MULTICYSTIC DYSPLASTIC KIDNEY

→ U/L

→ Developmental

Non-visualised kedney on IVP

↳ No renal tissue ∴ nt to take up the dye

ACUTE PYELONEPHRITIS

wedge shaped area of infarct or coagulative necrosis

⇓

"STRIATED NEPHROGRAM"

Infarcts

↓

do not take up the dye

WHITE MATTER DISORDERS

MRI is the most sensitive modality.

MS

Demyelinating

Dysmyelinating

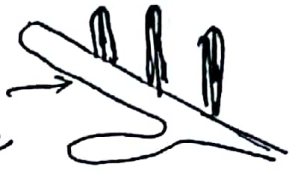
leukodystrophies

metabolic disorders

MULIIPLE SCLEROSIS

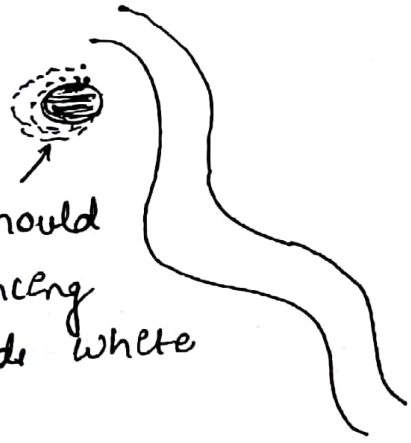
PERI-VENULAR. predominant Disorder

Ms is → white matter
Gray matter.
Both
⇓
or
white matter



DAWSON'S FINGER
⇓
⊥r to Lateral Ventricle
Best seen in "SAGGITAL PLANE"

Ms has a Relapsing Remitting course
'Active Demyelination'



Plaque should have advancing edge towards white matter.
↑
Dye when given is taken by inflammatory area.

Cq ⇒ OPEN RING SIGN
open end = cortical side

Q. Child come to you ☂ developmental delay
MRI shows ↯ Ab Ⓝ signal in white matter
⇓
Inborn error of metabolism.
[DYSMYELINATION].

Child ~ white matter ~ Large Head

ALEXANDER

1) Frontal lobe - begins. (frontal predominant)
2) Rosenthal fibres
3) Fibrinoid Leukodystrophy

CANAVAN's

1) Diffusely enters white matter

Spongiform Leukodystrophy -

MR spectroscopy = ↑ NAA

[ASPA → aspartoacylase → Breaks NAA]

* "Subcortical 'U' fibers are spared."

① KRABBE → globoid leukodystrophy [THALAMIC]

② Metachromatic Leukodystrophy ⇒ arylsulphatase A deficiency

← perivenular sparing ⇒ TIGROID PATTERN

~~Peroxisome~~ ~~Dis~~

* Peroxisome Disorder, * Xx linked Adrenoleukodystrophy

Occipital Predominant

Lorenzo's oil → effective in this disease

Q. PML (Progressive Multifocal Leuko encephalopathy)

Seen in HIV pt

caused by JC virus

↓

involves oligodendrocytes

↓

no myelination

Usually PML is non-enhancing (don't take up dye) bcoz there is no inflammation. so BBB is preserved.

* CHRONIC ISCHAEMIA [white matter problem due to chr. ischemia].

age related narrowing

Subcortical arteriosclerotic Leukodystrophy (BINSWANGER DISEASE)

presents ī dementia

GENETIC CAUSES (notch-3 mut^n)

(CADASIL)

Cerebral autosomal Dominant arteriopathy Subcortical & infarction & leukodystrophy

↑ M/c form of hereditary stroke Disorder.

CJD

→ prion Disease

→ cortical Spongiform [Grey Matter]

↓

- Cortex
- Caudate
- Putamen

RING ENHANCING LESIONS

NEUROCYSTICERCOSIS

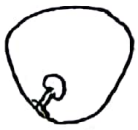
Vesicular

* Initially NCC is alive [viable stage]

↓

VESICULAR STAGE

(filled ī clear water)



cyst ē scolex

Membrane is intact in vesicular stage

↓

So, no surrounding inflammation

↓ → No BBB damage

So, **non-enhancing**

Colloidal

* When parasite is ~~dying~~ degenerating

↓

fluid becomes turbid [COLLOIDAL STAGE]

↓

membrane will degenerate

↓

attack by immune system

↓

Now BBB damage

↓

Dye is taken up

↓

Ring Enhancing Lesions

↓

Granular stage

on MRI – Thick walled enhancing Lesion.

Dead stage

No inflammation

No enhancement

Nodular calcified

TOXOPLASMOSIS

→ Ring enhancing Lesion
→ Eccentric nodule
→ HIV +' pts

BRAIN ABCESS

Ring enhancing Lesion
Pus in centre → thick & Viscous.

Diffusion ~~restr~~ wated. – MRI = Bright

METASTASIS

M/c site :- Grey-white matter Junction

THYROID OPHTHALMOPATHY

COCA-COLA BOTTLE appearance

Tendon is (N)
Body of M/s Bload

BRAIN TUMOURS

1> C Tx shows Calcification
"CA^{2+} COME"

C → Craniopharyngioma
A → astrocytoma
C → choroid plexus papilloma
O → oligo dendroglioma
M → Meningioma
E → Ependymoma

Q. ⊆ of the following Brain Tx is Not Glioma

a) astrocytoma

b) ~~Glioma~~ ganglicytoma → Neuronal cell origen Tx.

c) Ependymoma

d) oligodendroglioma

Q. Neurocytoma → neural cell origen Tx

Q. GANGLIOGLIOMA → (B) glial + neural origin

Q. Child has large head. CT scan reveal calcified Tx. in his lateral & ventricle. III. IV ventricles are dilated.

Ans → Choroid plexus Papilloma

overproduction Hydrocephalus.

OLIGODENDROGLIOMA -

1) glial Tx ⊆ has cortical extensions.

↓

H/O seizure

2) show calcification.

3) Frontal lobe of Brain.

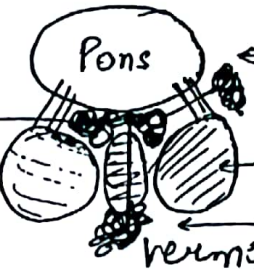
- FRIED EGG APPEARANCE on Microscopy
- CHICKEN WIRE LIKE VASCULATURE

EPENDYMOMA -

Glial Tx

children → 4th ventricle

adult → Spinal cord & Supratentorial Region



↓
Shows CSF spread
contigous
↓

hence from IV ventricle it spreads to
Cisterna magna & CP angle Cistern.

Q A young man comes to you c headache. MRI shows man in IVth ventricle extending into surrounding CSF spaces

Ans → Ependymoma

CP Angle Tx

1> Vestibular schwanoma

2> Meningioma

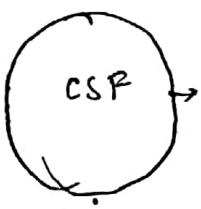
3> Epidermoid cyst
↓
Rich in keratin like fluid

Epidermoid cyst

Brownian Motion (-)
So, Non-enhancing
DW-MRI - Bright

VS

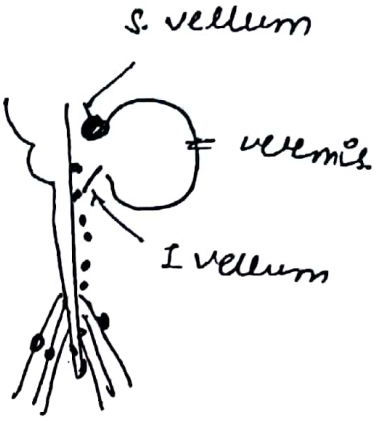
- Arachnoid cyst



→ located in middle cranial fossa

4) Ependymoma
It spread to CP angle

MEDULLOBLASTOMA



1) Posterior Fossa "midline"

2) It arises from vermis & sup. medullary vellum.

3) malignant Tx
↓
Invades sup. part of IV th ventricle.

4) Earlier considered PNET (Primeteve neuroectodermal Tx)
↓
from WHO 2016 ~~no~~ term ~~can~~ has been.
changed to "Embryonal Tumour"

5) Radiosensitive Tx

6) The flow of CF in IV th ventricle causes
CSF-DROP metastasis ⇒ Leptomeningeal Metastasis
↓
to spinal cord

↓
Sugar Icing or coating - MRI.
" or "
" Zuckerguss "

CRANIOPHARYNGIOMA

Histologically

Adamantenous	Papillary
"C"	
Cystic	solid
Children	Adult
Calcification.	no calcification.

GLIOBLASTOMA ⇒ Butterfly glioma

→ Tx is condensed in centre due to condensation of fibres in corpus callosum.

→ Crosses Midline, highly malignant

→ Other Tx & crosses Midline ⇒ "Lymphoma"

↓

HIV ptr.

Steroid Responsive Tx

↓

So, Biopsy should be taken before starting steroid

MENINGIOMA

Dural Based Tx on MRI

Dural Tail Sign.

Shows intense enhancement becoz of extra-axial Tx location.

Mother-In Law Sign.

Hyperostosis skull

VESTIBULAR SCHWANOMA ← CP angle Tu

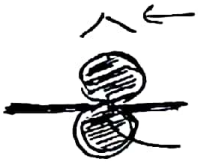
H/o - Hearing Loss
Tinnitus.

Macroscopic Microscopic finding → Antony A
" B
Verrucoary Bodies.

On MRI → Ice-cream cone appearance

Associated ↑ - NF -2

PITUITARY ADENOMA



Diaphragma sella → to protect from pressure
opening for infundibulum

Macroadenoma if size >10mm

Signs on MRI:-

1) Snowman.
2) Cottage loaf
3) figure of 8

Congenital deficient diaphragma sella

↓

ICP pushes pituitary

↓

causes ballooning of sella

" EMPTY SELLA SYNDROME " - 1°

2° → Pseudotumour cerebri
Due to Tetracycline
Vit A ~~ove~~ toxicity

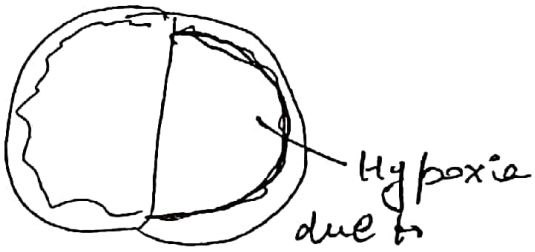
→ J-shaped sella
  ↳ seen in Mucopolysaccharidoses.

→ X-Ray skull.
  erosion of post clenoid procen → [Earliest x ray sign of Raised CT]

NEUROCUTANEOUS SYNDROME

1) STURGE-WEBER SYNDROME or ENCEPHALO-TRIGEMINAL ANGIOMATOSIS

Port wine stain.
H/o seizure
Not inherited Disorder
No Brain Tx
Congenital Glaucoma



2) TUBEROUS SCLEROSIS

AD
Seizure + MR + Adenoma sebacea
Cardiac Tx associated ∅ Tuberous sclerosis
= "Rhabdomyoma"

CMV infn → Periventricular calcifications.

Tuberous sclerosis has also association ~ Pecomas of Lung

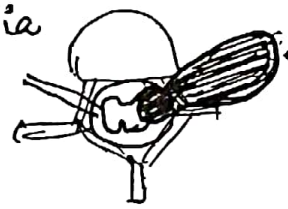
Q. A smoker comes ~ Honey comb lung in upper lobe. Bizzare arrangement.. Dx?

Ans :- LCH (Langerhans cell Histiocytosis).
↓
Eosinophilic Granuloma

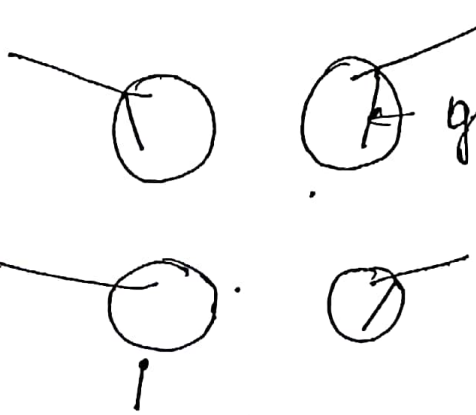
NF 1

1) Cafe-au-lait spots (~~cost~~ coast of California)
2) Peripheral + Spinal NF
3) Plexiform NF
4) ~~M~~ associated ~
   Mesodermal Dysplasia
   ↓
   Skeletal / Bony Defects
   +nt
   ↓
   Sphenoidal Dysplasia

smooth..



← Dumble Tumour



Lesser wing of sphenoid
greater wing of sphenoid

Empty Bore orbit sign
↑
due to absence of greater wing
≃ is due to sphenoidal Dysplasia

BONE Tx

5 steps ∘

1> Look ~~for~~ whether
- Immature
- Mature

2> Location
- a) single / multiple
  - 1° → metastatic
- b) Bone
- c) where in the bone –
  - Epiphysis
  - Metaphysis
  - Diaphysis

3> Pattern of destruction
- Well marginated → Geographic Lytic Lesion.
- ⟷
- Permeative → Moth Eaten

4> Matrix

Osteoid
- Ivory
- Homogenous

Chondroid
- Stippled
- Flocculent or Popcorn
- Arcs
- Rings

* Lung Hamartoma ⇒ CXR → Popcorn appearance 85

* Pulmonary Chondroma → associated c GIST.

Paraganglioma

CARNEY's TRIAD

↓

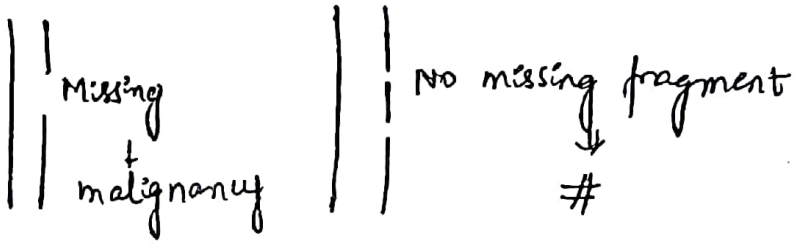
Pop-corn.

57 Beyond the Bone or not

↓

a) cortical Break → can also be due to #.

b)



b) Periosteam elevated ⇒ Periosteal Reac

⇒ Acute osteomyelitis

continuous lamellar periosteal reac.

⇒ Chronic osteomyelitis

Osteoid osteoma

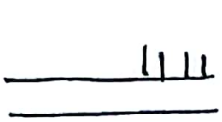
Solid

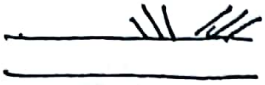
⇒ Tx groups in sports

Multilamellar

= Onion Peel X-Ray = EWING's SARCOMA

Periosteum is attached to Bone by Sharpy's fibres.

 → Spiculated → EWING's SARCOMA (less aggressive)

 → Divergent mineralisation of sharpy's fibres
↓
OSTEOGENIC SARCOMA. (more aggressive)

→ CODMAN Δ
↓
malignancy

BENIGN LESIONS IN BONE

1) HAEMANGIOMA
found in vertebra

2) LIPOMA

METASTATIC
↙
Osteoblastic
Prostate
Breast

↓
osteolytic
Breast

→ Pulsatile
Thyroid
Rcc

DEXA Scan.
↓
Bone Mineral Density.
Osteoporosis

Z score = comparing Bone Density of same age & same sex

T score = comparing Bone Density to young age

WHO scoring.

Tscore < -2.5 ⇒ osteoporosis

Tscore -1 to -2.5 ⇒ osteopenia

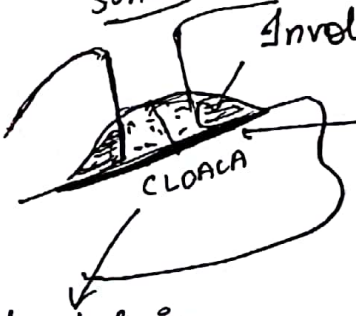
Rx - Bisphosphonates

Acute OM

Earliest X-Ray Sign ⇒ Blurring of tissue planes or soft tissue swelling

7-10 Days ⇒ Bony changes

IOC ⇒ MRI. → marrow oedema (24-48 hrs of onset) using STIR



Involucrum ← new Bone formation.

sequestrum :- Dead Bone ↓ Dense on X-Ray as no demineralisation occurs.

PATHOGNOMIC OF CHRONIC OM

Sinus hole in involucrum [PYOGENIC OM]

Pyogenic OM → bony extensive new bone

TB OM :- osteoporosis ++
almost no periosteal reac°
no new bone formation

MADURA MYCETOMA

MRI :-

oedema
fungal lesion

DOT In A circle sign

ARTHRITIS

OSTEOArthritis

- Wear & tear of articular cartilage
→ Loss of joint space in wt. Bearing (medial tibio femoral compartment)

Horizontal spurs.
↓
~~Osteo~~ osteophytes
↓
- Subchondral sclerosis
- cyst
- Loose Bodies

RHEUMATOID arthritis

Synovial Inflammation

Hyperaemia
- Periarticular Osteoporosis

- Bare area – erosions as ∴ inflammed synovium initially eat up Bare area
- Joint space narrowing (~~no~~ symmetrical)
- Dislocated Deformities
  - swan neck
  - Bountiniere
- Deformity ∵ out erosions
↓
SLE
JACOUD's Arthropathy

TB Arthritis

Inflammatory Jt. Disease

Hyperemia

↓

Periarticular osteoporosis ← earliest sign of TB knee

↓

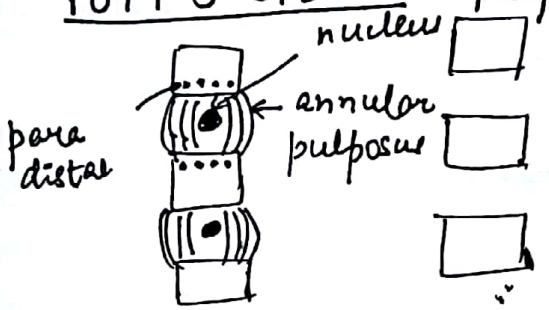
Erosion

↓

Joint space narrowing

Phemister's TRIAD

POTT'S SPINE



Blood supply of Disc → "AVASCULAR"

earliest finding in TB spine → "Disc space narrowing"

~~People not consuming~~

~~GIA~~

BRUCELLOSIS → OM of spine

People not consuming pasteurized milk

Anterosuperior corner →

PEDRO PON SIGN

Q. On X-Ray -

Density ↑
Debris +
Distension.
Dislocation
Disorganeze

→ Related Trauma
↓
Neuropathy.

Ans - CHARCOT'S JT
↓
eg in. DM.

⇒ 1st MTP

← Punched out
← Rat Bite erosion
↓
away from articular surface
} ⇒ GOUT

⇒ PSEUDOGOUT → Deposit of CPPD (calcium pyro-phosphate deposit).
↓
Chondrocalcinosis.

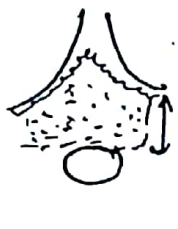
⇒ In DIP Pencil in cup ⇒ PSOARIATIC. ARTHROPATHY
↓
Bone Density (N)

METABOLIC DISEASES

Osteoid
↓
mineralization

1> RICKETS

Earliest X-Ray finding → Loss of provisional zone of calcification.



→ splaying cupping ~~Rta~~ Fraying of growth plate Widening

On giving Vit D → Recovery of provisional zone (Healing Rickets) ↓ White Line of Frenkel.

OSTEOMALACIA

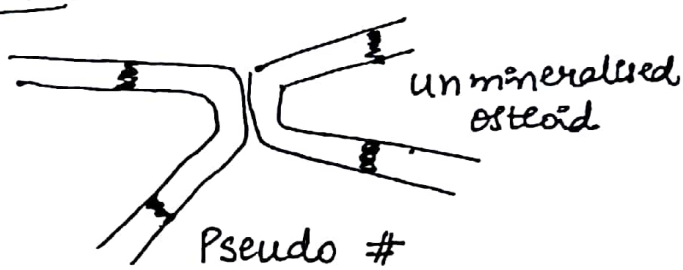
symmetrical

PELVIS

Looser's Zone seen in

1) Pubic Rami
2) Neck of femur

Ribs
Scapula (outer)

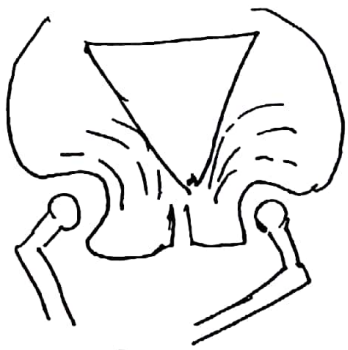


Pseudo #

LOOSER'S ZONE

Disease ∈ Looser's Zone

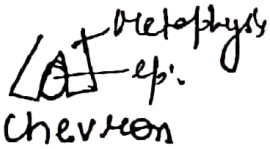
1) Osteomalacia
2) Fibrous Dysplasia
3) Paget's Disease



TRIRADIATE PELVIS (Pelvic cavity gets triangular)

Champange Glass Pelvis ⇒ **ACHONDROPLASIA**

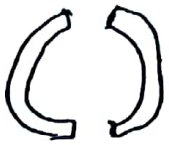
- AD
- Rhizomelic Dwarfism (proximal Bones shorter)
- Trident Hand
- ~~Arthritis~~ lumbar canal stenosis.
- Foramen Magnum stenosis



Chevron Sign

THANATOPHORIC DWARFISM

- Lethal cond"
- ß.



"Telephone Handle Long BONES"

P

* EPIPHYSEAL ENLARGEMENT :-

1) JRA (In child)
2) Hemophilic arthropathy
3) Bony Dysplasia → TREVOR's

* EPIPHYSEAL DYSGENESIS:-

1) Hypothyroidism
   - ↳ Delayed Bone Age
   - ↳ Wormian Bones ← Prominent Intrasecutural Skull Bones.
     - ↓
       - Osteogenesis Imperfecta
       - Down's Syndrome
       - Rickets
       - Pyknodystosis.
       - Hypothyroidism

Osteogenesis Imperfecta → Diaphyseal #
⇒ Different stage of Healing
(Battered Baby syndrome)

In accidental trauma → same stage of healing

* SCURVY

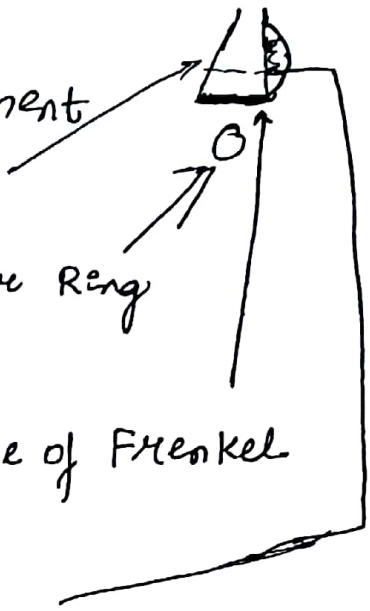
Osteoid formation ↓

In copper Deficiency ⇒ Pseudo scurvy

Osteoid

↓

Mineralization



Thin Bones → only margen is prominent (Pencil thin cortex).

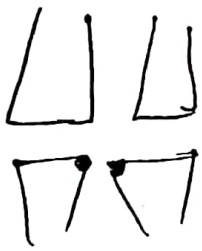
Wimberger Ring (Epiphysis).

Provisional zone become dense ⇒ White Line of Frenkel

Mineralization doesn't occur in the area ⇒ Scorbutic zone or Trummerfeld zone

Pelkan spur

Cong Syphilis



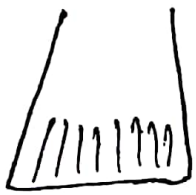
Erosion tibial Metaphysis ⇒ Wimberger sign

⇓

"Congenital syphilis"

Cong. Rubella

striations.



Celery stalk

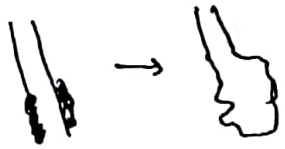
ANKYLOSING SPONDYLITIS

Sero -ve spondylite

Earliest sign → Sacroiliitis *

IOC ⇒ "MRI"

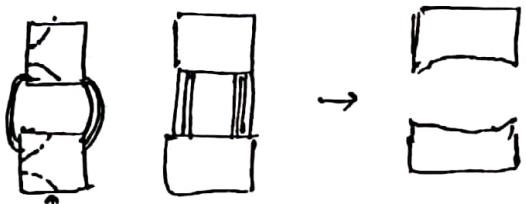
X-Ray 1st → Blurring of subchondral cortex on. (iliac) side of SI jt.



→ Pseudowidening SI joint

Changes in vertebra are due to Enthesis - itis

↓ where tendon & ligament are inserted



ROMANUS LESION

SHINY CORNER SIGN.

ANDERSON LESION

↓

Inflammation of Disco-vertebral junc".

in ankylosing spondylets ⇒ through & through (CARROT STICK #)

← syndesmophyte

↑ vertically arranged outer Disc fibres

↓

BAMBOO SPINE

DAGGER SIGN

(Internal Disc fibres)

PAGET'S DISEASE

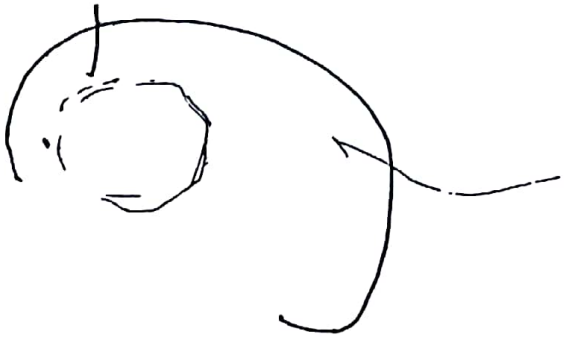
MOZAIC
- Lytic
- Mixed
- Blastic

Initially → osteolytic Lesions

Osteoblastic lesions
↳ cotton wool spots

skull becomes elongated

osteoporosis circumscripta



"TAM O SHANTER" SKULL
Scottish cap

← Blade of grass.

Signs

Skull
cotton wool
Osteoporosis circum-scripta

Tam o shanter skull

spine
Picture frame ivory

Long Bones
Blade of grass

OSTEOPETROSIS

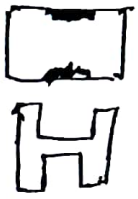
Defect of osteoclast

THALASSEMIA

Diploic Widening
Hair on end skull

SICKLE CELL ANAEMIA

Bone Infarct
Snow cap Humerus →



H-shaped vertebre

LEUKEMIA

Presence of Metaphyseal Lucency

NUCLEAR MEDICINE

nuclear scan Scintigraphy	SPET	PET

NUCLEAR SCAN

M/c isotope — Tc^{99M} → metastable isomer.

$t_{1/2}$ → 6 hours

Produced by Molybdenum Generator

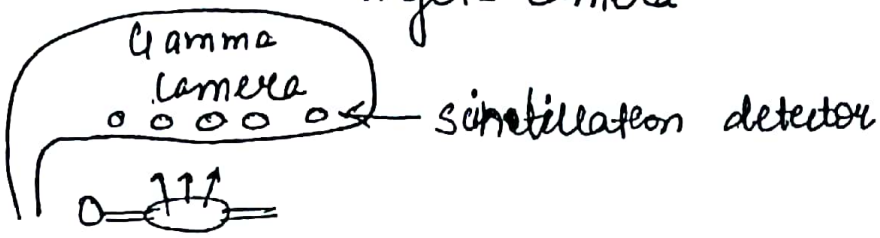
- Gamma rays

  Energy → 140 KeV

LIGAND → Tc - HIDA

Tc - MDP

Anger's camera



Cardiac scintigraphy

Myocardial Perfusion scintigraphy	Myocardial Infarct scintigraphy
Thalium Tc - Tetrofosmin Tc - Sestamibi Ischaemia → COLD	Tc - Pyrophosphate ↓ Bind to infarcted tissue Infarct → HOT

Tc - RBC MUGA scan → [multi-uptake Gated Acquisition]
↓
ventricular func^{n}

[Most accurate Investigation for ventricular func^{n} = MRI]

DYNAMIC RENOGRAM

Tc - MAG3	Tc - DTPA
↓	↓
Tubular Secretion + GF	Purely GF
↓	
Assess Renal func^{n}	Assess. GFR

STATIC RENOGRAM

- Tc - DMSA
- Structure
- Scarring
  ↳ Reflux
- ~~Post urethral valve~~

VUR - IOC
↓
MCU
PUV

Assess Distribution of Renal Func^{n}.

* T_c - RBC
  To localise the site of lower GI Bleeding as little as 0.1 mL/min

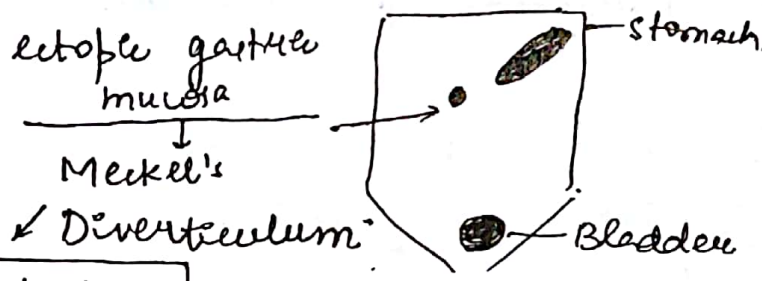
* T_c Heat Damaged - RBC
  To ~~localise~~ look for residual Splenic Tissue post-Splenectomy

* T_c - Pertechnatte
  Physiologically → choroid plexus
  - salivary gland
  - Thyroid
  - Gastric mucosa

Salivary gland

Only ↑ salivary gland T_x HOT on T_c-Scan
⇒ Warthin's T_x (OR)
⇒ Adeno-Lymphoma

Gastric Mucosa



IOC = T_c pertechnate

* T_c - Sulfur colloid.
  Taken by - macrophages
  - Reticulo endothelial system
  ~~Liver~~
  Liver of Kupffer cells tht

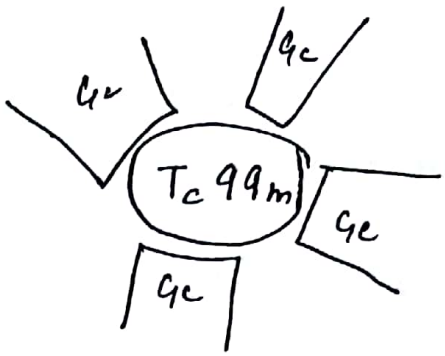
Q Hepatic Lesion. Rich in Kupffer HOT or T_c - colloid scan
⇒ FNH focal nodular Hyperplasia

SPECT

Single Photon Emission computed Tomography.

- Tc^{99m}.
- I-123

3D



multiple gamma cameras.

* **Tc - SESTAMIBI SPECT**

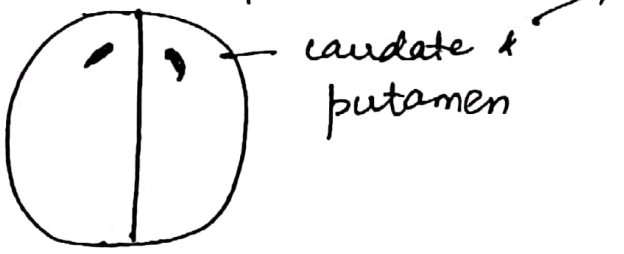
→ Used for 3D localization of Parathyroid Adenoma
→ for Myocardial Perfusion

* **Tc^{-} HMPAO - SPECT** at NIMHANS

- cerebral Perfusion

* **DAT SCAN**

I^{123} Isoflupane ⇒ COMMA SHAPED appearance (N)



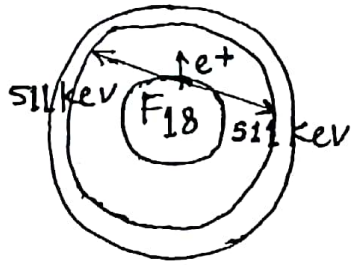
In parkinsonism
• • → "period"

PET Scan
(Positron Emission Tomography)

- Cyclotrone Generated Isotopes
  ↓
  portable ~~accelerator~~
  accelerater

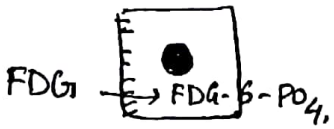
$$\xrightarrow{\text{Protons}} O_{18} \leftrightarrow \boxed{F_{18}}$$

$t_{1/2}$ - 110 min
(short lived)



Positron. (e^+)
Anti-matter
+
e^- electron MATTER
Annihilation.

18 Fluoro - Deoxy Glucose (FDG).
↓
non-metabolisable Glucose analogue



'WARBURG EFFECT'

Cancer cells have
more glucose transporter → Aerobic Glycolysis

Cancer cells take up FDG & form FDD-6-PO_4.
But it doesn't undergo glycolysis.
↓
So cancer cells now emit radiation due to FDG
↓
so used in • staging of cancer
• Recurrent Tumour

• Response to therapy
↓
as metabolism ↓ first than the size of Tumour on chemotherapy

Drawbacks of FDG

1) **Hyperglycemia**
FDG will not be taken up in case of hyperglycemia due to competitive ⊖ of GLUT receptor.

2) **Tx ⊛ ĉ low metabolic Rate**
→ carcinoid } FDG ⊖ Tx.
→ BAC

3) **Brain.**
glucose hungry organ.
High uptake of FDG.
So, Brain Tx are missed
Brain is **FDG - avid**

4) **Brown Fat**
metabolically active fat (thermogenic) found in supraclavicular area
So, ↑ uptake of FDG in this region.
* B/L symmetrical supraclavicular uptake of FDG
↳ Physiological

Prevention / Menemze
→ Keeping pt warm
→ Pre-medication ĉ BZD.

Alternatives to FDG

① C_{11} - methionine PET
Preferred for **Brain** Tx evaluation. (NIMHANS)

② NaF PET
for **Bone** Metastasis
Better than MDP

IOC for clinically suspect Phaeochromocytoma
= **MRI Abdomen**

Extra-adrenal → Paraganglioma

On MRI → Light Bulb Sign
→ Hepatic Haemangioma
→ Meningioma
→ Phaeochromocytoma

Light Bulb appearance on X-Ray
Post Dislocation of shoulder.

[ℂ Dislocation is more easily diagnosed by X-Ray
↳ Anterior Dislocation.]

Extra-abdominal Phaeo = **Paraganglioma seeking Isotope**

③ ~~F~~Fluoro DOPA PET

④ I123 MIBG.
(norepinephrine analogue)

⑤ 68- Gallium DOTATATE PET Scan.
DOTATOC

— Neuroendocrine Tx. (for sarcoidosis - 67 gallium)

⑥ 68- Gallium PSMA PET
[Prostate specific membrane Antigen]

→ for prostate malignancy

⑦ PET/CT

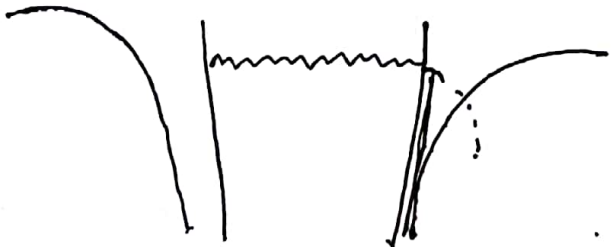
⑧ PET/MRI

PROSTATE

→ MRI is preferred

→ PIRADS

Ioc for **Fistula In Ano** → a) Fistulogram
b) MRI
c) CT
d) PET



Intersphincteric.

MRI → Due to relation of sphincters to fistula

LUTETIUM - 177

$t_{1/2}$ - 6.7 days

Strong β emitter, weak γ emitter

* **Lu - DOTATATE**

used for inoperable neuroendocrine Tx.

RADIOEMBOLISATION

- used in Liver Tx:

Radioactive agent through catheter directly to Liver

↓

Yttrium - 90 microspheres

"Pure β rays".

Phosphorus
Strontium
Samarium
} Bone seeking β emitter

Phosphorus	Strontium
1) β- emitter	β- emitter
2) More penetrating power	Less
↓	
3) marrow suppression S/E	safer

RADIUM - 223

$t_{1/2}$ - 11.4 days.

- α- emitter
- Bone seeking

~~Damage Tx~~

more safe than strontium as less penetration.

I^{123} - $t_{1/2}$ → 13 hours

I^{125} $t_{1/2}$ - 60 days

I^{131} $t_{1/2}$ - 8 days

I^{124} → PET Scan

I^{127} → Stable iodine isotope

I^{123} — ✓ cyclotron generated
✓ Gamma emitter
✓ Function.

I^{125} — ✓ for RIA
✓ Brachytherapy

I^{131} — ✓ Produce both β & γ
β - Well differentiated thyroid cancer
γ - Imaging

I

TELETHERAPY / EXTERNAL BEAM.

⇒ M/c method of Radiotherapy

Machine used → ⇒ Cobalt machine

$Co\ 60$ → artificial

$t_{1/2}$ = (5.2) years.

$Co\ 60 \longrightarrow Ni\ 60 + \beta + (\gamma)(1.25\ MeV)$

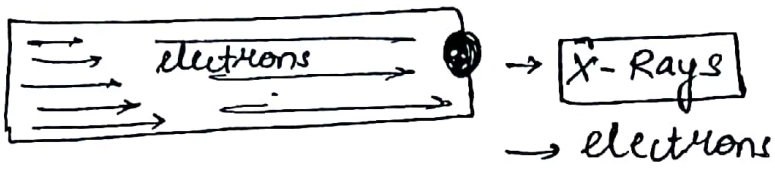
β

↳ gamma rays are killing Tx.

Drawbacks :-

1) Decay products
2) Half life
3) Fixed energy emission.

Hence, Nowadays machine used = LINAC (Linear accelerators)



≈ M/c radiation used in cancer therapy → X-Rays
≈ M/c " for deep seated Tx → X-Rays

≈ electron used for superficial lymphoma
↓
"MYCOIDES FUNGOIDES"

Intra-operative RT

LINAC Vs COBALT

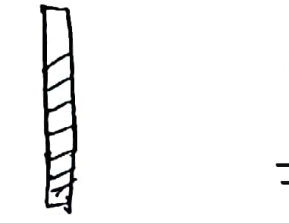
No isotope related concerns
No half life
Switch off/on.
Alter energy → orthovoltage.
→ supervoltage
megavoltage (MV)

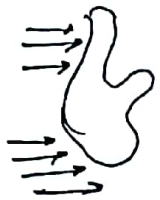
Maximum skin Burns.

a) cobalt
b) orthovoltage
c) supervoltage
d) megavoltage

CONFORMAL RT

Intensity modulated RT





⇒ intensity is conforming to 3D shape & Relationship

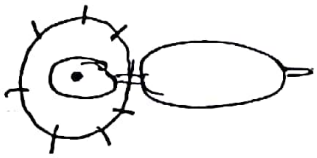
Used in
- Prostate
- Head & Neck

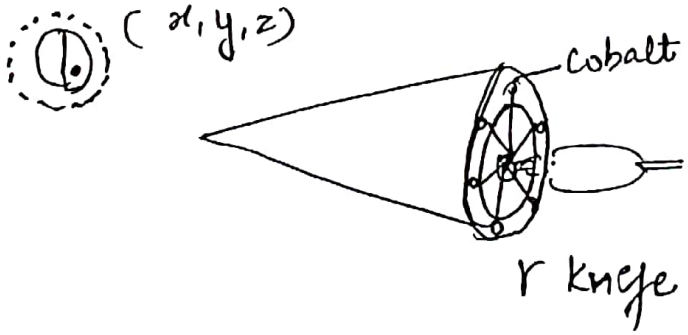
STEREOTACTIC Radio Sx

Gamma knife → invented by LAR LEKSEIL
used for Brain

Indications
1) Vestibular schwanoma
2) Pituitary adenoma
3) meningioma
4) Trigeminal neuralgia
5) cerebral metastasis < 10
6) AV malformation

lekseil's Frame





γ knife

Focussed γ radiations on Tx

↓

Initially cell swell

↓

DNA gets damaged

↓

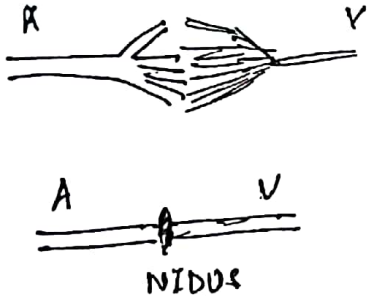
then shrinking

→ if Tx near optic chiasma

↓

γ-knife wdn't be used as it swells initially

AV malformation



HTN Bleed

1) Putamen
2) Caudate
3) Thalamus
4) Pons
5) Cerebellum

Q. Young pt in emergency shows lobar Hge

⇓

may be AV Malformation

Q. old pt c non HT lobar Hge.

⇓

Amyloid angiopathy.

↑ ka knife causes thrombosis of nidus

↓

thus damaging malformation.

* STEREOTACTIC Body RT / cyberknife

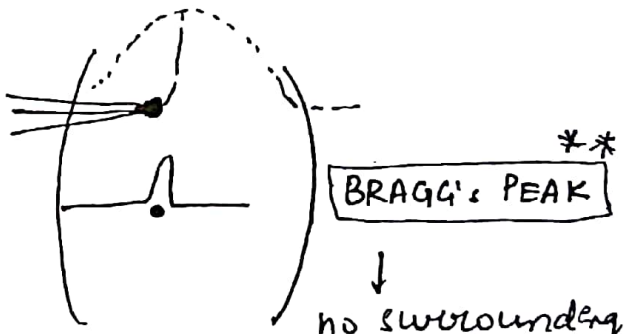
→ Based on LINAc

→ Whole Body

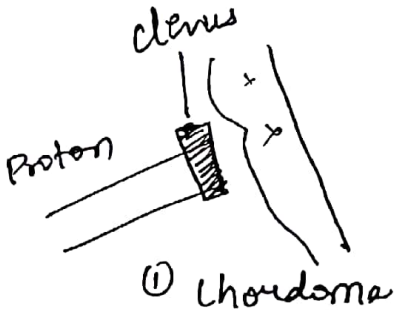
→ Frameless

* PROTON BEAM THERARY

X-Ray } Gamma ~~rays~~ waves.
↑ Ray. } Photon.



protons -
heavy
charged.



① Chordoma

② Pediatric Brain Tx → Sx is preferred. compared to RT
But now ↑ role of proton
Beam therapy.

③ Uveal Melanoma

BRACHYTHERAPY

→ Done for in contact cavity substance.

Adv :-

→ High Dose To Tx

Disad :-

Radiation exposure to Doctor

REMOTE AFTER LOADER -

→ new update

→ ↓ radiation exposure to doctors

M/c isotope used in Brachytherapy → ① Iridium 192
$t_{1/2}$ - 74 days

② Cesium - 137
$t_{1/2}$ - 30 years.

TYPES

- Low Dose: 0.4 to 2 Gy/Hr
- High Dose: >12 Gy/Hr

* Permanent Implants
  - ✓ Palladium
  - ✓ I - 125

Gold → for malignant ascites.

oldest isotope → Radium 226
$t_{1/2}$ → 1600 yrs.

Radium no longer used bcoz of harmful Decay products.

Environment:

Outdoor ← → Indoor

RADON
- $t_{1/2}$ – 3.8 day
- lung cancer.

How to measure Radiation exposure?

Def^n	Common	SI units
Total Radiation exposure	Roentgen	Coloumb/KG
Absorbed radiation	RAD	GRAY. 100 RAD. Joule/kg
Biological equivalent effectiveness	REM	SIEVERT. =100 REM

How to measure Radioactivity

Common	SI
Curie	Becquerel
1g Radium /sec = 3.7×10^{10} d/s	1 d/sec

MOA of Radiation Injury = Free radicle DNA-mediated Damage

Most sensitive phase of cell cycle = G_2M

Least sensitive phase of cell cycle - Late S

Fetus most sensitive at - 6-15 weeks.

Max. permissible Dose - 0.5 RAD.

Cong. malformation is seen after - 5 RAD

* ↓ Blood cell most sensitive - Lymphocyte

* Tissue " " Bone marrow

GIT

Ioc for CHPS → USG.

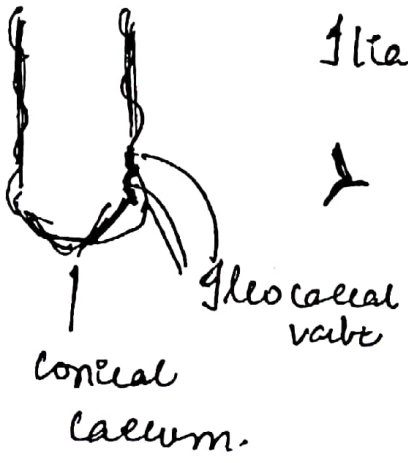
Ioc in pediatric Ac. Abdomen → USG.

INTESTINAL OBSTRUC"

Ioc → CECT.

Best X-Ray → X-Ray Abd. (supine)

BOWEL TB



Ileal strictures.
↳ String sign

Inverted umbrella sign or Fleischner sign

Asc colon shortens → pulled up caecum
↓
So, no more 90°

goose neck (obtuse angle)
ileum

Surgery

Handwritten Note

MBBS Help

http://mbbshelp.com

http://www.youtube.com/mbbshelp

http://www.facebook.com/mbbshelp.com

Name: _____

Subject: **Surgery**

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

UROLOGY

KIDNEY

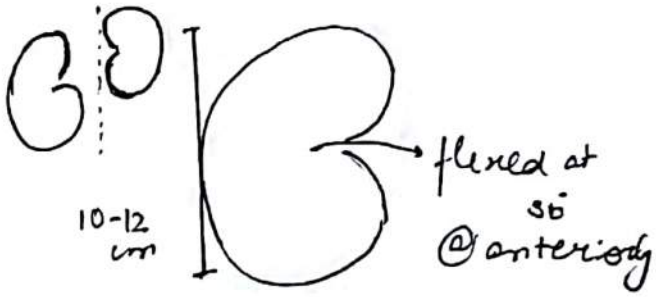
ANATOMY

Retroperitoneal Organ

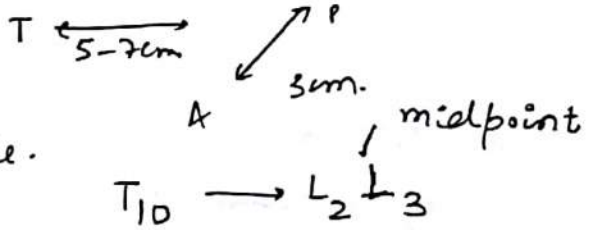
Ⓡ Kidney to Lower w.r.t. Ⓛ Kidney

Ⓛ Kidney is slightly midline

Flexed @ angle of 30° Anteriorly



DROMEDERY'S HUMP-
Persistent fetal lobulations
Physiological.
Hence no Rx required.
More common Ⓛ side > Ⓡ side.



1/3 Diaphragm

Lat 1/3 Medial 2/3 → Psoas

Quadratus Lumborum / Transverse abdominis.

CAPSULE

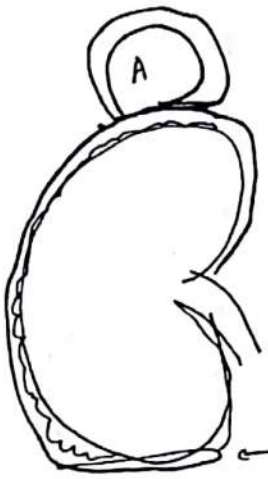
Inner → True Perinephric Fat

Outer → Pseudocapsule

↓

Gerota's Fascia → anterior ⇒ FASCIA OF TOLDI

Posterior ⇒ ZUCKERKANDL's FASCIA



— gerota's is deficient on lower side

⇓

helps in avoiding pressure necrosis

RENAL SINUS.

→ Site of fusion of collecting system & vascular system.

- Imp. Landmark for Sx

→ Renal sinus coalesces to form Renal Hilum.

→ Involvement of Renal sinus in RCC = T_3 Stage

RENAL ARTERY-

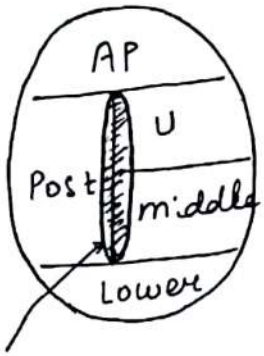
- arises from Aorta ($L_1 \rightarrow L_2$)

- R. artery → segmental artery

↙ Post (Most consistent)

↘ Ant: → apical SA, → upper SA, ↓ Middle, ↓ Lower

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp



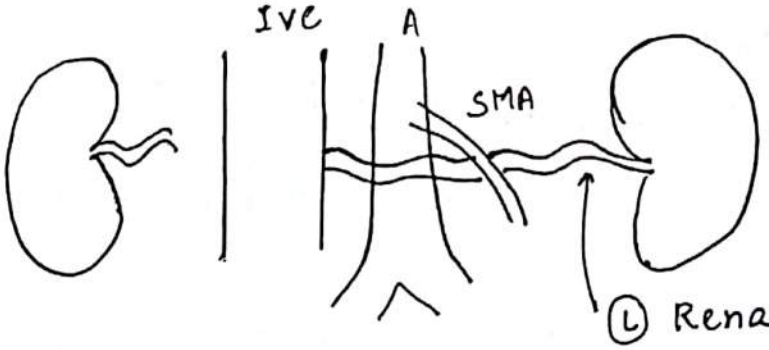
upper SA → Interlobar → Arcuate A → Interlobular A → Afferent arteriole

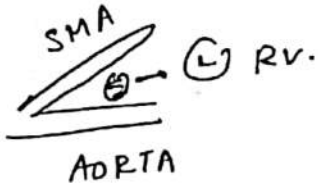
Avascular Zone = BRODEL'S ZONE

(associated ↓ least blood loss)

ANATROPHIC Sx = Sx done via Brodel's zone
or
BOYCE PROCEDURE

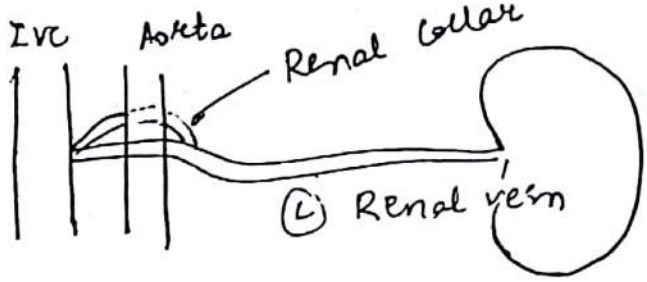
(R) Renal vein < (L) Renal vein. [Length]
L → L.
2-4cm 8-10cm.





* NUTCRACKER PHENOMENA

Compression of (L) Renal vein due to narrowing of angle b/w SMA / AORTA.



RENAL COLLAR- Bifurcation of (L) Renal vein around aorta. may cause constrn of aorta

UROLITHIASIS

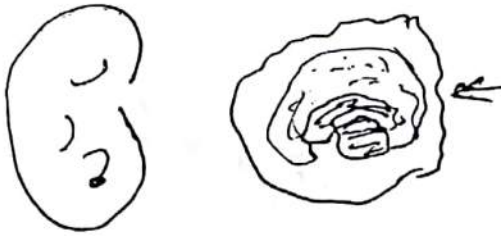
NEPHROLITHIASIS

→ 90%- radio-opaque

PATHOPHYLIOLOGY-

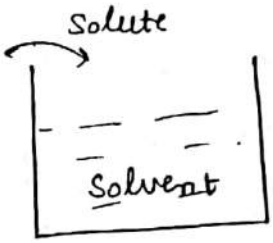
RANDALL'S PLAQUE → Precursor of stone

↳ Subendothelial deposition of cal. apatite.



← EPITAXY

growth of stone by deposition of one stone over other.



SOLUTION

CONC" PRODUCT- conc" of solute in solution

SOLUBILITY PRODUCT- Threshold saturation conc".

CP >> SP ⇒ STONE ~~formation~~

↑ Inhibitors

Pvt

FORMATION PRODUCT - Conc" at which effect of Inhibitors is neutralised.

If. CP > FP ⇒ STONE FORMATION

EQUIL-2, JESS } → Stone Probability Calculation score

* INHIBITORS FOR STONE FORMATION

1> Citrate (Most Potent)

2> Magnesium

3> Polyanions (mucopolysaccharides, glycosaminoglycans)

4> TAMM HORSEFALL PROTEIN.

5> Nephrocalcin

6> Uropontin

7> Osteopontin

MISC.

♂ >> ♀

White >> Black

Geog :- Extreme → Cold
→ Dry
→ Hot / Arid.

RARE In Children.

RISK FACTORS-

1) Dehydration
2) Infection
3) Hypercalciuria
4) ↓ citrate
5) Vit A Deficiency
6) Gout / Pseudogout
7) Renal Tubular Acidosis
8) Cystinuria

TYPES

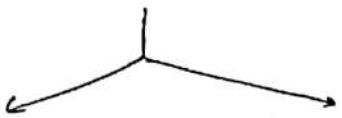
1> CALCIUM OXALATE (75-80%) / MULL BERRY / JACK. STONE.

↓ due to hard appearance

Radio-opaque

Reddish Brown (? Hematuria)
(? hemosiderin)

Spiculated



Cal. ox. MONOHYDRATE	Cal. ox. DIHYDRATE
↓	↓
DUMBELL shaped	ENVELOPE shaped
Resistant	ESWL sensitive

⇒ MULLBERRY STONES

⇒ a/i HYPERCALCIURIA.

>7 mmol/day in ♂

>5 mmol/day in ♀

on calcium in urine

>200 mg/day → urine Ca^{2+}

2) PHOSPHATE STONES. (10-15%)

RADIO-OPAQUE

WHITE

Shape:- COFFIN LID / RECTANGULAR

a/c INFECTION [Phosphate stones are M/c type].

[OMP^n - Cal. Phosphate

a/c ALKALINE URINE.

↓

a/c UREASE splitting Organism

(Protease → M/c Infec^n)

not E. Coli

Variants Of Phosphate

1> TRIPLE PHOSPHATE

Ca Amm. Mag. Phosphate

2> STRUVITE = Amm. Mag - Phosphate + Ca. oxalate Hydroxy apatite.

INFECTION STONES = 'STRUVITE'

STAGHORN CALCULUS = STRUVITE occupying Pelvi calyceal system

Types

COMPLETE

Occupancy of >80% of pelvi-calyceal system

INCOMPLETE

occupancy of atleast 2 Pelvicalyceal system.

3) URIC ACID STONES

Radio-lucent

Orangish colour

Shape: AMORPHOUS SHARDS (plate like)

a/c ACIDIC URINE.
(pH < 5.0)

a/c GOUT/ Pseudo GOUT.

a/c Uricosuria
Urine uric acid > 600 mg/day

4) CYSTEINE STONES

HARDEST

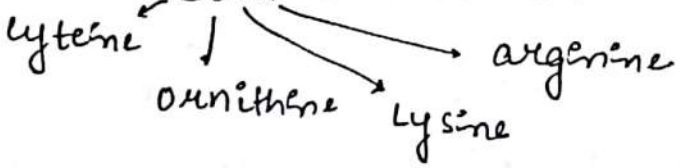
Radio - OPAQUE.

Bluish-GREEN (? Sulphydryl group @ Tail)

HEXAGONAL

a/c HOMOCYSTINURIA.

↓
AR
COLA METABOLISM Defect



Cystinuria > 200-250 µg/day. Urine cystine

5> BRUSHITE STONES

Radio- OPAQUE

Yellowish

PRISMATIC/ NEEDLE like

Calcium Phosphate Hydroxyapatite

6> XANTHINE

a/c Xanthine Metabolism Defect

Radio - LUCENT

BRICK - RED

7) AMMONIUM URATE

Radio - LUCENT

a/c LAXATIVE ABUSE (↑ Na^+ loss; metabolic acidosis)

IBS

a/c acidosis , ↓ Na^+

8) MATRIX STONE

STONE – Inorganic component

Protein Rich stone 65%

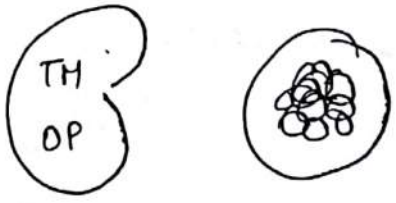
Organic sugars

Polyanions

BROWN COLOUR

SPONGY STONE c cystic spaces

ESWL Resistant



Soft spongy
Brown

ESWL RESISTANT STONES

Cal. ox. monohydrate

Brushite

Matrix stone

TOC- Renoscopic Removal

DRUG RELATED-

1) Indinavir
2) Ephazole
3) Triamterene
4) Ephedrine
5) Silicates.

COMMERCIAL NAMES

1) Ca oxalate Monohydrate = WHEWETITE
2) " " Dihydrate = WHEDDELITE
3) Triple Calcium Phosphate = WHITLOKITE

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

FEATURES

1) Pain @ Flanks.

@ Renal Angle Tenderness.

MURPHY'S PUNCH - demonstration of Renal angle tenderness.

2) Hematuria

3) Urosepsis

4) Hydronephrosis

NCCT → IOC
(Helical CT)

1st Line Inv. for FLANK PAIN = USG.

1st Line Inv. for RENAL STONE = X-RAY KUB

X-RAY KUB + USG → 97% sensitivity

Mx

CONSERVATIVE	INTERVENTION
INDICATION -	→ ESWL
1) Size < 5-6cm	→ PLNL
2) ⓑ + Hydration to maintain urine output 2L	→ Renoscopic Removal (" lithotripsy)
Cons.	→ Lap. surgical stone Removal
Antibiotics NSAIDs	

Dissolution Therapy

↳ Cystine ooo
↳ Uric Acid Stones

Principle :-

① Hydration

② alkalinisation of urine

③ Uric acid → allopurinol

④ Cystine → d-Penicillamine
or
Propionyl-Glycate

Precautions :-

1) Water → Hard is protective

2) Beverage -

Carbonated Beverage - protective except [Phosphate Rich Carb.]

3) Citrate Juice ↓↓ Milk.

3) Protein Restriction diet
↑↑

4) Na^+ Restriction

5) Adequate Ca^{2+} Intake.

↑↑ Ca^{2+} → ↑↑ Abs → ↑↑ stone

↓↓ Ca^{2+} → ↑↑ ox. absorption.
↑↑ stones

So, adequate Ca^{2+} intake Reqd.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

6) ↑ BMI → ↑↑ stone

7) orthophosphate → ↓↓ stone

8) Rice Bran → ↓↓ stone

INTERVENTION

Stone → Location
→ Size
↓ No.
↓ Composition

LOCATION

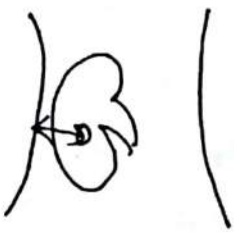
Non-Lower Pole

Lower Pole Location

Non-Lower Pole
↓
Size

<1cm → ESWL (RxOC)

1-2cm → S-S <10 cm, <1000 HF → ESWL



Stein → Stone

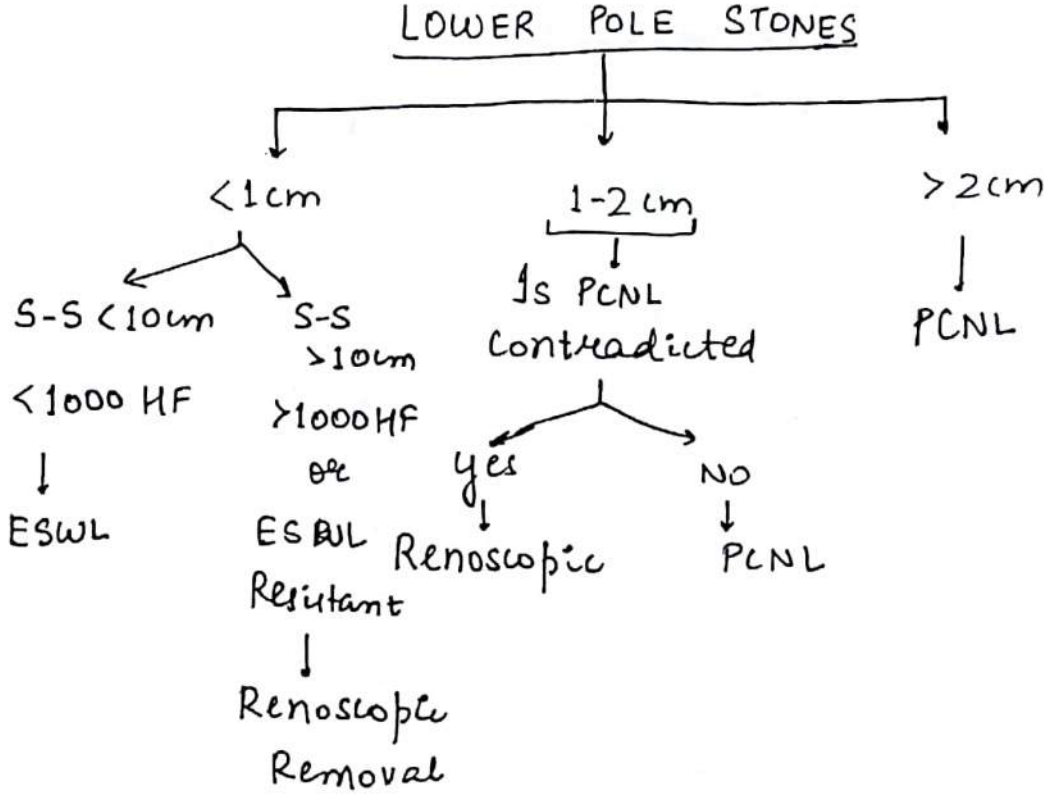
1-2cm → SS. >10 cm, >1000 HF → cystine st. / Cal. oxalate / Brushite / Matrix → Renoscopic Removal

>2 cm. → PCNL (RxOC)

< 1 cm → ESWL

> 2 cm → PCNL

1-2 cm → 1st Line ESWL —fail→ Renoscopic Removal



< 1 cm → ESWL

1-2 cm → 1st ESWL —⊖→ Renoscopy (RxOc)

> 2 cm → PCNL

* STONES IN ⑥ ♀ ↳ conserwative - Hydration
NSAIDs
Antibiotics

In case of obstruc" → DJ stenting (doubleJ)

* Stones In Horse-shoe Kidney

PCNL → Rx OC

* Stones In Calyceal Diverticula

PCNL → Rx OC

* Pediatric stones-

<1cm → TOC + ESWL

>1cm → PCNL

ESWL

Extra-corporeal shock wave Lithotripsy.

TECH:-

ESWL

- GENERATOR → Shock Wave
- IMAGING UNIT
  1) USG
  2) Flouroscopy

1st gen^{n} - Electrohydraulic Generator.

↓

used SPARK Plugs

↓

spherical S waves

2nd gen^{n} - Electromagnetic Generator

↓

Use- ACOUSTIC Lens

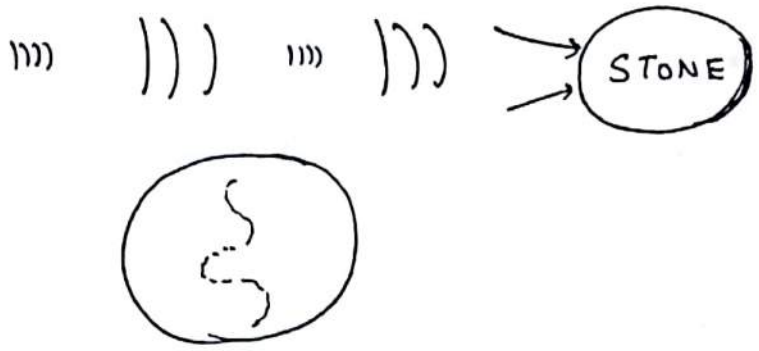
↓

Cylindrical ~~wo~~ shock waves

3rd gen^{n} - Peizoelectric Generator

↓

Plane shock waves ⇒ Exact + Precise



SPALL # - 1st Dent in the stone

C/I to ESWL

ABSOLUTE

1> Thrombocytopenia

2> ♀

3> Coagulopathy

RELATIVE C/I

4> CRF

5> Diabetic Nephropathy
↳ already fibrosis & scarring into ESWL may worsen nephropathy

6> Elderly

7> Cardiac Disease

8) Larger stones

COMPLICATION

1> Hematuria → MCC

2> Hematoma

3> Organ Injury

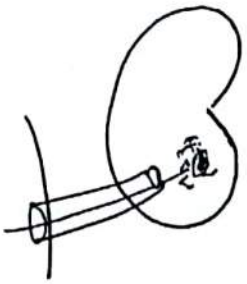
4> Chronic Sclerosing Fibrosis.

5> STEINSTRASSE → Street of stones

Ureteroscopic Removal ⇑ Blockage of ureter by fragments of stones

PCNL

→ Per Cutanlous Nephro ~~Lithotripcy~~ Lithotomy



Access to kidney = Via Inf. CALYX

(? access via Sup. Pole + ↑↑ of Pleural Injury)

exception- Horse-shoe kidney

↓

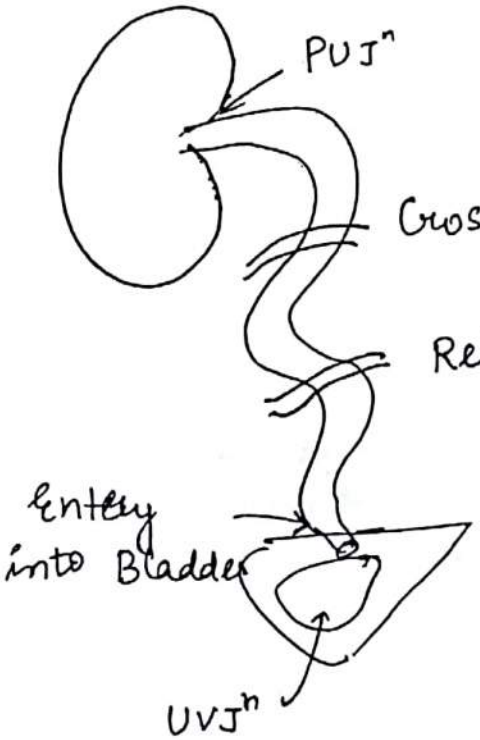
Access → Sup. Pole

COMPLICATION-

1) Hematoma
2) Hematuria
3) Colonic Perforation

URETERIC STONE

SITES OF IMPACTION



Gonadal vessels
Ureter
Iliac vessel

Relation ī ductus deferens / Round lig.

FEATURES -

1) Pain → Loin along Genitofemoral N/v
   ↓
   Groin
   $T_{10} - L_2$

Peristalsis causes pain.

2) Hematuria
3) obstruction.
4) Urosepsis

Mx -

1) Conservative Mx is preferred

* MEDICAL EXPULSION THERAPY (MET)

1) α-BLOCKERS → TAMSULOSIN
2) STEROID → DEFLAZACORT
3) CCB (Least preferred) → NIFEDIPINE

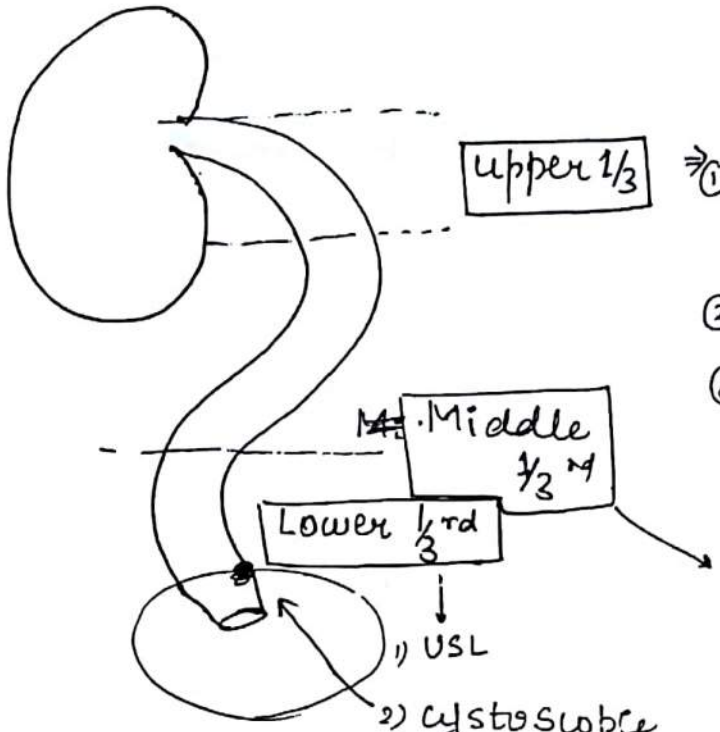
\+ Hydration

Antibiotics — NSAIDS

INDICATIONS FOR INTERVENTION

1) > 5mm
2) Symptoms > 3-4wks
3) young age
4) Severe Symptoms
5) not responding to medication
6) Obstruction.

Large stone causes Microtrauma → fibrosis



→ ① URETEROSCOPIC REMOVAL
or
URETEROSCOPIC LITHOTRIPSY (USL)

② ESWL

③ PCNL after pushing back

USL
Sx = Lap/Robot assisted Removal.

↳ for stones @ meatus.

3) DORMIA BASKET

↓

Blind Procedure
for Solitary - Lower 1/3 stone
Obselete now.

BLADDER STONES

→ Age = ↑↑ children B- Blader
↑↑ Elderly B- Bache, Buddhe

RISK

→ a/c Low Phosphate Diet
Infection
Schistosomiasis
Drainage - Foley's catheter
Foreign Bodies
↑ Uric acid

TYPES

1°	2°
Developed in STERILE URINE	a/c INFECTION
M/c- MIXED URIC ACID >> MIX. URATE	M/c- PHOSPHATE Stones
Radio-OPAQUE >> R. lucent	
JACK STONE / MULBERRY	

FEATURE

1) Pain @ tip of genitalia
↑↑ ambulation.
↓↓ recumbancy

2) Terminal Hematuria QQ

Mx -

CYSTOSCOPIC REMOVAL

Lithotripters

cystoscopic litholapexy

↓

Lap. Removal

PROSTATIC CALCULUS

ENDOGENEOUS P.C.

calcified CORPORA AMYLACEA.

Do not need Rx

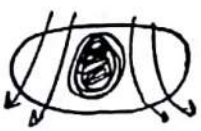
If symptomatic ⇒ TURP

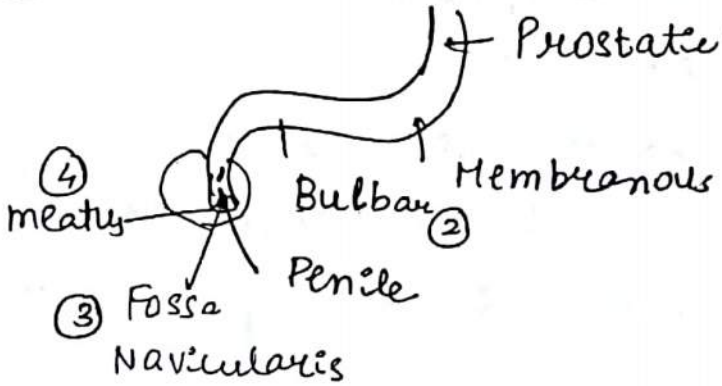
EXOGENEOUS P.C.

Calculus in PROSTATIC URETHRA

URETHRAL CALCULUS

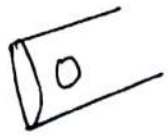
- Exclusive to ♂
- Pain @ tip of genitalia ↓ reduced stream of urine
- FORKING OF URINE





(M/c site for urethral calculus)

Rx- CYSTOSCOPIC REMOVAL

Proximal Impacted stones 

(eg. Meatus/ Fossa navicularis) → Meatotomy ± Stone removal

MALIGNANCY

RENAL

BENIGN

M/c Benign Lesion = SIMPLE RENAL CYST

M/c Benign TUMOUR = ONCOCYTOMA

ONCOCYTOMA

Pseudocapsule

♂ : ♀ = 3:2

TAN MAHOGANY Colour

Central STELLATE scar

GENETICS :- Loss of chromosome 1
Loss 14
Loss Y

ORIGIN :- Intercalated cells

ONCOCYTOMA		RCC [chromophobe]
Benign		Malignant
- -	HALE colloidal/ IRON STAIN	+++
-	Parvalbumin	+++
-	claudin	+++

IOC :- CECT → Central Stellate scar

CT Angiography → SPOKE WHEEL ARRANGE

Rx :- Partial nephrectomy (Nephron sparing Sx)

ANGIO MYOLIPOMA (AML)

<10%

♀ >> ♂

↑↑ c̄ age

5ᴹ - 6ᴹ decade

Sporadic >> Familial

↳ 3rd decade

a/c̄ TUBEROUS SCLEROSIS

ORIGIN :- Neural crest

QQ PEC (Perivascular epithelioid cells)

It consist of tortuous aneurysmal blood vessels

- + M/s (smooth)
- + FAT

CT → ~~1500~~ 15 HF

If fat +nt ⇒ **−20 HF**

+++ HMB-45 (Human Melanocyte Black)

↓

marker for Malignant Melanoma

↓

S-100

Tyrosinase

HMB-45

LDH

Melan-A

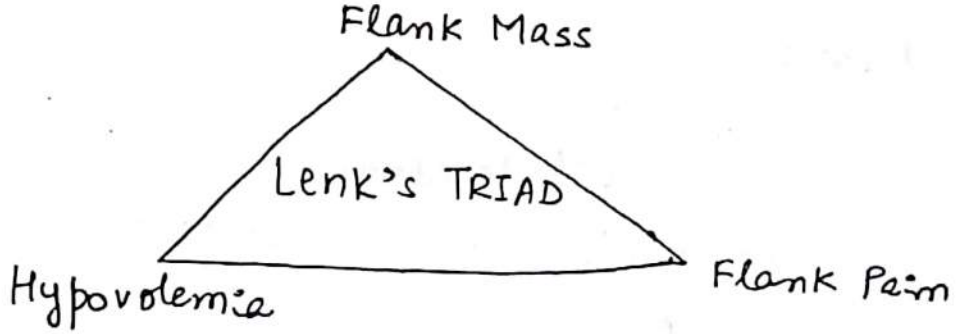
FEATURES:-

1) Spontaneous Retroperitoneal Haemorrhage

WUNDERLICH SYNDROME

↓

M/c C = Angiomyolipoma >> RCC



Rx o/c = Angio-EMBOLISATION.

Mx OF AML :-

< 4cm ⇒ Asymptomatic ⇒ observation.
Symptomatic — Wunderlich's
↓
Angio-embolisation.

> 4cm ⇒
1st Line ⇒ Angio embolisation
TOC ⇒ Partial Nephrectomy

RENAL CYST

IOC ⇒ CECT

BOSNAIK CLASSIFICATION

TYPE	REMARK	RISK OF Malignancy	Rx
I	clear, water cyst	0%	observation
II	I + Fine calcifi" + Fine septation	< 10%	observation
II_F	II + Perceived Enhancement		Closed Follow-up Ind" for Renal Mass Biopsy
III	II + Well defined calcification + Irregular Borders + Thick septations	60%	Sx

IV III + Soft tissue enhancement 90% Sx AIIMS

RCC

M/c Tumour of Kidney.

♂ >> ♀ (3:2)

65 yrs (Avg. age)

White > Black

Incidence = 12 in 100,000

Radio - RESISTANT TUMOUR.

↑↑ Predisposition for vascular spread.

(IVC extension → is seen in 10%)

U/L [B/L in <2%]

[TRICK - Rule of 2
any 2 organs 2 in no. in G.U. Tract
Risk of B/L Ca is < 2%]

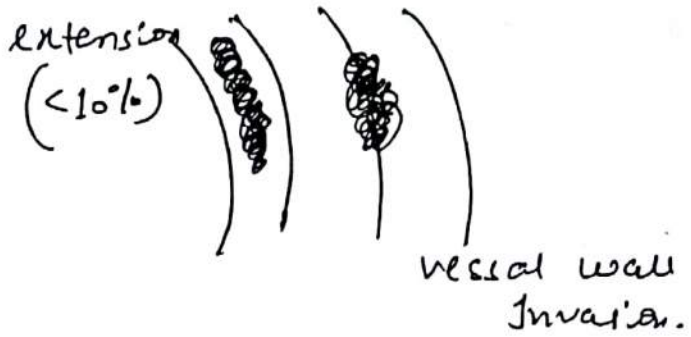
PATHOLOGICAL STAGE → most Imp. prognostic factor

OTHER PROG. FACTORS -

① Histological. (nuclear grade)
FUHRMAN's grading

② Tumour size

③ Vessel Wall Invasion



RISK FACTORS

1) TOBACCO
2) OBESITY
3) HTN

Other R/F -

1) Radiation
2) aromatic Hydrocarbons
3) Heavy metals
4) Thorotrast → It is a dye.
   Angiosarcoma (Most common Ca)
   cholangio Ca
   RCC
   Hepatocellular Ca
5) Diet

FEATURES

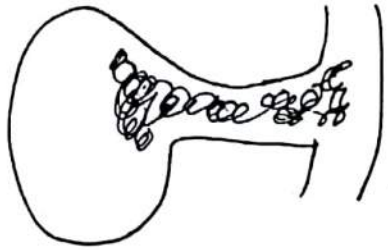
① Related to Kidney :-

INTERNIST TUMOUR.
GRAWITZ TUMOUR
HYPERNEPHROMA

1) Flank mass
2) Flank Pain
3) Hematuria

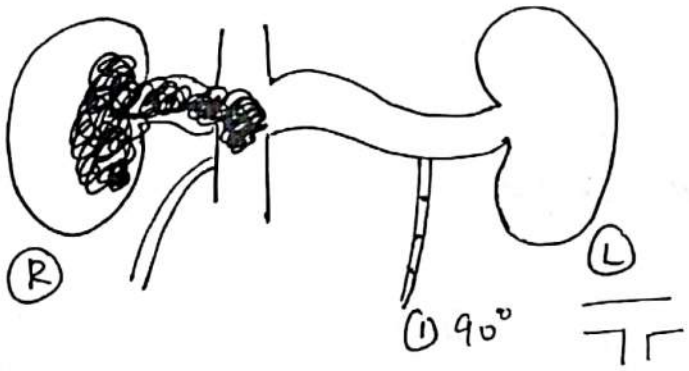
4> Perirenal Hematoma.

(II) Related to mass effect of RCC.-



1) ↑ B/L oedema ⇒ lower extremity

2) varicocele → due to Block of IVC.
B/L or Rt >> Lt



[varicocele usually is L > R but that due to RCC R > L]

② Incompetent valve of gonadal veins
⇓
∴ L > R usually

(III) Paraneoplastic Syndromes -

1) ↑↑ ESR

2) 2nd Anaemia

3) Hypercalcemia

4) HTN

5) Polycythemia

6) STAUFFER SYNDROME-
non-metastatic Hepatic failure due to RCC.

7) Other.

7) Cushing's

8) Hyperglycemia

FAMILIAL RCC

1) VHL → gene - VHL gene
Chromosome - 3
VHL gene code for HIF (Hypoxia Induc" Factor)

Mutation

↑ HIF 1 ↑ HIF_2

↑↑ EGFR ↑↑ VEGF

Tumour Neovascularisation

TUMOURS A/C VHL

1) BRAIN → Cerebral Haemangioblastoma

2) EYE → Retinal Angiomas

3) Renal → clear cell RCC
Renal cyst

3) ADRENALS → Pheochromocytoma

4) PANCREAS → Islet cell Tumour
Pancreatic cyst

5) EAR → Endolymphatic sac Tumour

6) Epididymis → Cystadenoma

IV) HEREDITARY PAPILLARY RCC

a/c C-MET Proto-oncogene Mut°.
↓
7q

a/c Type 1 Papillary RCC

III) HERE. LEIOMYOMATOSIS PAPILLARY RCC

→ Fumarate Hydratase mutation.
↓
1st → chromosome 1

→ a/c uterine/ cut Leiomyomas.

→ Type II Papillary RCC

IV) BIRT HOGG DUBE SYNDROME

→ a/c 17q mut°

→ a/c Chromophobe RCC >> Oncocytoma

→ a/c Spontaneous Pneumothoracis
Pulmonary cyst
Cutaneous Fibro folliculomas

MAINZ CLASSIFICATION

(PATHOLOGICAL)

① CLEAR CELL RCC (75-70%)

Origin → PCT

Genetics → Loss of 3p 00
8p
9p
Gain of 5q

Features → yellow
well circumscribed
lobulated
Highly vascular Tumour
↑ Tendency of venous extension.
Respond to Immunotherapy

Tumour Markers-
1> cytokeratin
2> CA-IX QQQ → carbonic anhydrase IX
3> EPC → epithelial Presenting carcinogen

PROG:- POOR.

(II) PAPILLARY RCC (10-15%)

Origin → PCT

Genetic → a/c TRISOMY OF 7, 17, Y

Features → hypovascular
Pseudocapsule
Fleshy Tumour
a/c CKD
Polycystic Kidney

TYPE

I	II
↑↑ Basophils	↑↑ Eosinophils
Better Prognosis	Poor Prognosis

TUMOUR MARKERS-

1) Cytokeratin-7
2) LMW-CK-7
3) AMCAR (α-mercapto CoA Racemase)
↓
also ↑ in Ca Prostate

Overall Good Prognosis

(III) CHROMOPHOBE RCC (<10%)

→ A/E Mut" in 1) Fumarate Hydratase
2) multiple gene mut".

→ Tan / Brown colour
→ well circumscribed
→ arise from Intercalated cells

→ FEATURE :-
1) PLANT cells
2) Resin nucleus
3) Perinuclear clearing
4) ↑↑ Eosinophils.

+++ HALE colloidal Iron stain

Prog → Good except sarcomatoid variety

(IV) COLLECTING DUCT

Origin → DCT

FEATURE- Grayish-white
Central in Location
↑↑ Infilteration

PROG → POOR

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

(v) MEDULLARY RCC

a/c Sickle cell Trait

LACY Pattern

WORST Prog.

Δ sis :- IOC ⇒ CECT

IOC → Rcc c venous extension ⇒ MRI

Best → Veno cavography

→ done if MRI is -ve.

→ Invasive nature

STAGING OF RCC

WHO Older ⇒ ROBSON

T_1 ≤ 7cm

θ T_{1a} ≤ 4cm ⇒ PARTIAL NEPHRECTOMY

θ T_{1b} > 4cm ≤ 7cm ⇒ RADICAL

T_2 > 7cm

T_{2a} > 7 ≤ 10cm

T_{2b} (≥ 10cm) ⇒ LAP. NEPHRECTOMY

T_3 Into Renal vein / IVC / Perinephric Fat

T_4 I/L Adrenal

Gerota's Fascia

Mets → C/L. Adrenal

N_1 = +ve LN

N_0 = No LN

MANAGEMENT

I) Sx (gold std)

II) ABLATION

III) ACTIVE SURVEILLANCE

Partial nephrectomy

INDICATION

T_{1a} ≤ 4cm

Solitary Kidney irrespective of size

C/L Diseased.

Pre-existing CRF (overloaded kidney

PARTS REMOVED

Preserve atleast 20% functional Kidney

ORGAN	MINIMUM FUNCTIONAL RESERVE
Kidney	20%
Liver	30% (25-30%)
Spleen	50%

Radical Nephrectomy

T_{1b} onwards.

Kidney
+ Perinephric fat
+ Gerota's fascia
+ Lymph node from celiac to bifurcation of aorta on the same side

Adrenal ⇒ routine removal is C/I.

Indication for removal
→ if adrenal involved
→ upper pole Tm.

COMPLICATIONS

PARTIAL	RADICAL
Hyperfiltration Syndrome (↑↑ urine protein Loss)	C/L CRF

(II) ABLATION

INDICATIONS :-

1> Elderly not fit for Sx
2> advanced Rcc
3> Post-Sx Relapse
4> multifocal familial Rcc

ABSOLUTE C/I :-

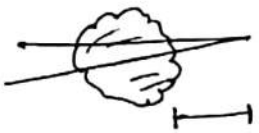
Any Tm > 4cm size

3 TECHNOLOGY

① CRYO
② RADIO FREQUENCY
③ HIFU

cryoprobe generate ICE BALL

CRYO



Temp = -20°C

we use liquid N_2 Helium

[1st FREEZE ⇓ then THAW] x cycle

⇓

To damage microcirculation.

NECROSIS ⇐ ISCHAEMIA ⇙

⟨III⟩ ACTIVE SURVEILLANCE

INDICATIONS

1> Elderly; not fit for Sx

2> Young pt. c features S/O BENIGN LESION

BOSNAIK → ~~I/II/I~~ $\underline{III}_F$/II/I ⇓ F/U 6 monthly CECT/ MRI ⇓ ↑/↓ Lesion decide B/M lesion.

C/I :-

1> >4cm

2> young pt c Solid/Dense Tm

3> Radiological features ⇒ S/O malignancy

LOCALLY ADVANCED RCC

TOC = ENBLOC NEPHRECTOMY

Kidney

+ G. Fascia

+ Adrenal

+ L.N.

+ all local Str. Involved

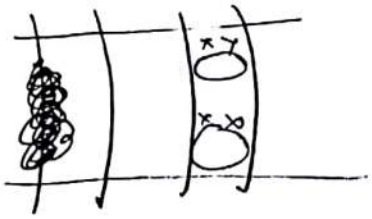
RCC ⊼ VENOUS EXTENSION

10%

STAGE [T_3]

RADICAL NEPHRECTOMY + THROMBECTOMY (RN)

RCC ⊼ VENOUS WALL EXTENSION



RN + VENO-VENOUS GRAFTING

Post S_x ⟶ chemotherapy
· +/-
Immunotherapy

1> serolimus
item serolimus
ieveolimus
] mTOR inhibitors

2> Sorafinib / Sunitinib Multi-Kinase inhibitors

3> Bevacizumab

4> Cetuximab etc.

RT ⟶ Rc ⟶ Radioresistant

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

FOLLOW-UP OF RCC

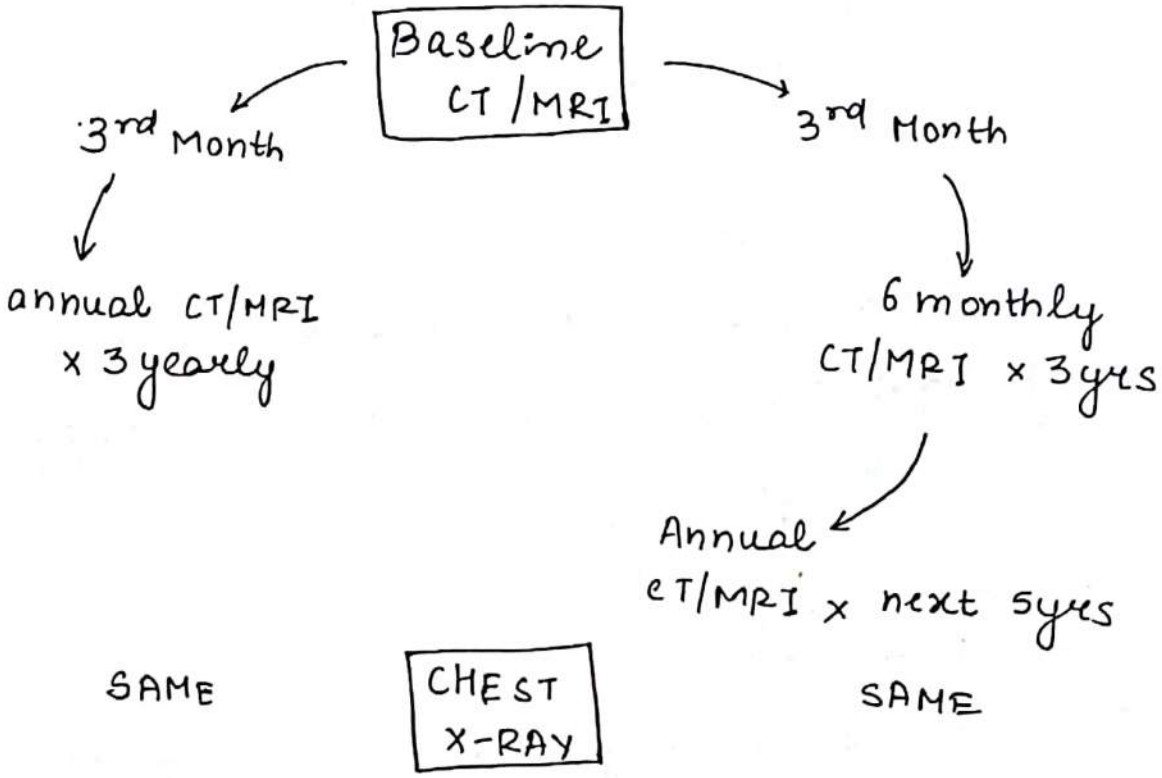
LOW GRADE RCC

$T_1 N_0 M_0$

HIGH GRADE RCC

$T_2 \rightarrow T_4$; N_0; M_0

any T; $N_1 M_0$



BLADDER CARCINOMA

TYPES

<1> UROTHELIAL CA (M/C Type) 90%
OR
TRANSITIONAL CELL CARCINOMA

<2> SCC (2-7%) 2nd M/C
- 2nd M/C
- Schistosomiasis
- Stones

<3> ADENOCARCINOMA (<2%)
- Dome of bladder - M/C SITE
- Drainage procedure [a/ē Ureterosigmoidostomy]
- Discharge @ umbilicus [a/ē URACHAL CA]

R/F FOR BLADDER CA

1> Cigarette (component of tobacco ⇒ 4-aminobiphenyl)
2> Cyclophosphamide.
(Phenacetin also)
3> Chemical
(Aromatic Hydrocarbon → Aniline)
4> Schistosomiasis
5> Stones
6> Radiation
7> F.B. [Catheter].

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

C/F

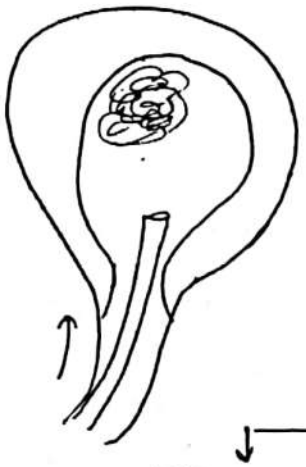
1> PAINLESS HEMATURIA

2> umbilical D/C (serous/ sanguenous)
   ↳ seen in URACHAL CA

Δ :-

IOC for Hematuria ⇒ CT UROGRAPHY

GOLD STD ⇒ CYSTOSCOPY

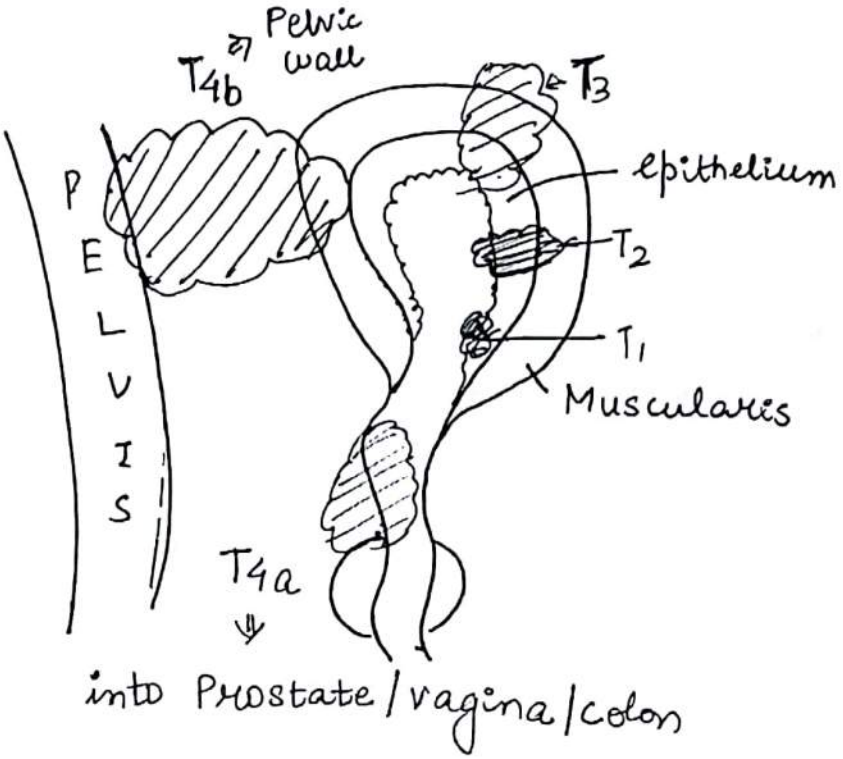


TRANS URETHRAL RESECTION OF BLADDER T_x (TURBT)

≈ cystoscopic Excision Biopsy

↳ Adv :- Tells About

- TYPE
  - UC
  - SCC
  - Ad.
- STAGE
  - T_1 = Into epithelium
  - T_2 = Into muscularis
  - T_3 = Outside Bladder
  - T_4 = Into local str.
  - Tis = CA In situ
- GRADE
  - G_1 → Low
  - G_2 → Intermediate
  - G_3 → High.



Mx

UROTHELIAL CA [UC]

MUSCLE NON-INVASIVE [Tis ; T1]

⇓ Check the grade

- **G1/2**
  - Solitary ⇓ SINGLE DOSE Intravesical CT
  - Multiple ⇓ 6 weeks Intravesical CT
- **G3 / cis** ⇓ Intravesical immunotherapy (BCG) ↓ 3 monthly booster doses for 3 years

MUSCLE INVASIVE [T2 and Above]

SCC → RADICAL CYSTECTOMY ↓ CT + RT

Adeno → RADICAL CYSTECTOMY ↓ CT + RT

PARTIAL CYSTECTOMY ↓ may be done for DOME of Bladder Ca → In young pt.

For Non-Invasive

⇓

3 MONTHLY FOLLOW UP
(Cystoscopic)

Intravesical CT
- Mitomycin
- Gemcitabin
- Doxorubicin
- Thiotepa (not used now)

Intravesical Immunotherapy
DOC ⇒ BCG
started 2 week post TURBT
↓
So that wound gets healed ~~i~~ in 2 week

C/I for BCG
1. ♀
2. HIV
3. ~~i~~ in 10 days of TURBT
4. Traumatic catheterisation

S/E -
BCGosis ⇒ Rx ⇒ ~~Pathotoxic~~ ~~CT+RT~~
↓
6 monthly ATT

FOR ADVANCED BL CA ⇒ Palliative CT + RT

⇓

after that

DIVERSION OF URINE

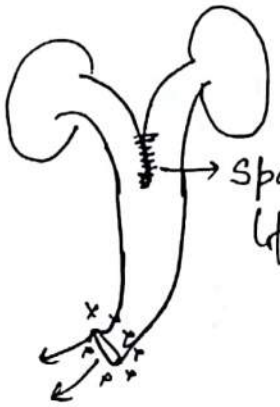
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

DIVERSION OF URINE

- URETEROSTOMY
- URETERO SIGMOIDOSTOMY
- ILEAL CONDUIT
- CONTINENT DIVERN

URETEROSTOMY

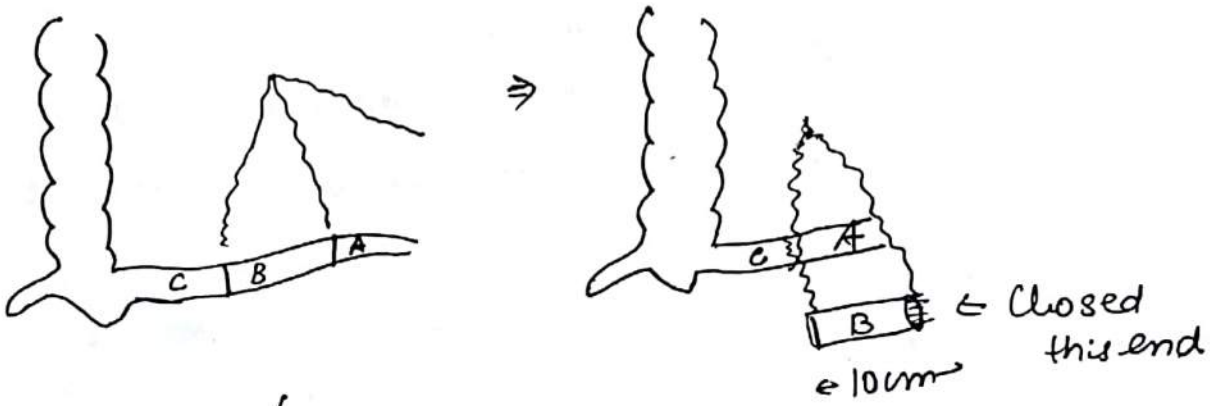
Opening ureters directly into the skin.

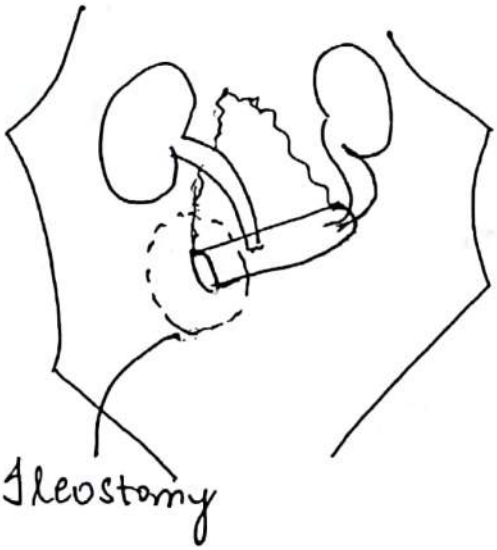


URETERO SIGMOIDOSTOMY

- Ureters directly opens into sigmoid colon.
- Hypokalemic Hyperchloremic Met. acidosis
- ↑ risk of Adeno Ca to colon (200 times)

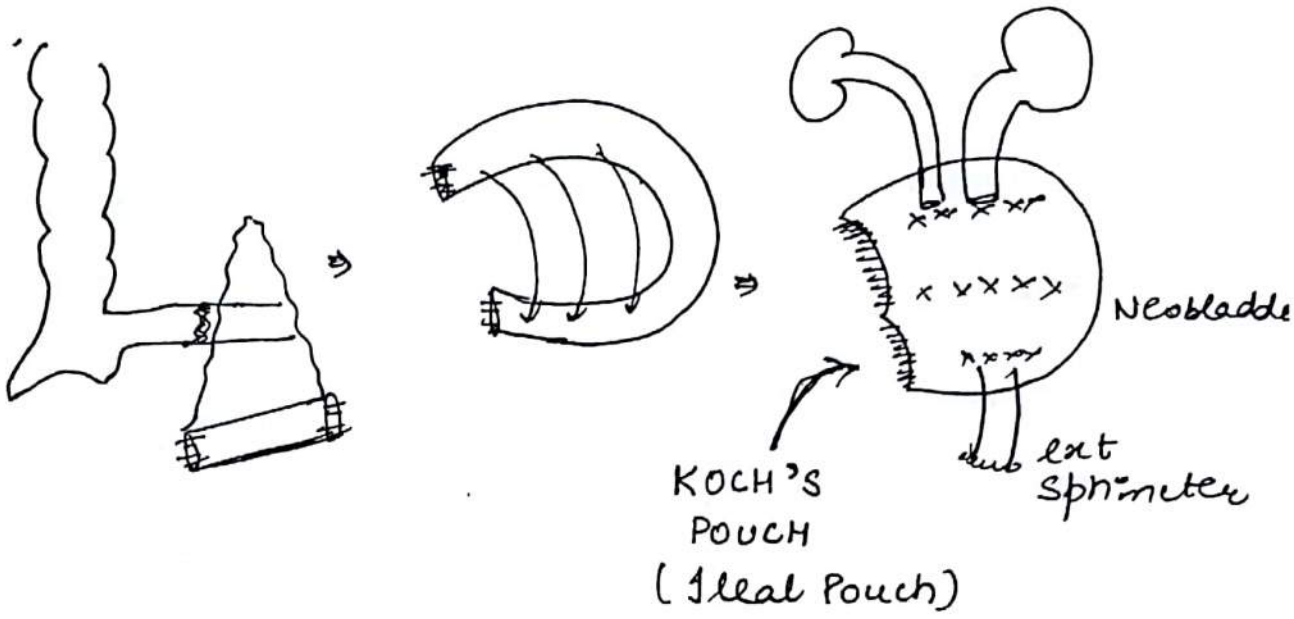
ILEAL CONDUIT





MOST POPULAR

④ CONTINENT DIVERSION (Neo Bladder)



If ascending colon is used ⇒ INDIANA POUCH.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

CA PROSTATE

M/C SITE = Peripheral zone Post. LOBE

M/C TYPE = Adeno Ca (mixed type >> small cell type

BLACK >> White

M/C visceral malignancy in GUT In ♂

Avg. Age > 68yrs (6th - 7th Decade)

GENETICS:-

RNASEL (HPC-1) on Chr. 1

$ELAC_2$ (HPC-2) on Chr. 17q

MSR-1 (Chr. 8)

R/F :-

1) Testosterone ⟶ DHEA
   ↑↑
2) Estrogen ↑↑
3) Insulin Like Growth Factor
4) Leptin ↑↑
5) Infection ↑↑
6) Vasectomy
7) Vit D Deficiency
8) Alcohol
9) Smoking

PROTECTIVE :-

1) 5α Reductase inhibitors
2) Green Tea
3) Soy protein
4) Vit E
5) Lycopene
6) Statins

PIN ⇒ PROSTATIC INTRAEPITHELIAL LESION

PIN ≠ CIS

Benign Prostatic acini surrounded by atypical cells

GLEASON'S SCORE (GS)

GRADING OF CA PROSTATE

GS	GRADE
2, 3, 4	LOW
5, 6, 7	INTERMEDIATE
8, 9, 10	HIGH

STEPS IN CALCULATION OF GS

1) Selected in 2 most common pathologies

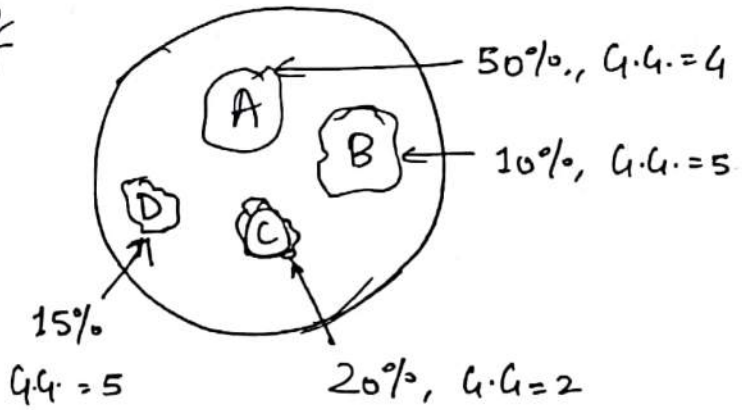
2) Grade the selected pathologies on scale of 1 to 5

1 → Most Differentiated

5 → Most Undifferentiated

3) Add the two scores to get final score out of 10.

Eg



STEPS

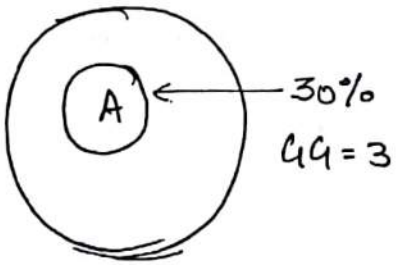
A + C

50% 20%

4 2

⇒ 6/10

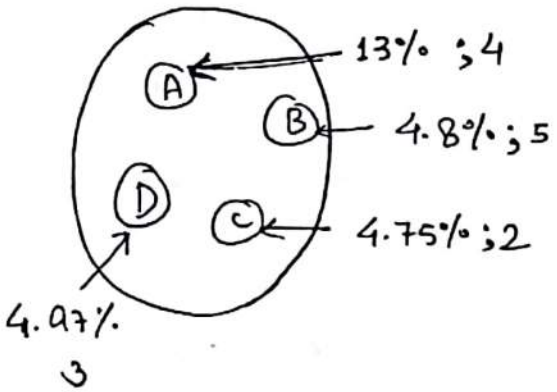
In case of single Pathology



STEPS

A + A

3 + 3 = 6/10



In calculation of GS; any pathology < 5% is not counted

∴ GS ⇒ 4 + 4 (A + A) = 8/10.

PARTIN'S TABLE
JEWITT - WHITTMORE Staging] for Ca. Prostate

STAGING OF CA PROSTATE

EARLY CA PROSTATE
- T_1 = Non Palpable; incidentally detected
- T_2 = Palpable; but confined to prostate

ADVANCED CA PROSTATE
- T_3 = outside prostate
- T_4 = Into Local structures

Δsis

TRUS + Guided Biopsy
+
↑↑ Tm Marker

SCREENING

M/c used method ⇒ Sr. PSA + DRE

Most effective ⇒ Sr. PSA + DRE + TRUS
(By WANTANBE 1st)

Age: started 50 yrs onwards.
>40 yrs (40-45 yrs) ⇒ Africans.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

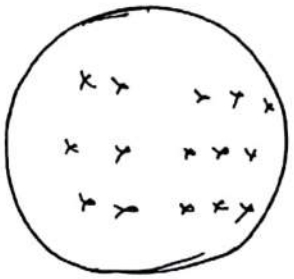
INDICATION FOR TRUS GUIDED BIOPSY :-

1) Malignancy
2) Evaluation of prostate nodule
3) Before Intervention for Benign Disease
4) PSA.

>4 ng/mL @ any age
>2.5 ng/mL @ >60 yrs
>0.6 ng/mL @ >40 yrs

MOST SENSITIVE >0.75 ng/mL/yr PSA VELOCITY

FREE PSA < 10-15% of Total



12 QUADRANT ——to——→ 16 QUADRANT Bx.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

TUMOUR MARKER :-

1> PSA

glycoproteins

Mol. wt. - 32 KD

7% carbohydrate

Liquification of semen

Serine Proteinase

Lysine arginase

It can exist in 2 forms

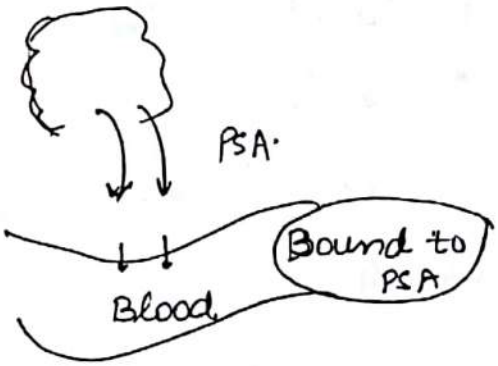
PSA

FREE

↑↑ in Benign Ds.

BOUND

↑↑ in Malignancy



Malignancy → Damage to Basement Membrane

↓

Free access of PSA to Blood

↓

PSA binds c Albumin

↑↑ Bound form

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

2> PSMA [Prostate specific Membrane Ag]

3> PCA_3 / DD_3
most sensitive marker for Ca
it is urine based marker
it is also k/n as EPCA-2 (Early Prostate Ca Ag)

4> AMACAR
also ~~auto~~ elevated in Papillary Rcc

5> Endoglin [CD_{105}]

6> TRM PSS [Trans membrane prostate serinase]

7> $PBOV_1$ [↑ Prostate + Breast over expression]

8> UROC - 28
↑↑ Ca Pr. ; ~~Ca~~
↑↑ Ca Br.
↑↑ Ca Bladder

9> ANNEXIN - A_3

10> GSTP-1 [glutathione S transferase protein-1]

11> $RASSF_1A$.

PIRADS - 2 [MRI Based]

↳ 2nd version Now

1 to 5

1 ⇒ very Less chance

2 ⇒ Benign

3 ⇒ Probably Benign

4 ⇒ s/o Malignancy

5 ⇒ highly s/o Malignancy

Mx -

Sx RT ACTIVE SURVEILLANCE WAITFUL WATCHING

<I> Sx

GOLD STD

Radical Prostatectomy

LAP

Open

RALRP (Radial Laparoscopic Radical prostatectomy)

CRITERIA FOR Sx

1) <75yrs or
>10yrs life expectency

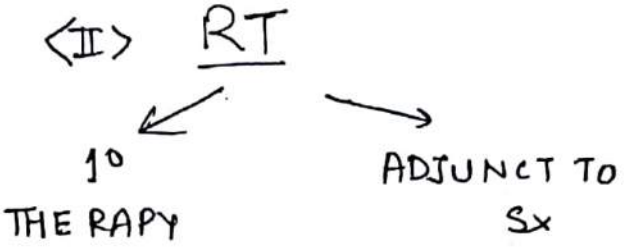
2) T_1 & T_2

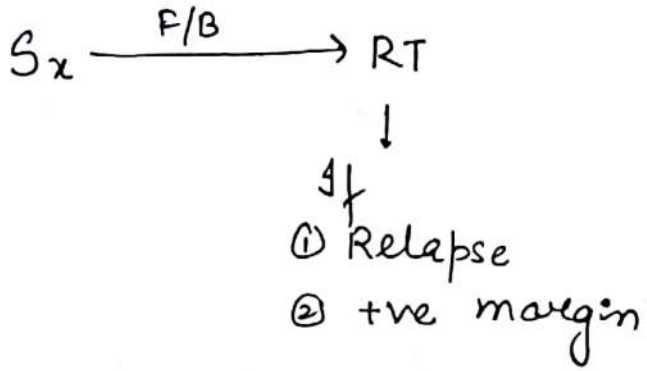
3) PSA < 20 ng/mL.

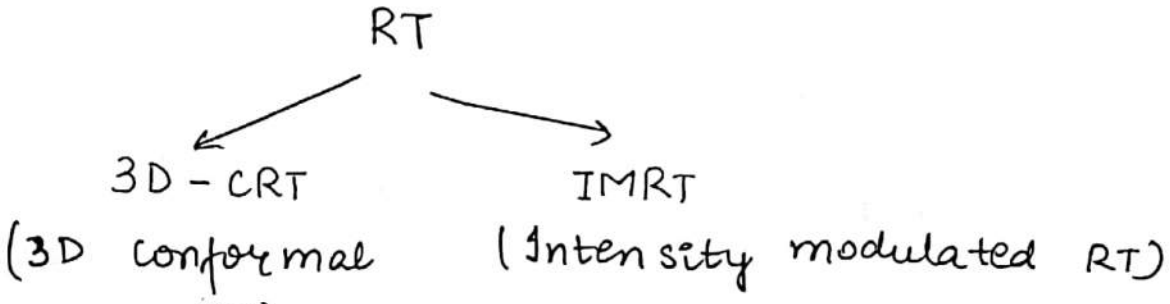
COMPLICATIONS

1) Erectile Dysfunction

2) Urine Incontinence





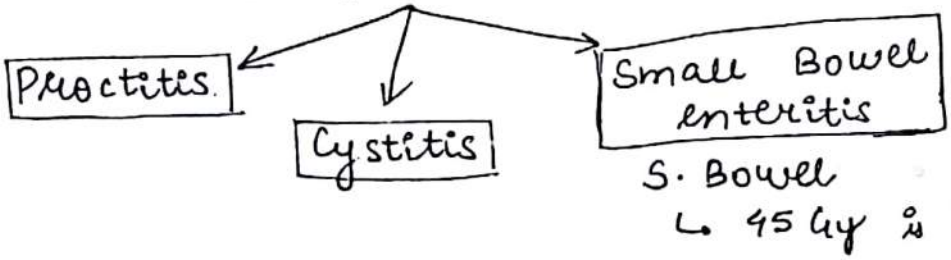


6 7 8

70-80 Gy (avg 76-78 Gy)
for 6 weeks

COMPLICATIONS OF RT -

Radiation Induced



S. Bowel
↳ 45 Gy is threshold

(III) ACTIVE SURVEILLANCE

⇓

3 MONTHLY – 6

During this monitor

PSA

TRUS

DRE

INDICATIONS

→ Low Risk
→ Moderate Risk
} Ca Prostate

AMIACIO'S CLASSIFICATION

LOW RISK

T_1

T_{2a}

PSA < 10 ng/mL

G.S. ≤ 6

INTERMEDIATE RISK

T_1

T_{2a-b}

PSA < 20 ng/mL

G.S. = 7

HIGH RISK

T_{2c} + above

PSA > 20 ng/mL

G.S. ≥ 8

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Blank Page

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Blank Page

Blank Page

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Blank Page

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Blank Page

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

ACTIVE SURVILLANCE -

3-6 monthly PSA
TRUS
DRE

INDICATIONS-

Low Risk — Mod. Risk — Ca Prostate

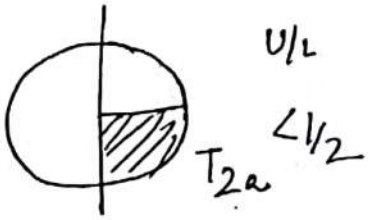
D'AMIACIO'S CLASSIFICATION

LOW RISK-

T_1, T_{2a}

PSA < 10 ng/mL

Glisson's score ≤ 6



INTERMEDIATE RISK

T_1, $T_{2a \rightarrow b}$

PSA < 20 ng/mL

gs = 7

HIGH RISK

T_{2c} and above

PSA > 20 ng/mL

gs ≥ 8

WAITFUL WATCHING

≥ 75 years

Simple observation

Mx of ADV. PROSTATE CANCER

H/c site- Metastasis ⇒ BONE >> LUNGS

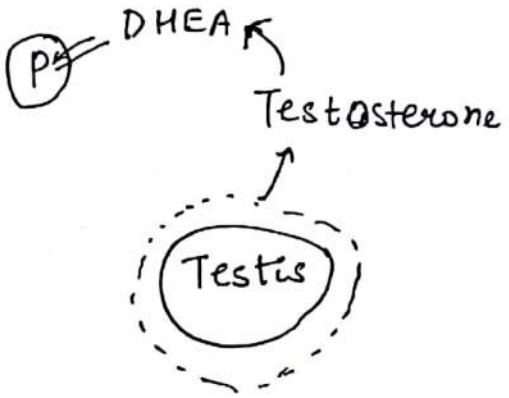
Bones → Lumbar V. >> Head of Femur >> Pelvis

2° to Bone ⇒ Ca Prostate > Ca Breast >> RCC > Ca Thyroid > Ca Lung.

METASTATIC CA PROSTATE

⇒) CASTRATION

- Sx → Subcapsular Orchidectomy
- Medical → ANDROGEN ABLATION.



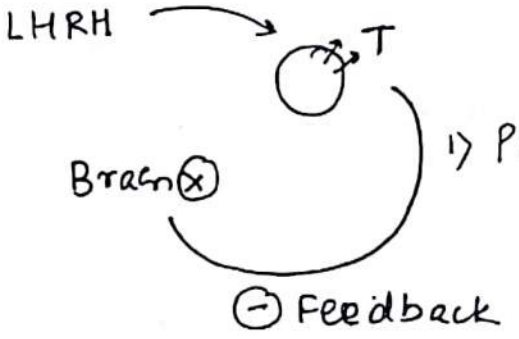
1) LHRH Agonist (Preferred)

2) LHRH Antagonist

3) Androgen Blocker

Remove all content.

SUBCAPSULAR ORCHIDECTOMY (CHARLES HUGGINS) procedure



COMPLICATIONS-

1) PROSTATIC FLARE (1b-1Bday)
Surge in Testosteron Levels due to LHRH
So, we add Androgen Blocker for 3 weeks

2) CVS events

3) Osteoporosis.

⇒ MCRPC (Metastatic Castreation Resistant Prostate Ca)

DRUGS

1) ~~ABITERONE~~ ABIRATERONE

anti CYP17

Block 17α hydroxylase

2) DOCETAXEL

3) IPLIMUMAB

also used for Malignant Melanoma

SIPULEUCAL T ⇒ CD_{54} extract

Anti Prostate Cancer vaccine

PROST-VAC - Pox virus based.

Anti Prostate cancer drug.

TESTICULAR CARCINOMA

GERM CELL

SEMINOMA
1) Classic
2) Spermatyte
3) Anaplastic

NON-SEMINOMA
1) Embryonal cell Carcinoma
2) Choriocarcinoma
3) Yolk sac Carcinoma
4) Teratoma

NON GERM CELL
1) Leydig cell carcinoma (M/c non germ cell Reinke's crystal)
2) Sertoli cell Tumour
3) Granulosa cell Tumour (Call exner Bodies)
4) Androblastoma

M/c type of germ cell Tumour

Overall = Seminoma

>60yr = Lymphoma

20-60yr = Seminoma

15-19yr = Leukemia >> Seminoma

<15 yr = Yolk sac Tumour (children pre pubertal)

EXTRA TESTICULAR = TERATOMA

SITE = Mediastinum >> Retroperitoneum
↳ Ant. (L > R)

Most malignant Germ cell Tmour. = Embryonal cell carcinoma

↓ hematogenous spread = CHORIO CA

↓ Brain metastasis ↗

↓ Spontaneous Haemorrhage ↗

CHEMO RESISTANT = TERATOMA

PARA TESTICULAR MALIG = Adenomatoid Tumour of Epididymis

M/c site for Soft tissue sarcoma in Testis = Epididymis

M/c Soft tissue sarcoma = Liposarcoma → M/c In adults

↓

In children

Rhabdomyosarcoma

M/c chromosomal Ab (N) = i 12p (EXTRA COPY)

M/c tumour of Tunica vaginalis = MESOTHELIOMA

ITGN (Intra Tubular Germ cell Neoplasm)

ITGN = C_{is} of Testes.

ass ↓ i 12p (extra copy)

gives rise to ALL GCT except Spermatocytic seminoma

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

RISK FACTORS FOR CA TESTIS

1> CRYPTORCHIDISM
4-6 times.

2> PERSONAL R/F
Radiation
Heavy metals.
Smoking

3> FAMILIAL R/F

4> ITGN

SEMINOMA

Greyish white
Nodular
Scaly
~~soft~~ firm
Sheets of cell separated by Trabeculations
↑ Lymphocytic Infilteration.
U/L (<2% - B/L)
ass c SARCOIDOSIS
TUMOUR MARKERS-
++ CD117
- CD30
++ LDH
- ~~α~~ FP
+ βHCG (in 10-20% only)

SPERMOCYTIC SEMINOMA -

Type of seminoma

Not ass. ~~c~~ i 12p

ITGN

BIL

also -CD 117

EMBRYONAL CELL CARCINOMA

Contains Pleuripotent malignant cells

Deffuse areas of H'ge & Necrosis

TUMOUR MARKER

↑↑ LDH

↑↑ αFP

↑↑ βHCG

-CD 117

++ CD 30

AE_1+ / AE_3+

OCT_3+ / OCT_4+

CHORID CARCINOMA

Tumour ass ~~c~~ syncytio cyto-trophoblast

↑↑ Hematogenous spread

MC TUMOUR FOR ~~BONE~~ BRAIN METs

ass ~~c~~ spontaneous H'ge

TUMOUR MARKER

++LDH

++ βHCG

-+/- AFP

YOLK SAC TUMOUR
or
ENDODERMAL SINUS TUMOUR

M/c type in Infancy

SCHILLER DUVAL BODIES +

HYALINE GLOBULES +

TUMOUR MARKER -

++ LDH

++ AFP

- β HCG

TERATOMA

MONSTER TUMOUR

They contain elements of ≥2 germ cell Lineage

Chemo - Resistant

Neg. for most Tumour Markers

(may be +ve for AFP)

⇒ GROWING TERATOMA SYNDROMA -

rapidly growith Teratoma ± infilterates into local structures

ir-resectable

⇒ TERATOMA CONVERSION TO SOMATIC MALIGNANCY -

Adeno Ca

Neuro Ecto dermal

Rhabdomyo Sarcoma

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

FEATURE OF TEST. CA :-

1) PAINLESS HARD TESTICULAR MASS
2) Dull aching sensation / heaviness
3) Infertility
4) Gynaecomastia

Mx :-

Painless Hard Mass

- USG → evaluate mass → features s/o malignancy
- SERUM MARKERS → AFP, βHCG, LDH → ↑↑↑

→ Δsis = TESTICULAR CA

[FNAC / BIOPSY is C/I due to risk of spillage]

→ HIGH INGUINAL RADICAL ORCHIDECTOMY

TRANS SCROTAL approach

- Repeat Sr. AFP / β HCG / LDH after 7 days (5 → 3 → 1)
- BIOPSY

BIOPSY

SEMINOMA — NON SEMINOMA

PERSISTENT ↑↑ Level → Residue? → INDUCTION chemotherapy

3 cycles of BEP
Bleomycin
Etoposide
Cisplatin.

↓↓ Level

STAGE 1

↳ Brachytherapy
c DOC leg/ hockey stick.
Inverted Y regimen.

STAGE -2

CT + RT

↳ 25 Gy 5-6 weeks

↙ 3× BEP

(no role of ~~LN~~ Retroperitoneal L.N. Dissec")

INVERTED Y

HOCKEY STICK

STAGE - 1

CT+RT

STAGE -2

Induction CT
3 cycles of BEP
↓
CECT Abd

If NO LN seen → RT

If LN seen → Retro Peritoneal LN Dissec"

Stage-3 = RP LND → CT + RT.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

CA PENIS

- PREMALIGNANT
  - ERYTHROPLASIA OF QUEYRAT
    - Cis of glans/ Prepuce + non-Keratinised Penile shaft
  - BOWEN'S DISEASE
    - Cis of Keratenised penile shaft & Perineum
  - BUSCHKE LOWENSTEIN TUMOUR (verrucous Ca)
    - Locally aggressive Lesion ± often infilterate into deeper str.
    - seen in Penis + Anus
- MALIGNANT
  - SCC
  - MM

- **BXO** - Balanitis Xerotica Obliterans
  - → also K/n Lichen sclerosis et atrophicus
  - → Chr. sclerosing Inflammatory Lesion affecting glans/ prepuce
  - - may involve any age group.

FEATURE -

1) Phimosis - non retractile foreskin.
2) Collagenisation of Dermis
3) Loss of Rete pegs in Dermis M/C

Mx: Long term (3-4 wk) Antibiotic course
↓ F/B
Circumscision.

PEDIATRIC PHIMOSIS

upto 5yr observation

After 5yr → if persists ⇒ go for Circumscion

PENILE CARCINOMA

M/c type- SCC

M/c site- Glans >> Prepuce >> Glans + Prepuce >> Penile shaft
(21%) (9%)

RISK FACTOR-

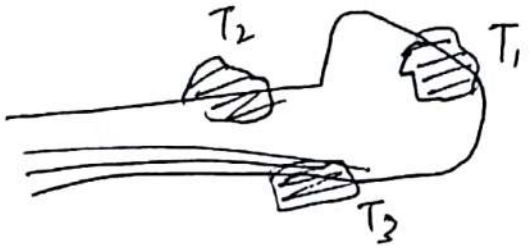
1) STD
2) HPV 16, 18, 21
3) Immunosuppression
4) Smegma [circumscision is protective]
5) Geography BRAZIL → MAX.
ISRAEL → Least

FEATURES-

- Painless
- ulcero-proliferative Lesion
- may bleed to touch

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

STAGING



T_1 → Subepithelial

T_2 → Into corporeal Bodies

T_3 → Into urethra

T_4 → Local structure

LN – Sup. Inq → Deep Inq → obturator → Iliac → Para Aortic

→ INGUINAL BLOCK DISSECTION

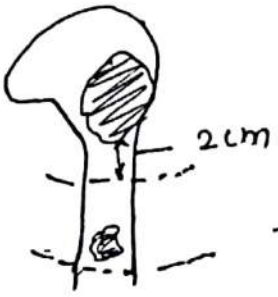
Recommended in ≥ T_2.

Mx

Wide Local Excision ± 2cm Margin.

+/-

Inguinal Block Dissection.



Total Penile Amputation

↳ proximal penile growth

WILM'S TUMOUR
NEPHROBLASTOMA

H/c type of tumour in children. (w.r.t Genito urinary Tract)

AGE → 3 yrs ← Max. Incidence

2 ⟶ 5 yrs.

FEATURES -

1) FLANK MASS - H/c clinical Presen"

2) Hematuria

3) HTN

4) Wt. Loss

5) Pain is least common.

Sporadic >> Familial

U/L

FAMILIAL WT

ass ⊂ WT_1 / WT_2

Chromosome 11

1) DENNYS DRASH

Nephropathy

Gonadal Dysgenesis

WT_1

2) BECKWITH - WEIDMANN Sy.

Midline abdominal wall defect

Macro-glossia, Visceromegaly.

Hypoglycemia

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

3) WAGR [Wilm's Tm, Aniridia, GU Abn, Retardation]

4) Li- FRAUMENI
   Ch 17q.
   p53.

IOC - CT SCAN (CECT)
   C-XRY → Lung Mets

TYPES

FAVOURABLE PROG	UNFAVOURABLE PROG	ANAPLASTIC (WORST PROG)
a/c epithelial cells Stromal cells → Blastemal cells	WT c SARCOMATOUS changes	WT (unfavourable type) + Chemo Resistant

STAGING

I - confined to kidney

II - Outside kidney But completely Resectable
   PRE-OPERATIVE BIOPSY done ~~000~~

III - Incompletely Resectable Tumour
   or
   Lymphatic extension.

IV - Hematogeneous spread

V - B/L WT

Rx

INDICATIONS FOR Neo-Adjuvent CT

1) Laege WT
2) Extra capsular
3) Lympho-vascular Invasion
4) B/L WT
5) Solitary Kidney

CT → DACTINOMYCIN
↓
VINCRISTINE

℞ Sx = RADICAL NEPHRO-URETERECTOMY
↓
Ureter removed as much as possible

INDICATIONS FOR PARTIAL NEPHRECTOMY

If all the cond" are satisfied,

1) Tumour confined to Pole
2) No capsular
3) No Lymphatic
4) NO vascular
5) No collecting Duct Invasion

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

BPH (Benign Prostatic Hyperplasia)

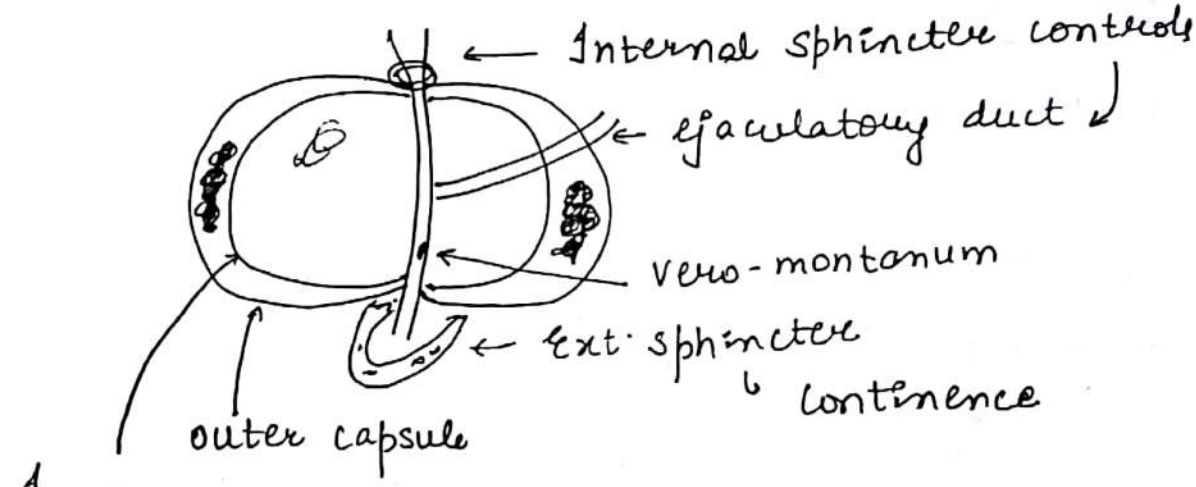
M/c site-

Median Lobe ; Lateral Lobe

M/c zone- Central / Peri urethral zone

STROMA- GLANDULAR DISEASE

Starts @ glands → Involves Epithelium



PATHOPHYSIOLOGY-

Hyperplasia of prostate

↓

Growth is restricted by Prostatic capsule

∴ Prostatic urethra gets compressed

↓

↑↑ Back Pressure

↓

Bladder wall changes

↑ compliance

By Detrusor Hypertrophy

↓

Bladder Decompression
↓
Trabeculation.
↓
Diverticulation
↓
Sacculation.

COMPLICATIONS

1) Obstruction
2) Urosepsis
3) Urine retention
4) Incontinence → Urge Incontinence
   ↓
   Overflow Incontinence
5) Bladder outlet obstruction ⇒ STONE
6) Infertility (Rare)
7) Hematuria (DECOY PROSTATE)
   ↑ Rupture of peri-prostatic venous plexus

SYMPTOMS

LUTS (Lower Urinary Tract Symptoms)

By Paul Abraham

VOIDING

- Hesitancy
- Poor stream
- Stuttered micturition (Intermittent flow)
- Post Void Br Dribbling
- Sense of incomplete evacuation (near Retention)

STORAGE

- Urgency
- Frequency
- Nocturia ≥ 3 episodes of voiding during sleep.
- Nocturnal Incontinence
- Urge Incontinence.

D/D OF LUTS

1) BPH
2) Ca Prostate
3) Bladder outlet obstruc^{n}
4) Stricture urethrae.

MARRION'S DISEASE ⇒ Idiopathic hypertrophy of Bladder neck & Internal Sphincter ⇓ Bladder outlet Obstruc^{n}.

5) Neurogenic Bladder.
   a/c ↑↑ age
   Parkinsonism
   DM
   Tabes Dorsalis

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Δ's

1) TRUS + PSA + DRE.

- Baseline level
- Assess Prostatic volume
- PSA velocity

5α ~~Red~~ Reductase Inhibitors causes ↓↓ PSA by >50% after 6 months of therapy

FOR LUTS

1) UROFLOMETRY

Urine flow rate

>15-22 mL/sec – (N)

<10 mL/sec → (A)b (N)

10-15 mL/sec → equivocal

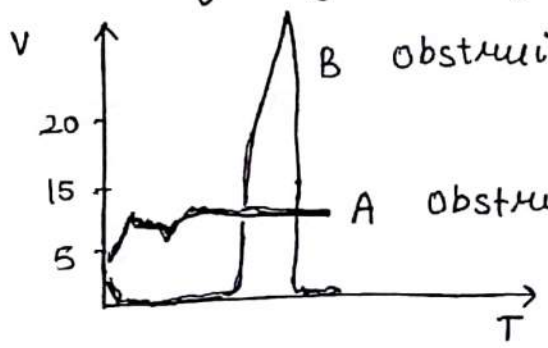
Best Inv. for LUTS

Min 150 mL of urine output must be voided

No age correction is reqd.

Q_{max} = Max. Vel. ⇒ MORE IMP.

Q_{avg} = Avg. velocity



B obstruc^n = Dynamic → stone

A obstruc^n = CONSTANT = malig / BPH

2) PRESSURE STUDY-

Ⓝ voiding Pressure < 60 cm H_2O

equivocal 60-80 cm H_2O

Ab Ⓝ > 80 cm H_2O

3) PRESSURE FLOW STUDY -

a) Low Vel. High Pressure ⇒ obstruct^{n}

b) Low vel. Low Pressure ⇒ Neurogenic

Mx

MEDICAL

1st Line

1) α BLOCKERS (1st Line)

PRAZOSIN, TAMSULOSIN → ↓↓ Libido, Orthostatic Hypotension

UROSELECTIN α-Blocker

↓

[ALFUZOCIN, SILDOSIN]

2) 5α REDUCTASE INHIBITORS (DOC)

FINASTERIDE → Type II Blocked

DUTASTERIDE

(type I & II Blocked

↓↓ PSA > 50% in 6 months

INTERVENTION

ENDOSCOPY

TURP

TUVP

TUIP

TUMT

TUNA

LASERS

PUL

STENTS

Sx

Prostatectomy

1) Suprapubic [FRAYER'S]

2) Retropubic [MILLIN'S]

3) Perineal Sx [YOUNG'S] ← 1st

INDICATIONS FOR INTERVENTION

1) Acute Urine Retention - Most Imp.

Rx of = Foley's Catheterisation
↓ fail
SPC (supra pubic catheterise)

2) Recurrent UTI

3) Recurrent/ severe Hematuria

4) Recurrent chronic Urine Retention

5) Bladder outlet obstruc"

6) Stones

7) Diverticulation/ sacculation

TURP

Resection of Prostate via electric Loop
↓
Anaesth ⇒ SPINAL
K/n Resectoscope
↓
Platinum : Iridium Alloy
(80:20)

TYPE

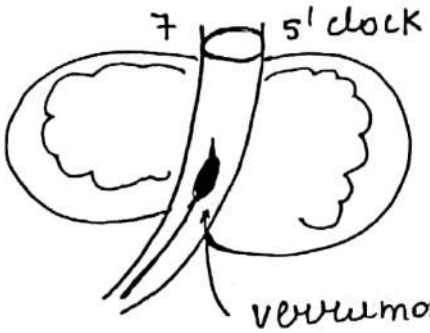
M- TURP (monopolar)	B- TURP (Bipolar)
Irrigant Used	
1.5% glycine or Mannitol	0.9% NaCl (TURIS) + Tr. urethral Resection in saline

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

M-TURP		B-TURP
More	Complication	Less
Longer	Hospital stay	Shorter

Tech :- TURP → started @ Median (Middle Lobe)

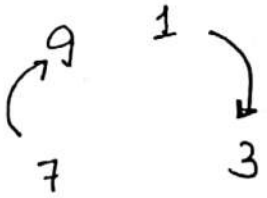
(@ Level of Bladder Neck)



↓

Resection of Lateral Lobes

NESBIT Approach

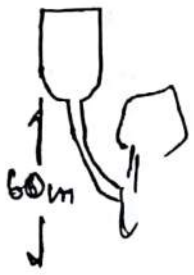


Min. Flow Rate of fluid req. for adequate vision = 300 mL/min

Min. Rate of fluid absorption = 20mL/min.

Avg. Duration of TURP = 50 min. 00

Adequate height of water column = 60 cm above the operating site



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

COMPLICATION-

α → operating Time

H/C overall → Retrograde Ejaculation.

↓ early - Dilutional Hyponatremia.

Intra-operative → Bleeding

OTHER:-

1) Perforation
2) Intra-operation PRIAPISM

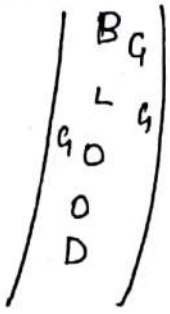
Rx OC = Inj^n Phenylephrine (3%) in 100mL NS

3) Stricture
4) TURP SYNDROME / WATER INTOXICATION

→ 1.5% glycine

Causes Dilutional Hyponatremia.

20mL/min —— avg. dur 50min



⇒ 1000mL

Na^+ 140 meq/L → 6L

NOW 140meq/L → 7L = Dilutional hyponatremia

If $Na^+ < 120$ mEq/L → TURP Syndr. (water Intoxication syndr)

a) HTN

b) Bradycardia

c) Nausea, vomiting

d) visual disturbance due to corneal oedema

e) altered syndrome.

R_x = (3N) NaCl → slow infusion (100mL → 2-3 hrs)
↓
Rapid Infusion

TUVP

(Trans Urethral Vapourisation of Prostate)

Resection via electrodes

ADVANTAGE - No risk of Retrograde Ejaculation

DISAD - ↑↑ Bleeding
Longer Hospital Stay
Infertility

TUIP

(Trans Urethral Incision of Prostate)

→ Preferred by young male concerned about Infertility & Retrograde ejaculation

→ COLLING'S KNIFE - ~~Infertility~~ /.
5' & 7' oclock
↳ extend it upto Verumontanum

TUMP

[Trans Urethral Microwave Therapy]

Thermal Ablation of Prostate

Temp > 65°C used

<65°C → Thermotherapy

DISAD -

can't be used for

>80g or <20gm Gland

TUNA

(Trans. Urethral Needle Ablation

Thermoablation.

LASERS

1) KTP → K^+ Titanyl PO_4^{3-}

λ = 532nm

2) Nd YAG → λ = 1064.

3) Thulium λ = 2013 nm

4) Holmium 2130 nm.

ass ē Peeling of Prostate

continuous LASER

BEST

Safe in pt. on Anti-coagulation

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

TULIP

(Trans. Urethral USG guided · Laser induced Prostatectomy)

HOLEP → Hol. Laser Enucleation of Prostate

BEST

> TURP → ↓↓ complication

↓↓ Hospital stay

costly

PVP → Photoselective Vaporisation of Prostate

Use Green Lasers (KTP)

VAP → Visual Ablation of Prostate

use holmium

Pts of Anti-coagulation.

DANGEROUS

Cornea
↓
Holmium
Yhulium

Retina
Nd YAG
Carbon
KTP
Lithium Borate

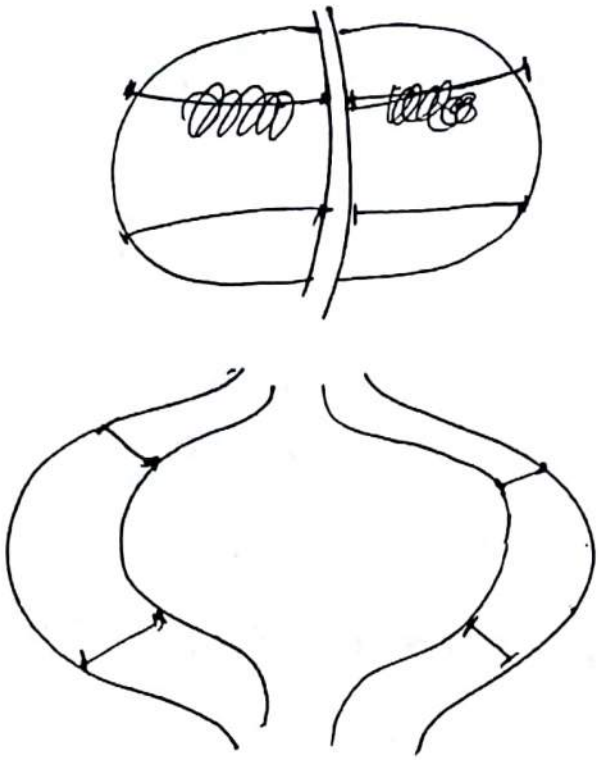
PUL

(Prostatic Urethral Lift)

→ Non-surgical correct of LUTS in BPH by Trans prostatic Placement spring Loaded T shaped sutures

→ Spring Recoil + causes opening of Prostatic Urethra

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp



GENITOURINARY TB

H/C SITE = KIDNEY >> Epidymis
(Testis → never Involved)

H/C Route of spread = Hematogeneous

H/C clinical Presentation = Sterile Pyuria >> Hematuria

RENAL TB

Renal Pyramid → INDEX SITE
↳ RP Granuloma
✓
Casseous Necrosis
✓
Abscess formation

PUTTY KIDNEY - Grossly necrosed Putrified Kidney

cement kidney
Shrunken
Calcified
fibrosed
non-functional

[AUTO - NEPHRECTOMY]

PUTTY Kidney → Cassed / Cavernous type

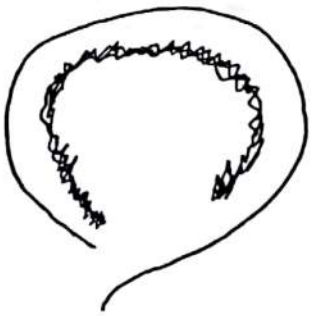
CEMENT KIDNEY → FIBROUS TYPE

MILLIARY TB → Numerous small (<3mm) granulomas representing seeds of millet

BLADDER TB

M/c site → DOME

Spared.
TRIGONE
↓
Bladder neck.



THIMBLE BLADDER
Contracted, non-functional

EPIDIDYMAL TB

2nd M/c site of TB

M/c site → GLOBUS MAJOR

PENILE TB

Rare type

a/c DIRECT spread

(by contact ī infected stool)

TYPE

1°

- → Painless
- Keratotic Patch over glans / Prepuce

OROFACIAL Penile TB

- → Severe necrotising ulcerative lesions over Penis
- → Painful
- → surrounded by pseudo membrane

PNT

[Papulo Necrotic Tuberculid]

- → Hypersensitivity Rxn for Tuberculin Skin Test
- → Painless ulceration over glans + penis f/b VARIOLIFORM SCARRING + Keratotic ~~plaque~~ patch.
- → culture negative
- Respond to ATT.

Dx → IOC = Culture
NAAT

Screening → Tuberculin skin Test
→ IGRA (interferon γ release Assay)
TB-gold TB-spot

RADIOLOGY -

IOC @ Radiology - CT Urography

X-RAY

calcification → Ring (A)
↓ ↓
Stone Renal Pyramid Granuloma
↓
TB

IVP - IOC for early GUTB
MOTH EATEN CALYCES
Phantom Calyx → Invisible calyx
Oncocalyx
URETER → Rigid, Pipe stem, narrow, Beaded
KERR's KINK - Sharp, Acute UPJ.

← hiked up Pelvis

GOLF HOLE URETER

Rx → ATT 6 months

UROTRAUMA

1) RENAL TRAUMA

GRADE

I → Microscopic Hematuria
Subcapsular Hematoma

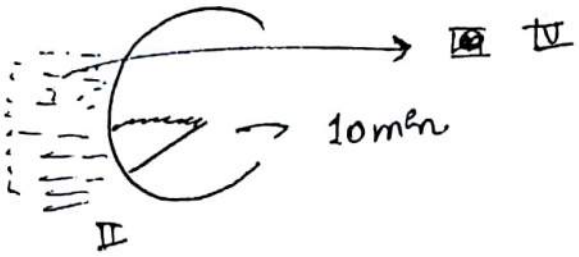
II → <1cm Laceration
Non-Expanding Peri-Renal Hematoma

III → >1cm Laceration (no urine Leak)

IV → Any Laceration ± collecting duct Injury
↓
Urine Leak.
+
Renal vessel Injury
(expanding ∨ hematoma)
peri-renal

V → Shattered Kidney
Hilum Injury
(In spleen → Hilum Injury → Grade 4)

IOC → NCCT ± 10 min delayed Film.
↳ Unstable Pt → IVU (single shot) → 8 minutes delayed film



Mx

R. TRAUMA

PENETRATING → Sx

BLUNT

UNSTABLE → single shot IVU

Injury → Sx

No Injury → observation

STABLE → CT SCAN

G 4,5 → Sx

G 1;2,3 → obser

Sx

REPAIR
RENORRAPHY

RESECTION
NEPHRECTOMY

% Functional Reserve

>20% → Partial Nephrectomy

<20% → Total Nephrectomy

URETERIC TRAUMA

H/Cl → Iatrogenic

IOC → Retrograde Pyelogram

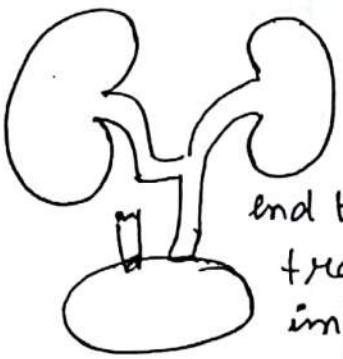
Mx

SITE	TOC
Upper 1/3	End to end ureteroureterostomy
Middle 1/3	-same- >> end-to side ureteroureterostomy
Lower 1/3	Ureteric Reimplantation

All repairs are done over Plastic Stents

In case of Length Discrepancy → BOARI's FLAP
→ PSOAS HITCH
Kidney to psoas ← RENAL HITCH

End-to-end (Preferred)



end to side trans implantation

Re- Implantation

BOARI's → U shaped Incision of Bladder.
FLAP

↓

Lifting up

↓

Rest bladder approximated

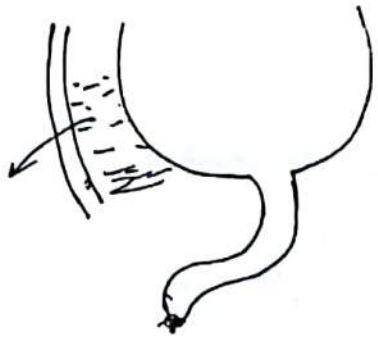
↓

Tubularisation of Bladder wall & was lifted up.

BLADDER TRAUMA (M/CC → # Pelvis)

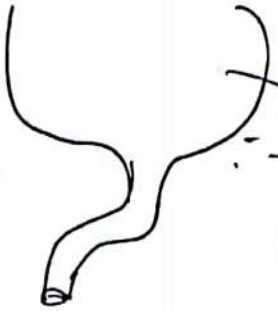
IOC = CYSTOGRAM

EXTRA PERITONEAL



ROC = FOLEY's CATHETERIZATION for 10–12 days

INTRA-PERITONEAL



↓

Bacterial P.

↓

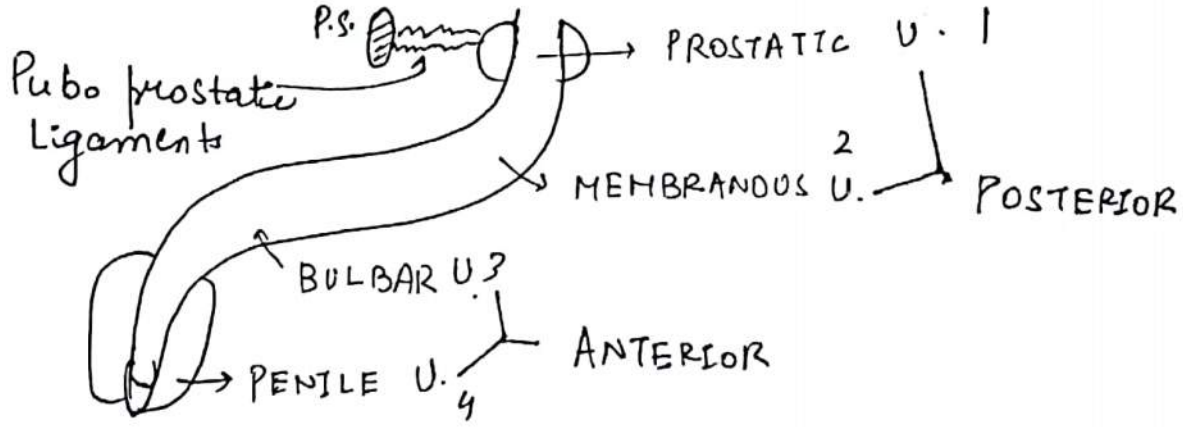
Acute Abdomen

↓

Sx

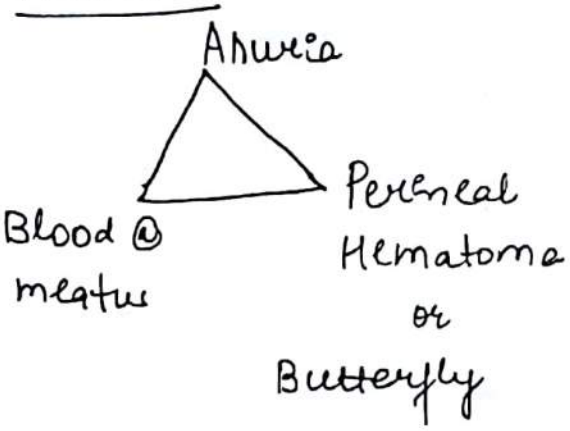
Urgent surgical exploration
F/B repair c 2-0 vicryl.

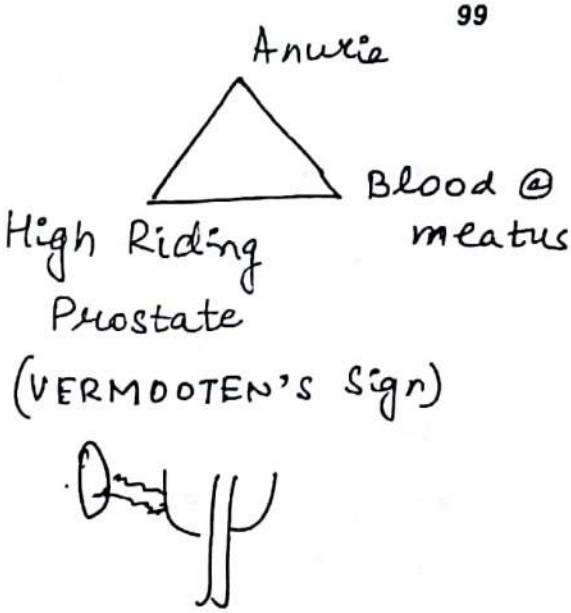
URETHRAL INJURY



ANT. U. INJ.		POS U. INJ.
3,4	PART INJ.	1,2
Straddle Fence Inj. Gymnastic Inj.	CAUSE	Pelvic #

FEATURES





Mc CALLUM COLAPINTO CLASSIFICATION

↳ Urethral inj (Posterior)

IOC - Redrograde Urethrogram (RGU)
(or flexible cystoscopy)

RGU

No Injury
↓
Foley's Catherisation

Injury detected
↓
Diversion
↓
SPC
↓
Realignment by Coude or council tip catheter
(By MITCHEL + BLANDY's Technique) → Definite Repair after 8-12 week
RAIL ROAD Tech.

COMPLICATIONS

Ant. U. Inj.		Post U. Inj.
Stricture	M/c	Stricture
Impotency (may be seen in penetrating Penile Trauma)		Incontinence Infertility

PENILE TRAUMA (#)

M/CC → Violent Sexual Activity

Tunica albugenea → 2mm → 0.5m on erection

Sudden loss of erection. (Detumescence)

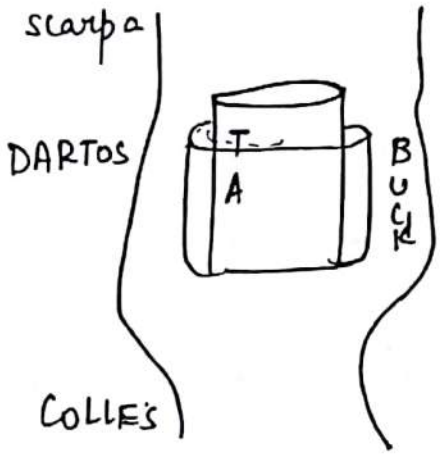
- POP/SNAP sound
- swelling @ base of penis

[EGG PLANT DEFORMITY]

Mx → all penile # are immediately repaired by 2-0 vicryl

FASCIAL LAYERS OF PENIS

- SUPERFICIAL
  - Outer — DARTOS
    - Continuous ↓
    - SCARPA → above
    - Colle's → below of perineum
  - Inner — BUCKS
- DEEP
  - ↓
  - Tunica albuginea



① T. A. rupture
Buck's F → Intact → SLEEVE or CYLINDRICAL hematoma

② T.A. rupture
Buck's F " → BUTTERFLY / PERINEAL hematoma

VESICOURETERIC REFLEX

- 1° → detrusor
- 2° → due to obstruc° to bladder outlet

L : ω = 5:1 (N)

(L) : ω < 5:1 → 1° VUR

(L) → Intramural ureteric length

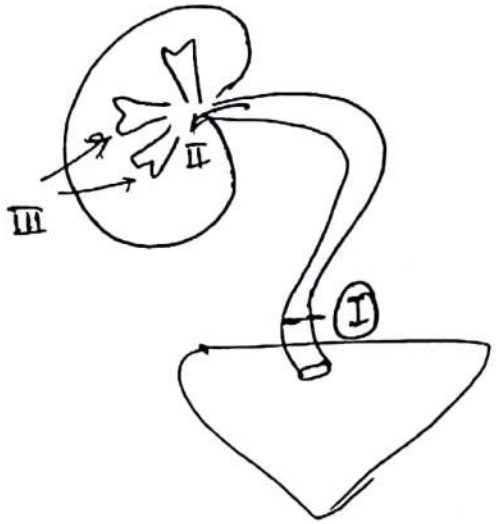
IOC → ① VCU (Voiding cysto Ureterogram) ② MCU

STAGING

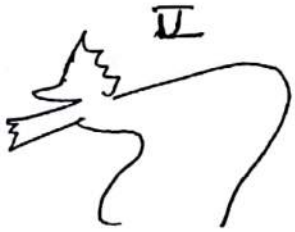
I	Reflux into ureter
II	Reflux into ureter + kidney
III	" + " + Mild Blunting of Calyx
IV	III + Dilatation of ureter + Effacement of Calyx

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

IV - Gross Defⁿ of ureter + Distortion of Pelvi-Calyceal system



Effacement of calyx



Gross Dilatation of ureter + Distortion.

Recurrent UTI → M/C presentation

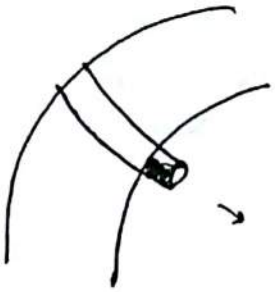
Mx

1° → Grade 1,2,3 → Conservative Antibiotics

Grade 4,5 → Intervention

- Endoscopic → STING Procedure (Injⁿ of Deflux)
- Sx
  1) Cohen's cross trigone Implantation
  2) Lead better Politano Sx

2° → Rx the cause

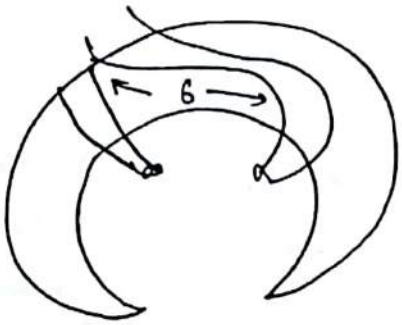


5:1 (N)

3:1 VUR

↘ 0.5

3/0.5 = 6:1



COHEN's cross trigone Implantation

CRYPTORCHIDISM

→ Undescended TESTIS

→ Non descent of Mid-point of Testes below midpoint of scrotum

Stable descended Testis → Intra scrotal Testis but midpoint of Testis is above the mid scrotum

RETRACTILE TESTIS - (N) descended Testis but moves up due to ↑ Cremasteric Reflex hyperactive

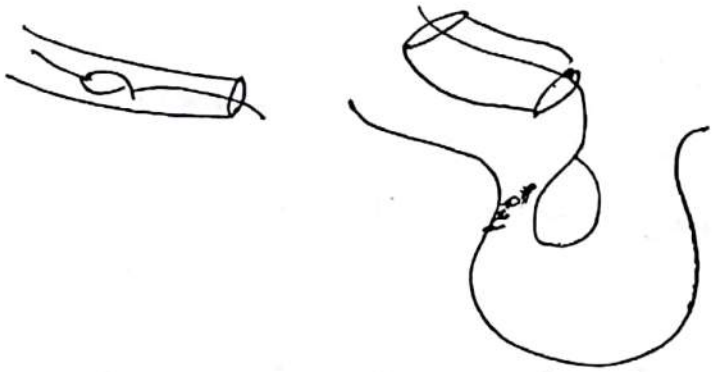
VANISHING TESTIS → Testis ⊆ was present in embryological phase but absent on BIRTH

Time of Ⓝ DESCENT → 5 months
Spontaneous descent occurs upto 5th month.

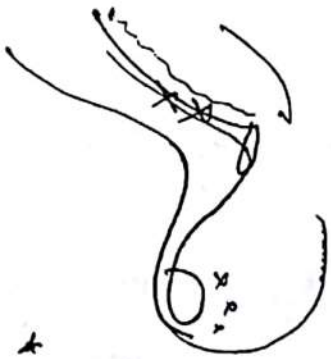
Rx -

Time of Sx = 6-12 months.
6th > 12th month.

Sx = ORCHIDOPEXY ——→ Bring down ↓ testis in subdartos space



STEPHEN FOWLER Sx
2 Staged



STEP-1
Ligate Testicular artery
AIM → Lengthening of cord
Stretch the cord to max & fix it

STEP-2 → wait for 6 months → Orchidopexy

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

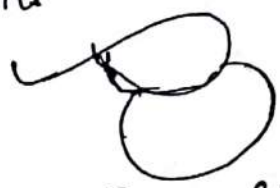
TESTICULAR TORSION

CAUSE -

1) Inversion of Testis (M/C cause)
   ↓
   Horizontal Position of Testis

2) High Investment of Tunica vaginalis

3) Cord bet" Epidymis & Testis



BELL CLAPPER

MAx → 10 - 20 yrs
Peak - 13 - 14 yr

Golden hours - 1st 6 hrs
Only 20% salvage after 24 hours

C/F.

1) Excruciating Pain tenderness over hemiscrotum

2) PREHN'S SIGN
No relief of pain on elevation of Testicle

D/D - epidymo - Orchitis
Pain ↓ on elevation
Blue - dot sign
↳ infarction of appendix of testis

COMP^{n} -

1) Loss of viability
2) complete necrosis
3) Sympathetic orchidopathy
   ↓
   [Destruction of C/L (N) Testis]

IOC - USG
Doppler study (for viability)

Mx

VIABLE
↓
Derotation of fixation of testis
+ Prophylactic fixation of C/L Testis

NON-VIABLE
↓
orchidectomy

CLEFTS

Cleft Lip + Palate >> Cl. Palate >> Cl. Lip alone

♂ > ♀

Lips → B/L cleft

♀ > ♂

Left U/L

M/c chromosomal Abⓝ = Chr. 22p

M/c syndrome a/c → VANDER WOODE SYNDROME

(Velocardiofacial Defect)

↓

Cleft + Lip / Facial Pit / Sinus / Fistula

PIERRE ROBIN'S SYND-

glossoptosis → falling back of tongue

Micrognathia

Retrognathia

Cleft Palate (alone)

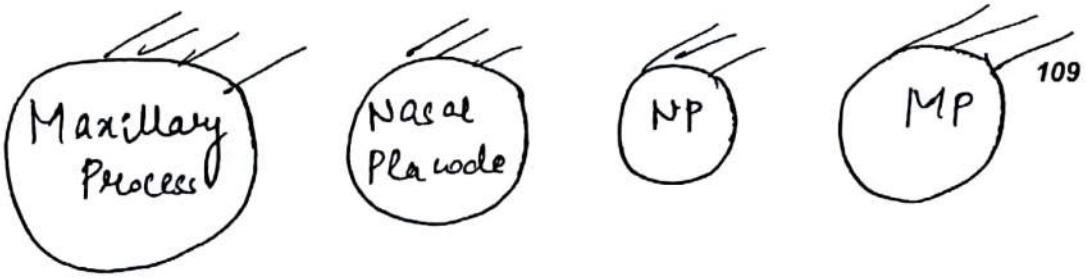
CLEFT LIP

INCOMPLETE

any Cl. Lip c intact nasal cavity

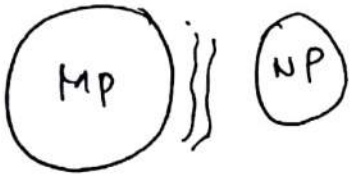
COMPLETE

Cl. Lip extending into nasal cavity



CENTRAL Cleft

Rare Lip Defect (rare)



LATERAL Cleft Lip

CLEFT PALATE

INCOMPLETE

any cleft palate ∈
~~inf~~ intact fusion of palatine shelves ∈ nasal septum × vomer

↓

Type II

COMPLETE

Non-fusion of palatine shelves ∈ ~~fusion~~ nasal septum / vomer Bone

↓

Type I

PALATE

1° (ant)

upper Lip
alveolar ridge

Incisive Foramen

Parts

2° (Post)

Hard Palate
Soft Palate

Complete Cleft Incomplete

IIa. cleft of uvula

IIb. Cl. of uvula + soft palate

IIc.
IIc. Cl. of U + soft Palate + hard Palate

Alphabets damaged in speech

D K Bose P G I.

Mx

CLEFT LIP

Tennison's Z plasty

Millard Rotation flap

CL. PALATE

1) Farlow Sx

2) Teisser's Sx

single step Repair

3) Wardill Kilner 2 step Repair.

Timing of Repair

Cl. Lip alone ⟶ 3-6 mnth.

Cl. Soft Palate ⟶ 6-9 mnth

Cl. Lip + Soft Palate ⟶ 6mnth → 6-9m

Cl. Hard Palate ⟶ 9-12 → 9mnth

Cl. SP + HP single stage → 9m

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

2 stage → 6m → SP
→ 12-15m → HP.

RULE OF 10 (Millard's)

Cl. LIP

> 10 weeks old

> 10 pound

> 10 gm Hb

Cl. PALATE

> 10 mnth

> 10 kg ③

> 10 gm Hb%

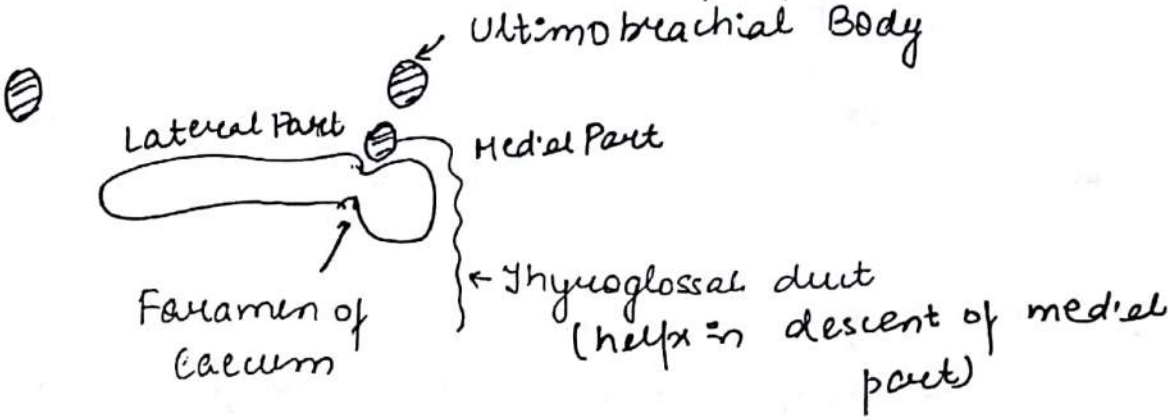
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

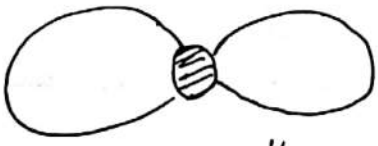
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

THYROID

EMBRYOLOGY -

Development starts at 3rd week of Life





Fusion = 5th week.

Follicle = 5 + 3 = 8th week.

Colloid formation occurs in 8 + 3 = 11th week of life.

Regression of Thyroglossal duct → starts @ 5th week
completed @ 8th week

DEVELOPMENTAL ANOMALY -

1) THYROGLOSSAL DUCT CYST / FISTULA QQ.

→ Persistent Thyroglossal Duct due to failure of Regression by 8th week of Life.

→ Midline swelling & moves ↑ deglutition & protrusion of tongue

→ Epithelium: pseudostratified Columnar Epithelium. (ciliated)

mucin secretion ⇒ cyst formation

M/C location = SUBHYOID/ Infrahyoid ~~Intrahyoid~~

M/C long. anomaly of thyroid.

→ <1% Risk of malignancy

↳ Papillary Ca. (Medullary Ca is never seen)

↓

parafollicular cells.

seen on Lateral side

FISTULA

→ It is acquired. [cyst is always congenital]

→ It occurs due to [spontaneous or iatrogenic] rupture of cyst.

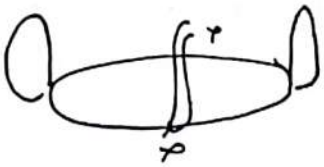
R_x = TGD/ Fistula = SISTRUNK S_x

↙ ↓

[Excision of cyst + Central Part of Hyoid]

this S_x is also done for chronic lymphodema

wedge ~~Resection~~ excision of subcutaneous tissue

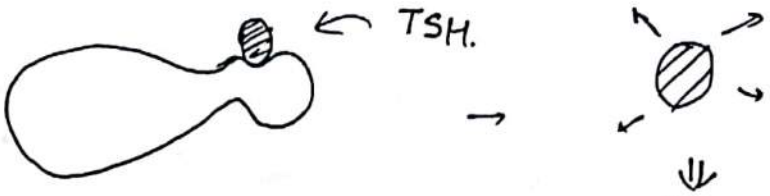


Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

2> LINGUAL THYROID

→ Not ectopic thyroid

→ Persistent thyroid tissue @ base of tongue (foramen of cecum)



⇓

Dysphagia
Dysphonia
Dyspnoea.

Hypothyroidism → Hypothalamus
↓
TRH
↓
pituitary
↓
TSH

R_x = Thyroid suppression by T_4 supplementation.

Preferred M_x = Radioactive Iodine ~~surg~~ Ablation.

S_x not done due to technical difficulty

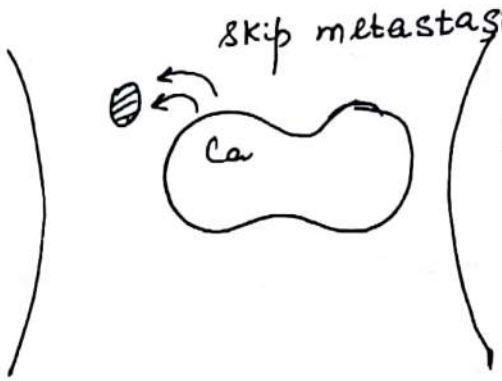
3> ECTOPIC THYROID

H/c Site = Central Part of Neck
Trachea
Esophagus
Aorto-Pulmonary window (mediastenum)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

4> LAT (LATERAL ABERRANT THYROID)

→ Thyroid tissue located in Lateral Part of Neck
→ considered as SKIP METASTASIS from Superolateral Pole Papillary Carcinoma



NECK MASS
↓
FNAC
↓
(N) Thyroid Tissue
↓

Lateral Part of Neck = ? LOcation = Central Part of Neck
↓
LAT (Skip metastasis)
↓
R_x = Total Thyroidectomy + Central Neck Dissection (Level 6) + Modified Radical Neck Dissection. (Level 1 → 5 removed)

Check thyroid Gland
↓
(N) → ECTOPIC THYROID → R_x = observation

Ab (N) → MALIGNANCY → Total Thyroidectomy + Central Neck Dissection.

5> PYRAMIDAL LOBE

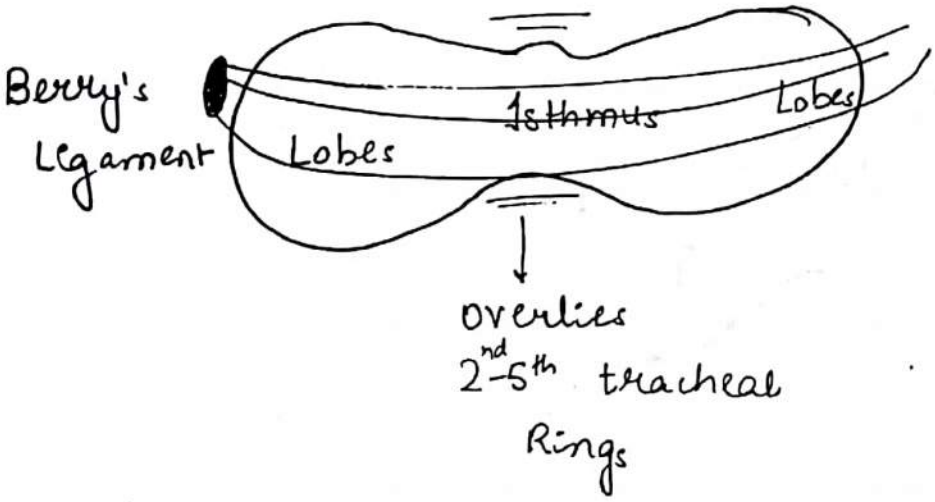
→ Persistent fibrous attachment of thyroglossal duct ī Thyroid.

→ usually not palpable.

ANATOMY

Wt = 18-20gm

Colour = Brown



Capsule = Inner → True

Outer → condensation of Pretracheal Fascia (Deep Fascia)

Berry's Lig - Condensation of Pretracheal Fascia @ posterolateral Part of thyroid before its insertion into Cricoid Cartilage.

It is a/c RLN anatomically.

M/c site for RLN **Injury** → Berry's Lig

↓

Iatrogenic type of Injury

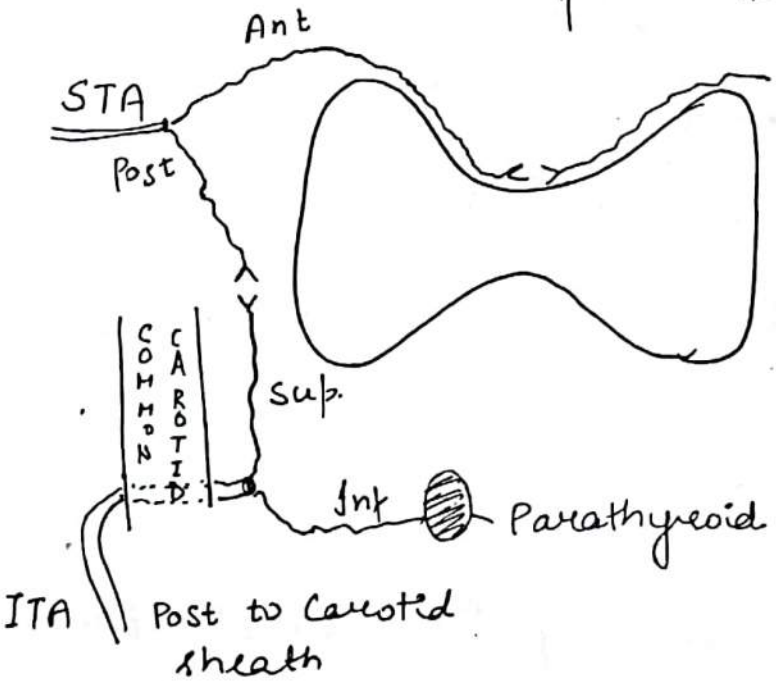
ARTERIAL SUPPLY

1> Sup Thyroid Artery – 1st Br. of Ext. Carotid Artery

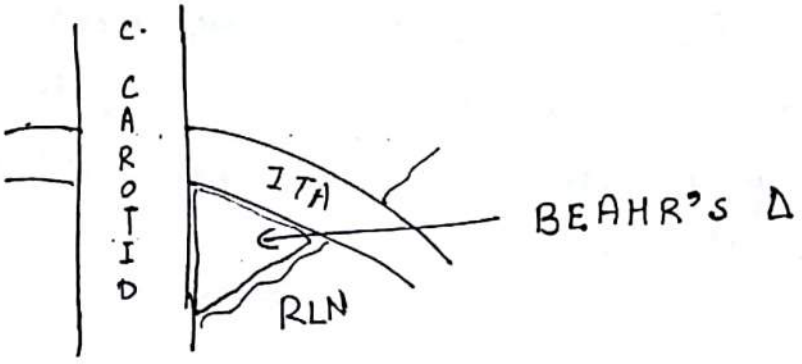
AIIMS

2> Inf. Thyroid Artery – Br. of Thyrocervical Trunk

THYROID IMA – Direct arterial Br. to thyroid from Aorta. (5-10%)



Divides into sup. Inf



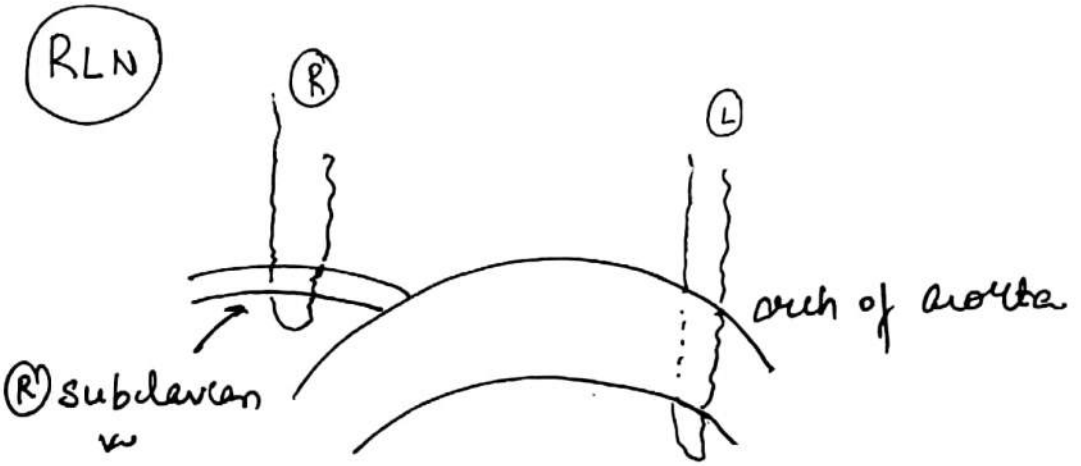
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Inf. Thyroid artery] → Ligated ~~closely~~ as close to the gland as possible ~~otherwise~~
Sup. " "]

VENOUS

Sup. Thyroid vein] → Int. Jugular vein
Middle " "]

Inf. Thyroid vein → Innominate vein.



Non-(R)current Laryngeal N/v → 0.5 - 1.5%

↓

(R) side > (L) side

(aberrant)

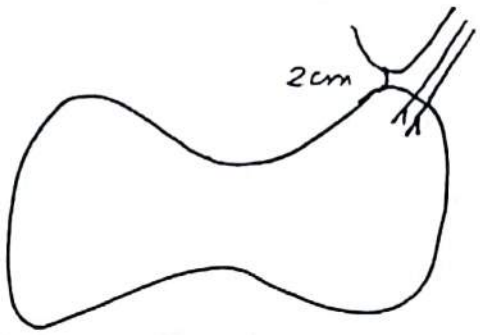
ARTERIA LUSORIA → Origin of (R) subclavian. ~~from~~ distal to (L) subclavian ~~side~~ artery coming post. to oesophagus to reach (R) side

DYSPHAGIA LUSORIA

↳ Dysphagia due to ~~(R)~~ aberrant (R) subclavian due to post. indentation. on oesophagus.

Ext. Laryngeal N/v
related ī sup. pedicle

TYPE -1

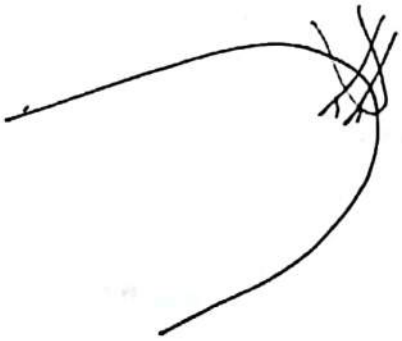


SLN > 1-2 cm.
from
S. Thyroid Pedicle

TYPE-2

SLN < 1cm apart b/w
SLN & ST. pedicle

Type 2b



Below the Pedicle

MISC.

TSH — (N) = 0.5 - 5.5 μU/dL

T_3 — ↓ functional Reserve

T_4 — ↓ Production Reserve

T_{4-3} = 1 day (b1/2) T_{4+3} = 7 days

HYPOTHYROIDISM ↑↑ TSH ↓ T_3 ↓ T_4

HYPERTHYROIDISM ↓↓ TSH, ↑ T_3, ↑ T_4.

SUBCLINICAL HYPO → Marginal elevation of TSH
(N) T_3, T_4.

SUBCLINICAL HYPER – Marginal decrease of TSH
(N) T_3, T_4.

* **EUTHYROID SICK SYNDROME**

TSH → (N)
T_3 T_4 ↓ (marginal)
a/c Chronic Illness

* **REFETOFF SYNDROME**

End organ Resistance to T_4.
TSH - (N)
T_4 ↑↑↑
T_3 may be (N)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

FREE T_3, T_4 →

T_3, T_4

BOUND

- Thyroglobulin
- Prealbumin.
- Albumin

FREE

Functionally Active

FREE T_4 ∝ Negative log TSH.

Eg. ↑↑ T_4 → ↓↓↓ TSH.

HYPERTHYROIDISM

↑↑ RAI uptake

where gland is taking excess of Iodine.

CAUSES

1) Graves Disease
2) Plummer's D
3) Toxic adenoma
4) Drug Induced (JOD BASEDOW effect)
5) Malignancy
6) Struma ovarii

↓↓ RAI uptake

No uptake of Iodine

CAUSES

1) Thyroiditis (subacute/ chronic)
2) Factitious Thyrotoxicosis (↑↑ exogeneous uptake)
3) HAMBERGER's Thyrotoxicosis

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

GRAVE's DISEASE

→ Diffusely enlarged
→ WARM
→ SMOOTH
→ Palpable Thyroid

} Key word

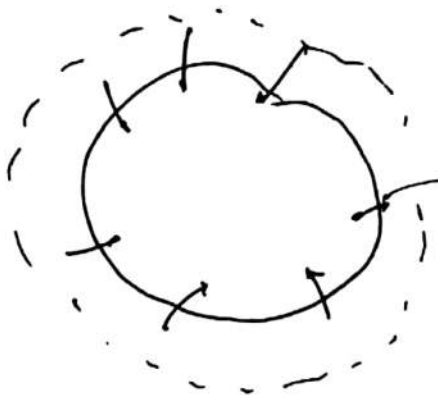
∴ Features of Toxicity

CAUSES

1> AUTOIMMUNE.

a/∵ CTLA$_4$ [Cytotoxic T-lymphocyte Antigen 4]

TSIg [Thyroid stimulating Antibodies] or
TSH Ⓡ antibodie



TsIg ⇒ "Diffuse Toxic Goitre"

2⇒ ass.∵ DR3, HLA B8
HLA DQA1*501.

[HLA DR B$_1$ *701 ⟶ Protective For Graves]

Other = DAMS PG. ⟶ Grave's Disease.

DM ↙ | ↘ ↘ Pernicious Anaemia

Addison's Disease | Myasthenia Gravis

2) Lithium Rx

3) ♀

4) Infection.

FEATURES

THYROIDAL

1) Heat Intolerance
2) Wt. loss
3) Tachycardia
   Water hamer pulse
4) Palpitations
5) Arrhythmias
6) Diarrhoea
7) Menorrhagia.
8) Exagerated Knee Jerk

EXTRATHYROIDAL

1) GRAVES OPHTHALMOPATHY
   → Proptosis
   → Eye signs
   1) Von Graffe's Lid Lag (upper)
   2) Dalrymple Sign
      visible upper sclera
   3) Stellwag's Infrequent Stare
   4) Mobius Sign - Loss of near accomodation
   5) Jellink Sign - ↑ periorbital pigmentation.
   7) Griffith Sign - Lower lid Lag.
   8) Kocher's Sign
      Eye Globe Lag

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

9) BALLET SIGN
Loss of upward & Outward accomodation

10) BOSTON SIGN
Jerky Eye Movement

11) Vigoroux Sign- chemosis

12) Gifford Sign- Lack of eversion of upper lid

13) Groove Sign- Inability to retract down upper eyelid.

2) SKELETAL CHANGES

→ Subperiosteal Bone formation.
→ Thyroid acropachy → swelling of metacarpals.
→ ~~G~~

3) GRAVE'S DERMOPATHY

↑↑ Glycosaminoglycan Deposition.

→ Pretibial myxoedema.

4) Gynaecomastia

5) Thrill → Felt at Superior Pole

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

DIAGNOSIS

1) Hyperthyroidism

2) Antibodies → anti TG
TSIg (↑↑↑) [HALLMARK]

3) **THYROID SCAN**

metabolically active thyroid take up radioactive ~~iodine~~ elements used for purpose of scan

Active thyroid → HOT
Inactive " → COLD

Elements → I^{123}, $Tech^{99}$ → $t_{1/2}$ = 6hrs

↓

$t_{1/2}$ = 12-13 hrs

ADV :→ short $t_{1/2}$
→ Not organified in mitochondria
→ ∴ Lesser radiation exposure

→ γ RAYS

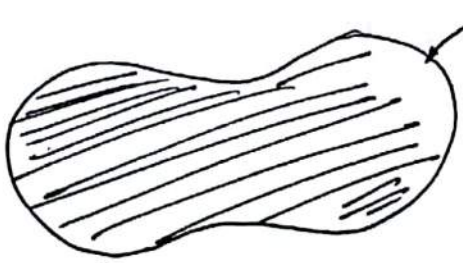
captured by γ cammeras.

→ **I^{131}** → $t_{1/2}$ = 7-8 days

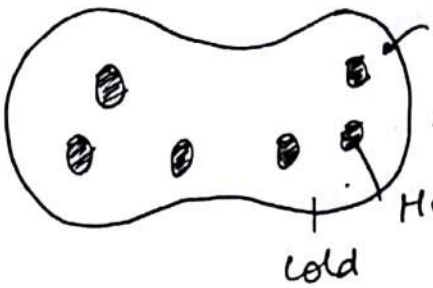
↓

γ + (β) - used for destruc".

So, therapeutic use



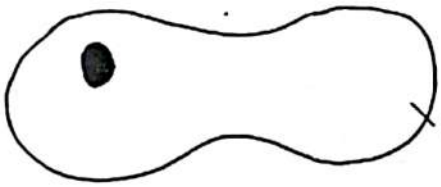
⇒ Diffuse Toxic Goitre
Diffuse uptake.



⇒ Multiple HOT nodules on cold Background

⇓

TOXIC MULTINODULAR GOITRE
[PLUMMER's DISEASE].



⇒ Solitary Hot Nodule on cold Background

⇓

TOXIC SOLITARY NODULE
(TOXIC ADENOMA)

Rx

DRUGS — RAI Ablation — Sx

1) DRUGS

AIM ⇒ to achieve euthyroid states.

→ Methimazole → C/I in ♀/Lactation
→ Propylthiouracil → safe in ♀/Lactation.
→ β-Blockers → avoided in sinus bradycardia
→ Steroids

Carbimazole → "CUTIS APLASIA"

⇒ DRUGS can be used as 1° Therapy if FOLLOWING CONDITIONS R FULFILLED

1) Small size Gl. (<40gm)
2) Negative Antibody titre
3) Moderate Elevation of T_3, T_4
4) Quick response to Drug.

REGIMENS

BLOCK . Replace ← → Step Ladder Regimen

II) RAI Ablation

I^{131} → β property

Indication :-

1) moderate size (<80gm)
2) Elderly
3) Not responding to drug
4) Remote Location residents

C/I :-

1) young pt.
2) ⓟ
   †
3) Lactation
4) Smokers
5) Graves Opthalmopathy

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Smoker —RAI→ Graves —RAI.→ Worsening ophthalmopathy

III) **Sx**

S_xOC = Total Thyroidectomy / Near Total / SUB TOTAL

- Near Total → Preserve 1gm of thyroid @ Berry's Ligament
- SUB TOTAL → Leave 4-7gm of Thyroid.
  - U/L → HARTLEY DUNHILL S_x 7-8gm on 1 side
  - B/L. → Leave 4-4gm on (B) side

INDICATIONS FOR S_x :-

1) young pt
2) Gland >80gms (Large)
3) ♀ ⊙ (S_x → 2nd Trimester)
4) Lactation.
5) Desire to conceive in 6 months.
6) Smokers
7) Graves Ophthalmopathy

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

TOXIC MULTINODULAR GOITRE

ELDERLY
MN Goitre
Long standing
Long term
Amiodarone
I_2 supplementation.

} Keywords

$\bar{c}$ features of toxicity.

Long standing suppression generates autoactivation of the thyroid nodules

FEATURES

only features of Hyperthyroidism seen
No extra thyroidal feature

M/c → arrhythmia / Palpitation

Rx ① Sx
② Preferred

② RAI Ablation

DISADV:- Dose of radiation reqd is too high.
At this dose there is risk of development of radiation thyroiditis.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

TOXIC ADENOMA (SOL. TOXIC NODULES)

Young pt.
Solitary nodule
Long standing nodule turning autonomous
↓ toxicity

Avg size = > 3cm

a/c gsp mutation - G → g coupled protein.
S → Stimulation.
p → protein

Rx - Sx (Hemithyroidectomy) is preferred.
[young age, avg. size > 3cm]

Other → RAI Abl. → Small nodules
Middle aged → elderly

(TRIAL) → PEI (percutaneous Ethanol Injec^{n})

APATHETIC THYROTOXICOSIS

→ Rare type
→ Seen in elderly
→ overt C/F of Hyperthyroidism. are not seen
→ Rather few subtle feature may be seen.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

FEATURE

1) Rate & Rhyth Disturbance
2) Myalgia
3) Depression
4) Anxiety

Rx

1st Line → Antithyroid Drugs

↓ fail.

RAI Ablation (TOC)

Sx is c/I.

~~THYT~~

THYROIDITIS

	SUPPURATIVE / ACUTE	SUBACUTE	CHRONIC LYMPHOCYTIC	CHRONIC SCLEROSING
	↓	↓	↓	↓
1)	BACTERIAL	DE-QUERVAIN	HASHIMOTO's	REIDEL's
2) CAUSE	Bacterial Infe"	Viral Post-Partum	Autoimmune	Autoimmune IgG4 disorder
3) PAIN	++	Viral +++ PP (−)	Initially ++ Later (−)	Painless woody mass
4) Thyroid Func"	Euth	Euth.	Hypo >> Hyper ↓ Initially	Euth >> Hypo
5) Leucocytosis	+++	(−)	(−)	(−)
6) ESR	↑↑	Viral ↑ PP (N)	(N)	(N)
7) ΔSCS	FNAC	FNAC	FNAC	BIOPSY
8) Mx	Conservative	Conservative	T4 supplemen" Sx → malignancy Lymphoma >> Papillary	corticosteroids or Tamoxifene

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

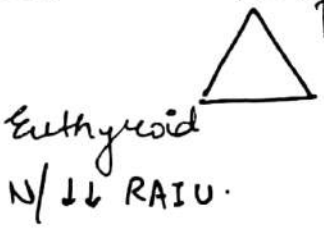
Sx for compressive features
wedge Ex or Isthmusectomy

ACUTE / SUPPURATIVE THYROIDITIS

H/C In children.

H/C org.- Staph. aureus >> strepto

TRIAD.



Rx - conservative

Sx - Done for recurrent acute thyroiditis.
↓
Because of Infected Pyriform sinus/ fistula.

DE-QUERVAIN THYROIDITIS

2 TYPES

VIRAL		POST-PARTUM
Painful	PAIN	Painless
↑↑	ESR	(N)
+++	HLA-B 34	---
Euth	Thyroid status	Euth

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Phases of Hyper → Eu → Phase of Hypo → Euth.

Rx – symptomatic care

HASHIMOTO's THYROIDITIS

also known as STRUMA LYMPHOMATOSIS

♀ : ♂ : 10:1 → 20:1.

> 2/3rd → Perimenopausal Age.

Autoimmune → HLA DR3 / DR5 / DB8

SYNDROME → 1) DOWN syndrome
2) TURNER syndrome

FEATURE

1) Painless gland (Pain may be seen in early gland)
2) Hypothyroidism
3) Firm, granular, Bosselated Gland → Phyllodes Tx
4) Microscopy ↑↑ oxyphill cells.
Askenazi cells
↑↑ Lymphocyte
↑↑ Plasma cells
↑↑ Eosinophils

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Dsi → ↑↑ Antibodies (antimicrosomal)

anti TPO

anti Tg

anti NA-I symporter

Mx-

1) T_4 supplementation

2) TSH > 10 → start T_4

↓

5-10 μU/dL

↓

check Antibodies

↑↑ → Start T_4

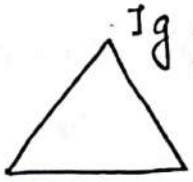
Not Elevated → observation

Sx → Malignancy — Lymphoma > Papillary

↓

Diffuse B cell Lymphoma

REIDEL'S THYROIDITIS



Euthy >> Hypo

LI RALU

Hard woody gland.

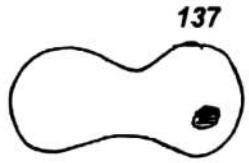
Biopsy → Ioc.

Mx → C.steroid / Tamoxifene

Sx → compression [Isthemectomy]

SOLITARY THYROID NODULE

IOC - USG guided FNAC QQQ



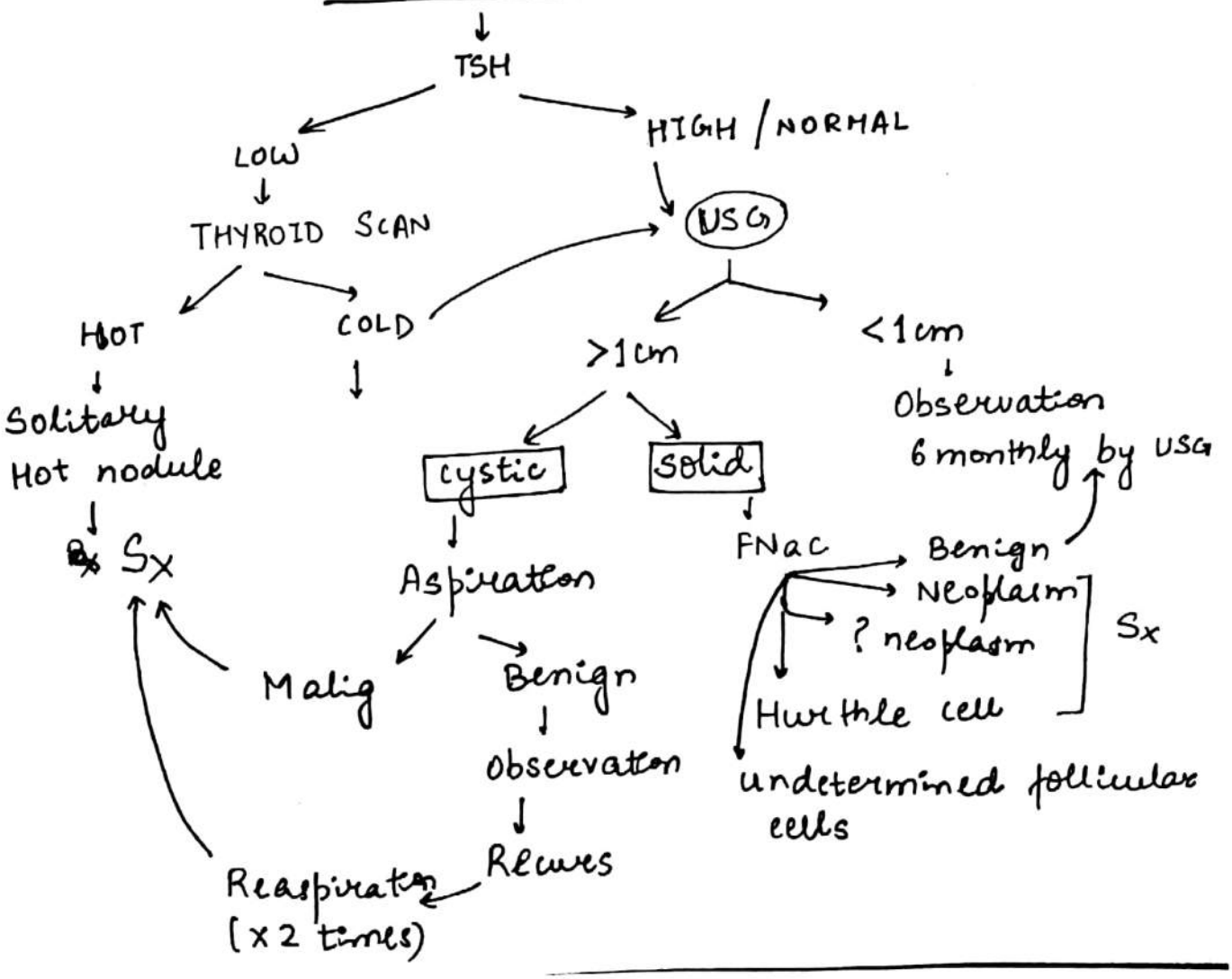
Blind FNAC = High False Negative

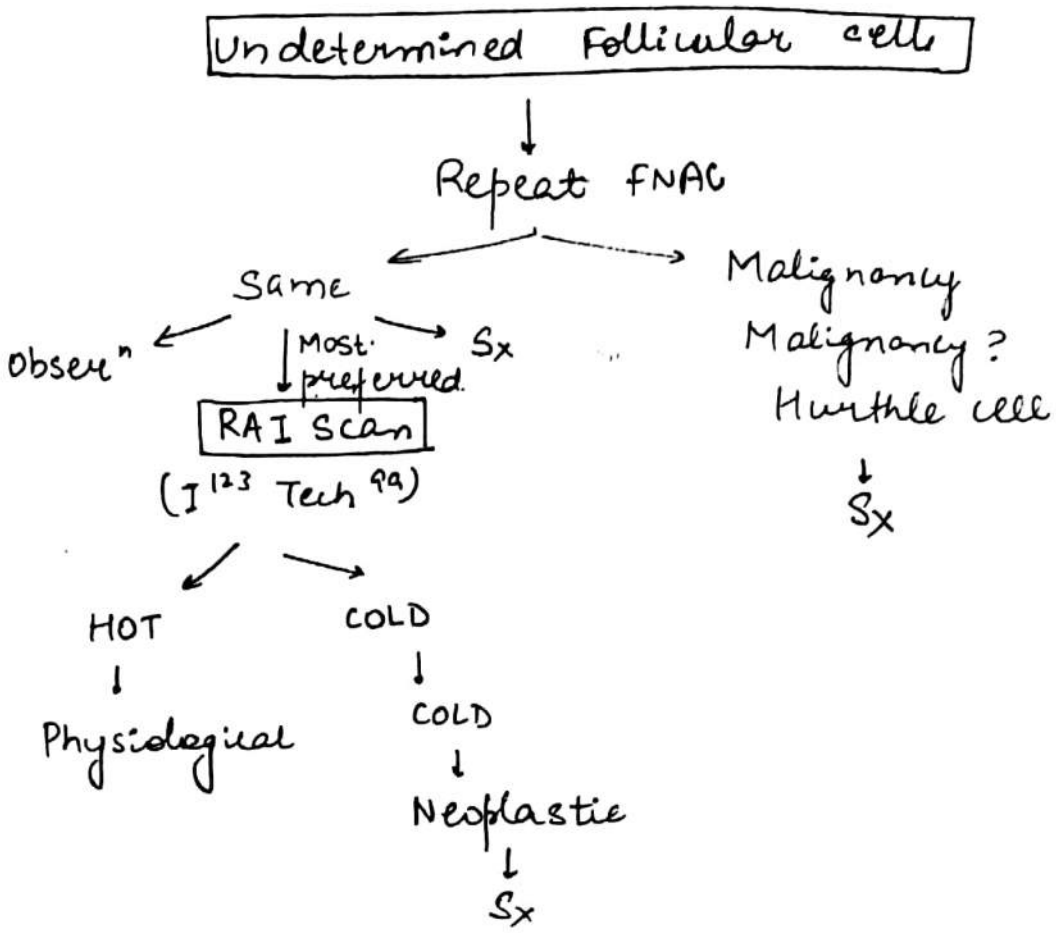
USG FEATURES S/O MALIGNANCY

1) Taller than wide

2) Microcalcification (<5mm) → stippled
3) ↑ central vascularity
4) Irregular border
5) Heterogeneous appearance

THYROID NODULE





↑ RISK OF MALIGNANCY –

1) Male
2) Age >40yr
3) Children.
4) Post Radiation exposure.
5) Cold nodules

Sx = HEMITHYROIDECTOMY > LOBECTOMY

CARCINOMA

GENETICS

RET
MET
TRK
BRAF
→ PAPILARY CA.

RAS
γ PPAR.
gsp
p53
miRNA 197 / 346
→ FOLLICULAR CA.

RET → MEDULLARY CA.

[↑↑ RAS ↑↑ HMBE-1. ↑↑ Galectin 3 ⇒ S/o malignancy]

↓

useful to differentiate Adenoma vs carcinoma

FAMILIAL COND

1) FAP -
   - → AD
   - → Chromose 5q,21
   - → Papillary Ca of thyroid

2) WERNER SYNDROME / Adult PROGEROID.
   - → AR
   - → WRN gene

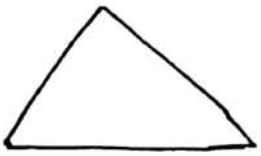
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

3> COWDENS

→ AD

→ PTEN - 10q

→ ECTODERMAL GI Polyps (Mostly)



MACROCEPHALY

TRICHOLEMOMA (2nd MC)

Mental retardation

Thyroid / BREAST neoplasm.

→ Benign w.r.t. colon.

4> CARNEY'S COMPLEX TYPE 1

→ AD

→ γ PPAR

a/k/m/a → NAME SYNDROME

- N → nevus
- A → Atrial myxoma
- E → Ephilides (freckles)

LAMB SYNDROME

- L → Lentigenous
- A → Atrial Myxoma
- M → Myxoma
- B → Blue nevus.

BATMAN [not an official name, pneumonic]

Breast

Adrenal

Thyroid Tx

Myxoma

Nevus

5) Mc CUNE ALBRIGHT SYNDROME

- AR
- gNAS mut^n
- Cafe-au-lait spots
- osteoteˉ dysphatic Bone changes

PAPILLARY CA THYROID

- H/C carcinoma → overall
  - Post Radiation
  - I_2 sufficient area
- ♀ > ♂
- 30-50 yrs.
- a/ˉ Lymphatic spread.

- FEATURES

1) FLAT on cut section [(N)/Benign lesion always bulging]
2) cuboidal cell ˉ ↑↑ cytoplasm
3) ORPHAN ANNIE EYE BODIES, coffee Bean nuclei
   These are inclusion bodies.
4) ↑ Nuclear crowding
   ˉ grooving in of nucleus

5) PSAMMOMA BODIES
   calcified sloughed off dead cell

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Other ~~Site~~ Reason for PSAMOMMA.

Meningeoma
Mesothelioma
Serous cyst adeno Ca ovary
Endometrial Adeno Ca
Adeno Ca Lung

MICRO/ OCCULT PAPILLARY CA-

→ Size < 1cm
→ No Lymphatic } invasion
→ No vascular
→ No capsular

PROGNOSTIC FACTORS-

→ Age is Most Imp. factor for DTC (Differentiated Thyroid cancer)

Follicular | Papillary

- 2nd Mi. size

For PAPILARY

1) AGES → Age, Grade, Extension, Size

2) AMES → Age, Metastasis, Extension, Size

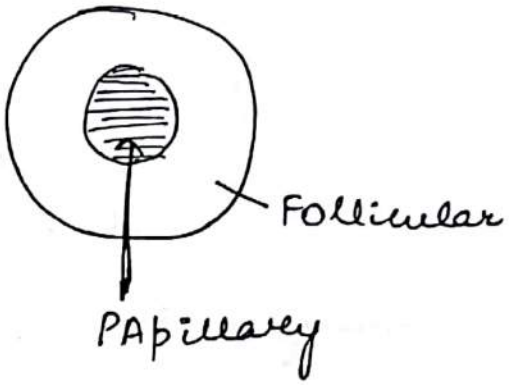
3) MACIS → Metastasis, Age, completeness of Sx, Invasiveness, size

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

	GOOD	BAD
Age	< 40 cm	> 40 cm
Size	< 2 cm	> 4 cm
Sex	♀	♂

LINSAY TUMOUR

Well circumscribed
Follicular variant of
Papillary Carcinoma



Genetics - ↑↑ RAS
↓↓ RAS/PTC
↑↑ BRAF

Mx OF PAPILLARY CA

MUTIFOCAL → 85%

°o TOC - TOTAL THYROIDECTOMY
[Routine Central Neck Dissec" is not Done]

INDICATIONS FOR CENTRAL NECK DISSEC" (CND)

1) Any Tm > 4cm size
2) ++ LN in central Neck

INDICATIONS FOR ➤ MRND + CND

1) LAT(Lateral aberrant Thyroid)
2) ++ LN in Lateral part of Neck

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

FOLLICULAR CARCINOMA

♀ > ♂

40 - 60yr

SOLITARY (papillary - multifocal)

well capsulated

M/C Type → In I_2 Deficiency
arising from long standing multi-nodular Goitre

Microscopy → Follicles +nt
But Devoid of colloid

Hematogenous spread.
↓
M/C site = Bones >> Lung
↓
Osteolytic (Pulsatile mets)

Adenoma can't be differentiated from Ca. by FNAC

Age > 40yrs
Size > 4cm
→ more s/o CARCINOMA.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

FOLLICULAR.

MINIMALLY INVASIVE

CARCINOMA c̄

Microscopic Invasion into capsule or Invasion of small., medium size vessels/ lymphatics

WIDELY INVASIVE

Gross capsular invasion or Invasion of Large size vessel / ~~ve~~. lymphatics

PROGNOSTIC FACTORS

1) AGE
2) SIZE
3) Capsular
4) Lympho
5) Vascular } Invasion
6) Family H/o
7) Metastasis

Mx of Follicular

TOTAL THYROIDECTOMY

>4cm

2-4cm c̄ High Risk Features

Capsular Invasion

Lymphatic "

vascular "

HEMI THYROIDECTOMY

≤2cm

2-4cm c̄ out any additional risk

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

No Neck Dissec^{n} needed

HURTHLE CELL NEOPLASM.

Variant of Follicular CA. [

♀ >> ♂

Age → 60-75yrs

Capsulated * MULTIFOCAL.

Lymphatic + Hematogenous spread

Microscopy → HURTHLE CELLS seen.

Highly infiltrative.

∴ CT Neck / MRI is mandatory for Hurthle cell carcinoma

Mx →

Hurthle Cell Adenoma	Hurthle cell Carcinoma
↓	↓
Hemi Thyroidectomy	Total Thyroidectomy
>> Lobectomy	+
	Central Neck Dissection

ANAPLASTIC CANCER

→ Elderly (7th – 8th decade)

→ <1%.

→ Rapid, Painful Enlargement of long standing Goitre

→ On Microscopy - Pleomorphic Giant cells
Spindle cells
Epitheloid cells

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

M_X → TOTAL THYROIDECTOMY + CENTRAL NECK DISSECTION

Pre-op CT/MRI is Mandatory

Post-S_X ⟶ Chemotherapy

chemosensitiser → ADRIAMYCIN (DOXORUBICIN) + PACLITAXEL / CISPLATIN

In case of local extension
↳ [Enblock Thyroidectomy]

LYMPHOMA

< 0.5%

Non-Hodgkin's Type → Extranodal → DBCL Diffuse B cell Lymphoma.

R_X - CHOP
C - Cyclophosphamide
H - Doxorubicin
O - Vincristine
P - Prednisolone.

LONG STANDING MNG + Rapid Enlargement
↓
TOXIC → NO PAIN → YES → ANAPLASTIC CA (or Lancy sign of Local Invasion)
TOXIC → YES → PLUMMER'S
NO PAIN → NO → FOLLICULAR CA

3th → Papillary
4th → Follicular
5th → Medullary
6th → Lymphoma
7th → Anaplastic
8th

POST-OP Mx OF DTC after TOTAL THYROIDECTOMY

Thyroid scan

Follow up ~ Thyroglobulin

Most Imp. Tumour Marker for follow-up

INDICATION

1> Post Total Thyroidectomy ~ Metastasis

2> >4cm

3> 1-4cm ~ High Risk features

4> Capsular
5> Lympho
6> Vascular
} INVASION

<1cm.
- Solitary
- multifocal

NO SCAN

PREPARATION

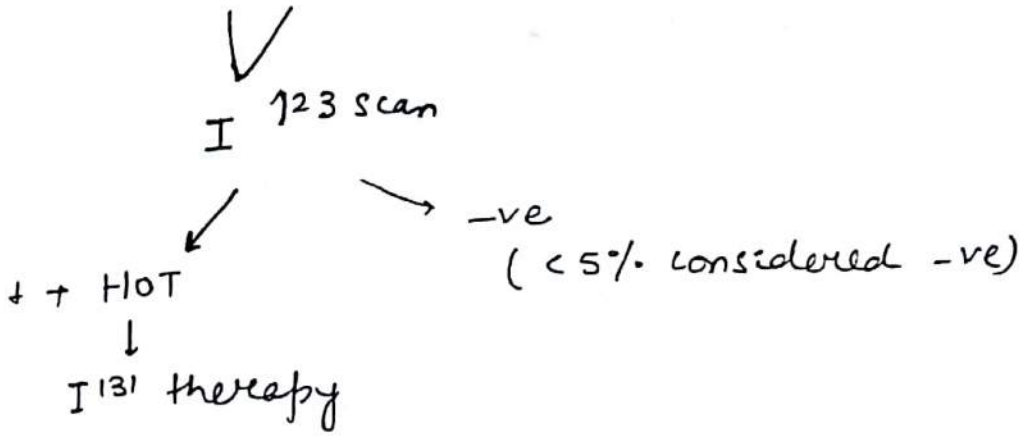
CONVENTIONAL

Keep thyroid supplementation away for 4-6wks.

AIM → ↑↑ TSH (30μU/dL)

RECOMBINANT TSH

ADV → Test can be done in 48hrs
No waiting for 4-6 wks
No Risk of Life threatening Hypo



DOSE - 200 m Cu → Out Dosimetry
1500 - 1000 m · c̄ Dosimetry

Thyroid scan → -ve , Tg ↑↑↑

Single Dose I^{131}

CASE-2

Persistent Ig elevation

PET SCAN θθ

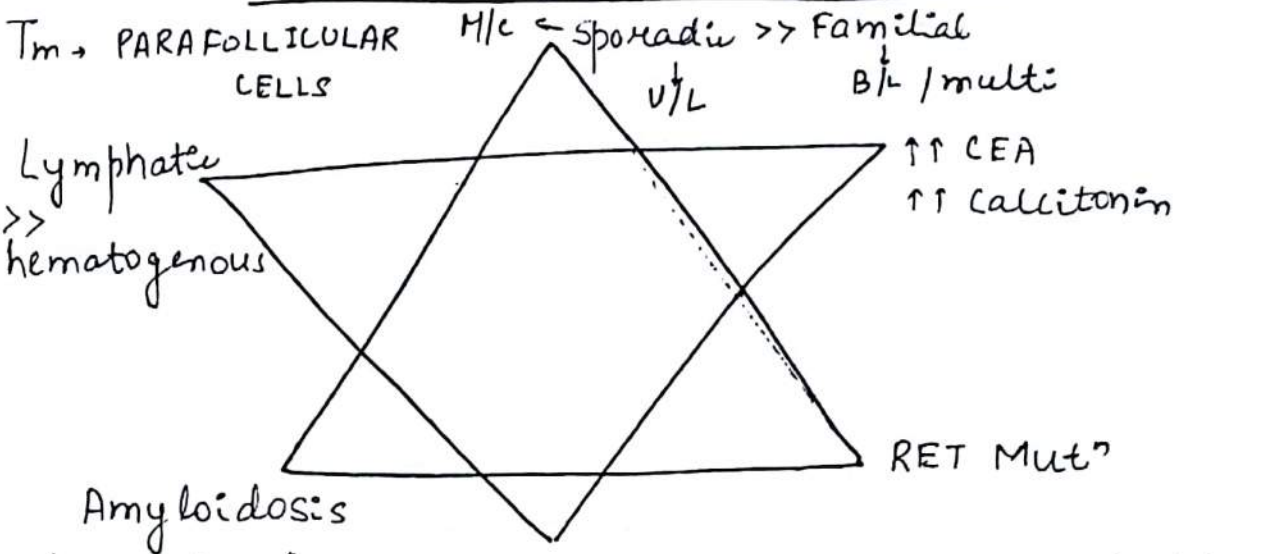
also in
[FOLLOW-UP OF HURTHLE CELL.]

THYROID REPLACEMENT POST. TOTAL THYROID $\uparrow^{ve}$ DTC

(THYROID SUPPRESION DOSE)

CONDITION	TARGET TSH
Residual Disease	< 0.1 μU/dL
Disease Free + High Risk	0.2 - 0.5 μU/dL
Disease Free (No added Risk)	0.5 - 2 μU/dL

MEDULLARY THYROID CANCER



↑↑ Histamine → vasomotor feature
↑↑ ACTH → Cushingoid feature
↑↑ serotonin → Diarrhoea

M/c distant Mets → LIVER >> BONES.
(osteoblastic)

Mx - TOTAL THYROIDECTOMY
c̄ prophylactic central Neck Dissec.

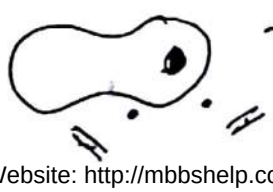
INDICATIONS for MRND + CND

1) ++ Central Neck. node
2) Size > 1.5cm

Remain ~~1st~~ one step Ahead –

TT + CND

TT + CND + MRND (U/L)


TT + CND + MRND (B/L)

Mx of Adv. MTC (Metastatic)

1) Debulking Thyroidectomy

2) Chemotherapy
   Vandetanib → DOC for metastatic MTC
   Labetuzumab (anti CEA)

3) Radiotherapy

⇒ No Role of Radioactive Iodine Ablation

For LIVER METS

→ TRANS ARTERIAL CHEMOEMBOLISATION (TACE)

→ TARE → I^{131}, $Yettrium^{90}$
↓
Radiotherapy

DEBIRI → technique of TACE.
Drug eluting Beads of Irinotecan

CALCITONIN → used for follow up of medullary thyroid cancer.

PARATHYROIDS

ANATOMY

Sup. PT O O

Inf PT. O O

40-50mg each.

Colour → yellow

↳ in newborn = Gray

Sup. PT

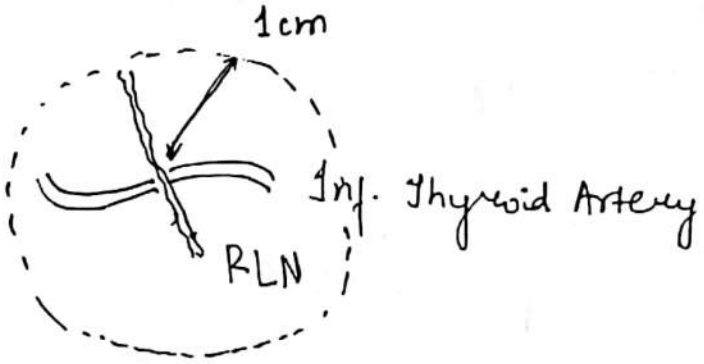
↓

Develops from 4th Pharyngeal arch

Inf. PT

↓

Develops from 3rd Pharyngeal arch



Inf. Parathyroid

Sup. Parathyroid

V I D S → Sup.

↓ ↓

ventral Inf. Dorsal

MICROSCOPY

OXYPHILL cells — CHIEF cells: Most. Imp — WATER cells: seen after Puberty

PHYSIOLOGY

PARATHORMONE → 84 AA

↙ 32AA functional

↘ rest- non- functional

→ PTH

Bound (50%) ← PTH → Free

Bound: 90% Albumin, 10% Phosphates

→ t½ of PT → 3 min

→ ↑↑ Blood calcium Levels

→ Calcium ⟶ albumin

Ca every rise or fall above 4 gm/dL of albumin level.

↳ S. Calcium changes by 0.8 mg/dL.

Eg.

If Ca^{2+} – 8.8 mg/dL

Albumin – 6 g $\xrightarrow{2}$ L

$2 \times 0.8 = 1.6$

$Ca_{eff} = 8.8 - 1.6 = 7.2$

HYPERPARATHYROIDISM

M/c → Adenoma >> Hyperplasia > Carcinoma

↳ in MEN-1 → Hyperplasia >> Adenoma

ADENOMA = Enlargement of single PT out of 4.

HYPERPLASIA = Enlargent of all PTs.

If 2 enlarge → double adenoma

CARCINOMA- P.T. c ↑↑ in size + Atypical features +
Capsular Invasion +
↑ mitotic count +
Pleomorphism

TYPES

1°	2°	3°
↑↑ PTH produc" by Ab (N) gland ī defective feed back	↑↑ PTH produc" by (N) gland c intact feedback mech. in response to chronic hypocalcemia eg. CRF malabsorp".	Autonomic activity of gland in response to prolonged stimulation

DIA HUNGRY BONE DISEASE

Rapid, massive absorption of Calcium by the bones after correc^{n} of Hyperparathyroidism. leading to life-Threatening Hypocalcemia.

CALCIPHYLAXIS (Uremic arteriopathy)

Necrotising gangrenous lesions due to blockage of arteries by deposition of Calcium in a/i state of uremia

DIAGNOSIS

1) S. PTH → ↑
2) Ca^{2+} ↑↑
3) $[S.\ Cl^{-} : PO_4^{3-} > 33]$.
4) Mild Metabolic acidosis (Hyperchloremic)
5) S. Mg^{2+} → (N) or (↓) (Osteitis Fibrosa cystica)

M/cc of Hypercalcemia -

- OPD → Hyperparathyroidism
- Overall
- In Hosp. Admitted

→ MALIGNANCY

FEATURES

Painful Bones
Kidney Stones
Abdominal groans

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Psychic Moans.

Fatigue overtone

Nowadays:

1) Dyspepsia
2) Polyurea
3) Polydypsia
4) Anxiety
5) Myalgia

KIDNEY → 1) Nephrocalcinosis
2) Polyurea
3) Polydypsia
4) HTN
5) Nephrolithiasis (<20%)

BONES → 1) Subperiosteal Bone resorption of
2) Osteoporosis
3) Osteopenia
4) Osteitis fibrosa cystica
(woven cancellous Bone)

X-RAY → 1) subperiosteal Bone resorp^{n} of Radial Aspect of middle phalanx of 2/3rd finger
2) Tufting of distal phalanx
3) Salt & pepper skull

4) Osteonecrosis of Jaw (BROWN TUMOURS OF JAW)

GIT - 1) Dyspepsia
2) ulcers
3) Ac. Pancreatitis
[Calcium >12.5 mg/dL]

Neurological Symp - Depression
Anxiety

Others → Myopathy → proximal.
purely muscular weakness.

℞ -

PR-OP LOCALISATION OF PARA-THYROID :- QQQ

NON-INVASIVE
(PReferred)
SESTAMIBI SCAN (Best)
↓
(DUAL SCAN)
↙ ↘
Tech 99 | SPECT
IOC for ectopic parathyroids
↓
Para-esophagus >>
Mediastinal >
Intrathymic >
Intra carotid >
thyroid >
Carotid sheath

INVASIVE
FNAC
Arterial sampling

4D-CT → 4th Dimension for functional assessment checks vascular gradient

USG → IOC for Intrathyroidal PT's

Rx-

INDICATION FOR Sx

1) All Symptomatic HPT

2) or

Asymptomatic Patient ī any of the following

a) Age < 55 yrs

b) Nephrolithiasis

c) GFR < 60 mL/min → grade III CRF

d) Serum Calcium > 1 mg/dL above baseline

e) Z score < -2.5D

Sx

ADENOMA	HYPERPLASIA	CARCINOMA
4 gland exploration F/B Resec" of Ab (N) gland.	Either ① Partial Parathyroidectomy or 3½ gland Sx Preserve 30-40 mg of most (N) appearing gland	Removal of gland + adjacent tissue + Ipsilateral Neck Dissection.

Nowadays- Minimal Invasive Parathyroidectomy is done via 2cm incision

② Total Parathyroidectomy
F/B autoimplantation
into brachioradialis
of non-dominant arm

Pockets
10-12

1-3 piece /Pocket

Size = 1-2 cm.

For Localisation in future - Non-absorbable suture or clips are used

POST- Sx

PERSISTENT HPT
persistently elevated S. Calcium after Sx

RECURRENT HPT
Elevated Ca Levels after a phase of 6 months of (N) calcemia

* Intra operative PT Assay
Confirmatory PTest for PTs
Fall in PTH level >50% after 10 min of removal of Ab (N) gland

HYPOCALCEMIA

S. Calcium < 8.5mg/dL

FEATURES

1) Earliest - ~~Hypo~~ Tingling or perioral numbness
2) Tachycardia / Palpitation / arrhythmia
3) Chovstek Sign.
   Twitch @ facial M/S on tapping over zygomatic arch
4) Trousseau's Sign (Most sp)
   Carpopedal spasm

Mx -

< 8.5mg → 7.8mg/dl → Oral Calcium (1gm × QID) + Vit D / Rhocalcitriol.

Ca^{2+} < 7.8mg/dL → I.V. Calcium gluconate

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

ADRENALS

PHEOCROMOCYTOMA

Tm arising from chromaffin cells of Adrenal medulla (derived from neural crest cells)

also k/n/a **10% TUMOUR**

10% Familial

10% - B/L

10% - Malignant → Any Pheo ± metastasis

10% - Extradrenal

Non-specific - (seen in Benign also)

Pleomorphism

↑↑ Mitotic count

Atypical cells

HIGH PASS score → Pheo in adrenal severity score

↑↑ Ki67 ↑ Index of necrosis → s/o malignancy

→ PARAGANGLIOMA → Extra-adrenal Pheo

M/c site = ORGAN OF ZUCKERKANDL.

↓ M/c location

(L) to Bifurcation of Aorta

→ Sporadic >> familial

↓ M/c

5th - 6th D

↓

3rd Decade

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Familial → a/c MEN$_2$
VHL
NF$_1$

→ GENETIC - Mut^n in SDH (succinyl dehydrogenase)

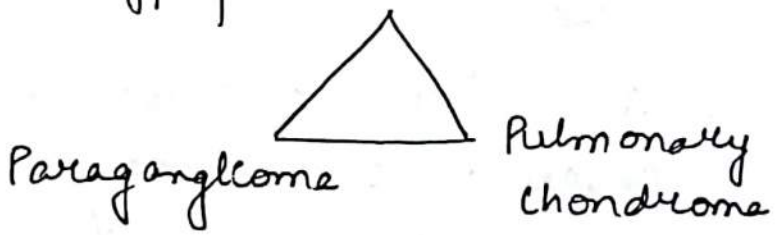
B → Pheo
D → Paraganglioma

Norepi ——PNMT——→ Epinephrine
(Phenylethanolamine N-Methyl Transferase)

Pheo → ↑↑ NE/ ↑↑ E

Paraganglioma → only NE (except → org-of Zuckerkandel. it contains PNMT also) So, ↑↑ E.

CARNEY'S TRIAD
wild type of Gastric GIST



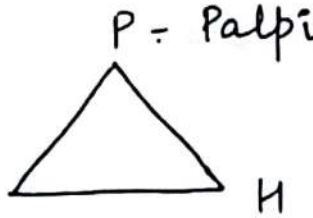
CD 117 ⊖
PDGF ⊖
BRAF ++
Ins like GF ++

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

CARNEY'S STRATIKIS SYNDROME

GIST + Paraganglioma.

C/F-



Diaphoresis

+

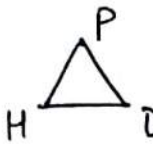
Episodic HTN (90%)

Headache (70%)

Δsis -

IOC = Urine 24hrs Free METANEPHRINE.

1st Line Inv → Plasma free metanephrine



+ Ep. HTN

↓

Rules out Pheo ← (−) Plasma Free Metanephrine

↓ (+)

24 Hr. Free Urine Metanephrine

(−) ← (−) (+) → (+) Δsis

Repeat 24 Hr Urine free Metanephrine

Pheo Ruled out ← (−)

↓

EQUIVOCAL

↓

CLONIDINE SUPPRESION TEST

(+) → Pheo ruled out

(−) → Δsis confirmed

LOCALISATION

IOC - MRI > CECT

↓

[Ligh Bulb Sign] (also seen in Hemangioma Liver)

DOPA PET > MIBG Scan

- <50yr or Suspecting multifocal Lesion
- >50yr or solitary

(Metiodo Benzyl guanidine)

PR-OPERATIVE Conditioning

α BLOCKERS → Phenoxybenzamine (2 weeks prior to Sx)

1st sign of Blockade → Nasal congestion.

other → Orthostatic HYpotension.

↓

Add β Blocker prior to Sx

(2-days prior to Sx)

↓

Sx = Lap. Adrenalectomy (upto 5cm)

open > 5cm.

α-agonist may be added to prevent hypotension

In ♀ ⇒ Termination of ♀

↓

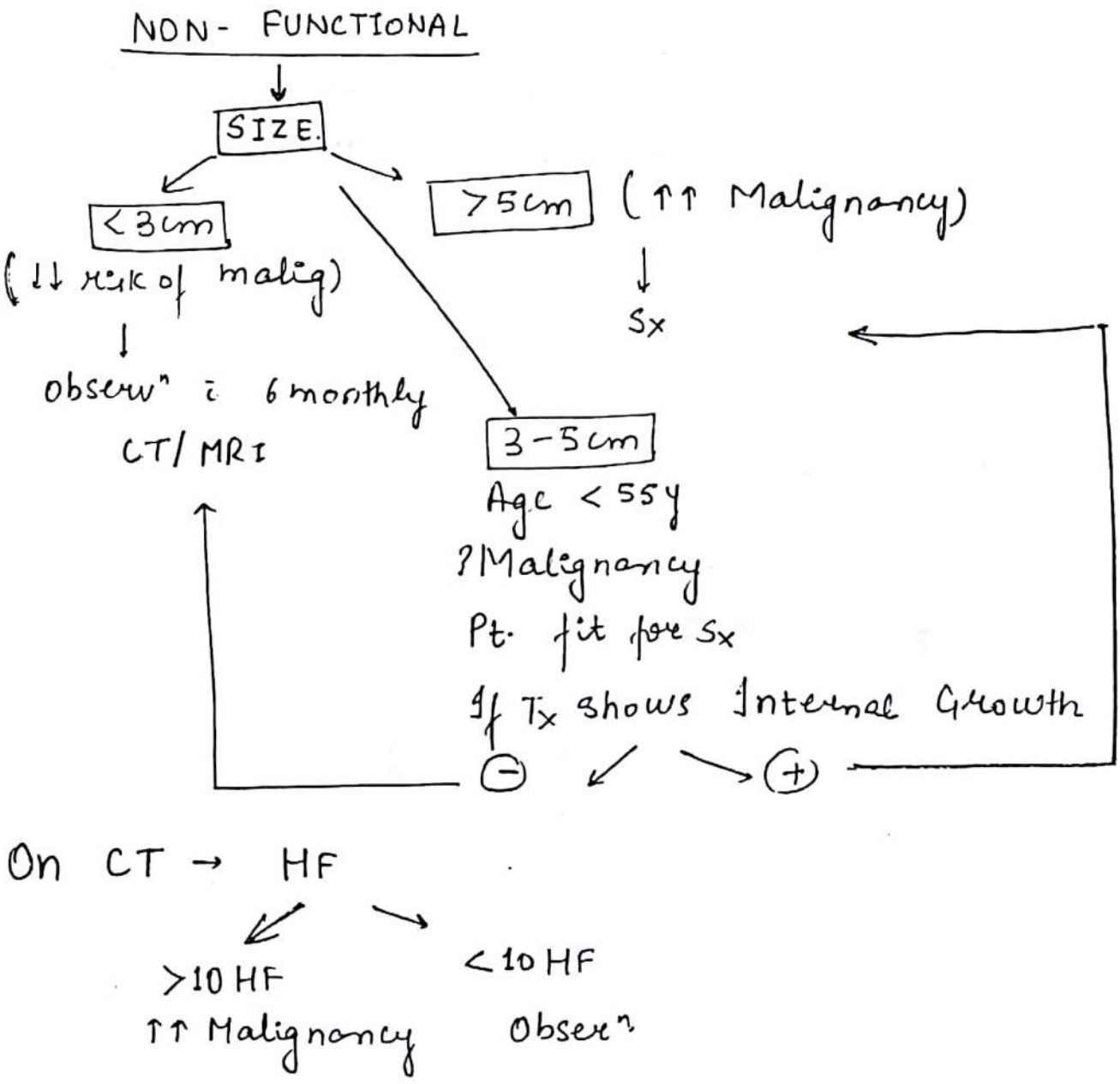
Lap Adrenalectomy Sx

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

ADRENAL INCIDENTALLOMA

→ Accidentaly/ Incidently detected while screening for other pathology

→ 70% - non functional
30% - functional (Aldosteroma - M/C)



On CT → HF

>10 HF
↑↑ Malignancy

<10 HF
Observ"

ADRENOCORTICAL CARCINOMA

→ Rare

→ ♀ : ♂ (1.5 : 1)

→ Bimodal Age - 1st → 1st Decade
2nd → 5th - 6th Decade.

→ Mostly → Acc [Functional]

↓
H/cc
Aldosteronoma >> Cushings

Features s/o Malignancy

▷ WEISS Index

↑↑ size (>5cm)

Atypical cells

Pleomorphism

↑↑ mitotic count

WHO CLASSIFICATION

I < 5cm size

II >5cm

III Any size c Local Invasion

IV Disseminated

Rx - Radical Resec° of Adrenal

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

MEN SYNDROME

[Multiple Endocrine Neoplasia]

MEN_1		MEN_2
WERMER SYND.		SIPPLE Synd
MENIN	← GENE →	RET protooncogene (Rearrangement during transfection)
On 11q13 AD [110 codons, 610 axons]		Chr. 10 AD
JUN-D proto. oncogene mut^{n}.		gDNF glial derived neurotrophic factor

MEN-1

Parathyroids (80%) · Pancreas (60-70%) · Pituitary (40-50%)

PARATHYROID

M/C site for MEN 1

M/C ab(N) ⇒ Hyperparathyroidism

↓

M/Cc

↓

Hyperplasia >> Adenoma

M/C ↓ Biochemical Ab (N) ⇒ Hypercalcemia

1st ↓ age - 13-15 yrs.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

PANCREAS - Neuro-endocrine Tumours

Functional >> Non functional

Gastrinoma >> Insulinoma >> Polypeptidoma

M/c func^n Tx

M/c NETx overall

Others → VIPoma (vasoactive Intestenal Peptidoma)

↓

WDHA syndrome / Verner Morrison Synd.

Watery Diarrhoea

Hypokalemia

Achlorhydria

PITUITARY

Post Pituitary is never involved

Only Ant. Pituitary involved.

M/c Lesion = PROLACTINOMA

♂ → Infertility

♀ → amenorrhoea

↳ galactorrhoea

Blindness may be seen due to compression over optic chiasm

Other Tx of MEN-1

1> Bronchial / Thymic / Gastric Carcinoid.

CARCINOID → [git M/c]

Appendix → Ileum → Rectum → Bronchus

2> Lipoma

3> Cutaneous + Facial Angiofibromas

4> Thyroid Tumours

5> Adrenal Mass

Δ sis of MEN$_1$

CRITERIA → Involvement of 2 out of 3 target endocrine organ.

FAMILIAL MEN1 → Any 1 of 3 target organs involved in 1st degree relative of MEN-1

SCREENING

→ At Birth :- MENIN GENE MUT^{n}.

⊕ ← ↓ ⊖ MEN-1 ruled out

MRI ⇐$^{++}$ At 5yr. Pituitary @ Annual Sr. Prolactin.

↓

Sesta mibi Scan ← At 8yr @ Parathyroid @ Annual Sr. PTH / Ca^{2+}

At 20yr @ Pancreas
@ annual sq

Evaluate that NET ++ ←
- Gastrinoma
- Insulinoma → C-peptide
- Glucagon.
- VIPoma

Chromogranin A → NF Tumour
Synaptophysin →

Δ-- Gastrinoma →

BAO → >15 mEq/hour
or
>5 mEq/hr.
(in post vagotomy state)

+

↑↑ Fasting Gastrin
(>1000 pg/mL → Asi
100 - 1000 pg/mL → equivocal)

↓

Secretin stimulation Test

↓

Rise > 200 pg above Baseline. Δ stic

Insulinoma → IOC = 72 hrs monitored fasting glucose

↑↑ C-peptide >1.2 µg/dL
Insulin >12 µIU/mL

<50 mg/dL → ♂
<40 mg/dL → ♀

Pro- Insulin > 40%

Ins : glucose > 3

MEN-2

MEN$_{2A}$ — MEN$_{2B}$ More aggressive

M/C site ← MTC →

Interscapular Region ← Pheo →

> Cut. Lichen (deposition of amyloid in Papillary Dermis)

Flexure Amyloidosis

Hyperparathyroidism

Hirschprung's Disease
↳ No fecal soiling

Mucosal neuroma (M/c → Lips, Buccal cavity)

GI neuroganglioma

Marfinoid Habitus

Everted Eyebrows.

Megalocolon.

Chr. constipation
↳ fecal soiling ⊕

Tongue ~~so~~ nodules

SCREENING

At Birth → RET Mutn

⊕ ↓ ⊖

MEN$_2$ ruled out

Pentagastrin stimulated calcitonin Level

↓

Elevated → Prophylactic Total Thyroidectomy

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

MEN_{2B} → T in 1year

MEN_{2A} → < 5-6year

(No L.N. Dissection)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

SALIVARY GLAND

TUMOURS

BENIGN

1) PLEOMORPHIC ADENOMA (PLA)

H/c overall salivary Gland Tumour

H/c Tumour of Parotid Gland

H/c Benign Tumour overall

PLA - Epithelial cell
Mesenchymal cell
Duct cell
} ⇒ Pleomorphic

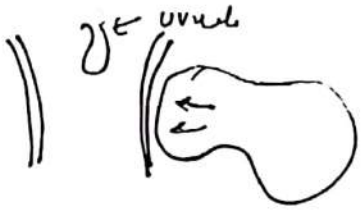
♀ >> ♂ [3:1]

* PAROTID PLEOMORPHIC ADENOMA :-

H/c site ⇒ Superficial Lobe Lower Pole (Tail)

DUMBLE Tx → when Both lobes involved (Sup & Deep)

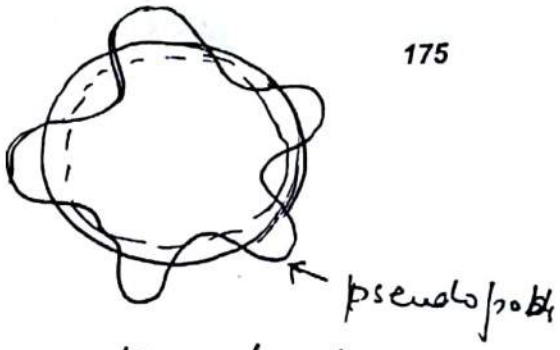
Medial Displacement of Tonsillar Pillar



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

FEATURES-

- Encapsulated
- Firm
- mobility
  - freely mobile except in upward Direc' "CURTAIN SIGN" (due to insertion of deep cervical fascia into zygomatic arch)



SIGNS OF MALIGNANCY

- Facial N/V weakness
- Ulceration
- Fixity
- Rapid ↑ in size → onset Pain.

CARCINOMA EX-PLEOMORPHIC ADENOMA

Malignant conversion of Long standing PLA

Q PLEOMORPHIC ~~AD~~ CARCINOMATOSIS

100% Carcinomatosis conversion

∴ no adenoma component

Δsis :- PAROTID MASS

IOC = FNAC

100% accurate

95% specific

90% sensitive

Biopsy is C/I

due to ↑↑ RISK of

1) ~~FN~~ ~~Inj.~~ Facial N/v Injury

2) Tumour spillage

3) Parotid Fistula.

Tm for malignancy → MUC_1 ; DF_3

For Malignacy ? → MRI > CECT

to evaluate gland + its relation.

PAROTID MASS

BENIGN

Sup. Lobe

↓

IOC = Sup. Parotidectomy or Suprafacial Parotidectomy

Deep Lobe

↓

Total conservative Parotidectomy (N/v sparing)

MALIGNANT

↓

Radical Parotidectomy

(Parotid + ~~Rest~~ Pre-Auricular LN + Involved part of Facial N/v

↓

RT

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Recurrent PLA → Sx → RT QQQ

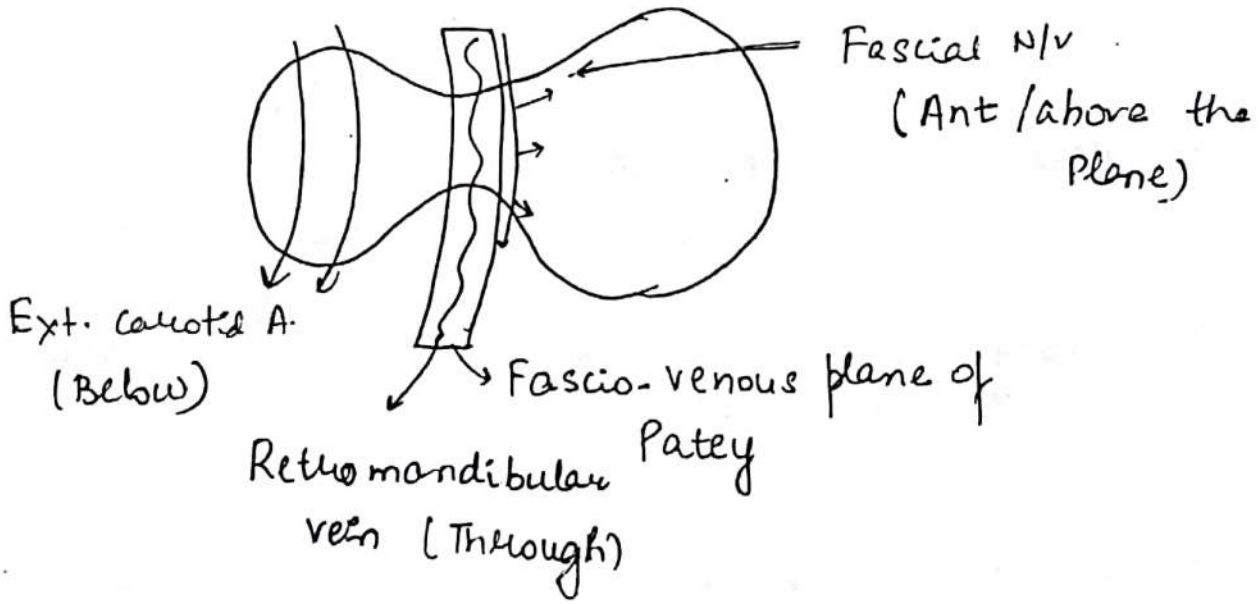
FACIAL N/V RECONSTRUC°

Sural N/V (BEST)

Others- Auricular Temporal N/V
Anti-cubital Brachial N/V

Sup. Parotidectomy →
Removal of sup. Lobe of Parotid to expose Branches of Facial N/V.

Supra facial Parotidectomy →
Wide local excision of Benign sup. Lobe Tx
ē out exposure of Facial N/V branches
Adv → Less Inj to Facial N/V.



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

2) WARTHIN'S TUMOUR

2nd M/C Salivary Gland Tumour.

Exclusive to Parotid

K/n as ADENOLYMPHOMA → Minnomer

K/n as PAPILLARY CYSTADENOLYMPHOMATOSIS

♂ >> ♀ (4:1)

Can be B/L (10%)

Strongly A/E Smoking
Radiation

↑↑ in Mitochondria → Tech 99 → HOT SPOT

M/C Site → TAIL of parotid

Microscopy - 2 rows of papillae lined Columnar Epithelium.

3) ONCOCYTOMA (<1%)

K/n as OXYPHILIC ADENOMA

Tan or Mahagony colour

pseudo capsule

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Parotid → M/c site

Tech^{99} → HOT SPOT

(overall → Kidney → M/c site → oncocytoma)

M/c Benign TX

4) LYMPHOEPITHELIAL LESIONS

a/e CMV Infec'

k/n as GODWIN'S TUMOUR

Mostly Benign

ass/c → BLEL → Benign Lymphoepithelial Lesion.

Gland Parenchyma → replaced by Lymphocytes.

<5% ⇒ malignant

↓

ESKIMOMAS

MALIGNANT

1> MUCOEPIDERMOID CARCINOMA

→ M/c malignancy → overall
- Parotid
- Infancy

→ a/c radiation

MEC

- Low Grade
  - Encapsulated
  - Mucous cells
- Int. Grade
  - Clear cells
- High Grade
  - Non-encapsulated cell
  - Epidermoid cells
  - ↑↑ mitotic count
  - ↑↑ infilteration

Rx = Radical Resection f/b RT
[except Low grade muco-epidermoid]

Mu Co Epidermoid
- Epidermoid → M/C malig
- Epidermoid → Infancy
- Epidermoid → overall

Mu Co → Low
Epidermoid → Int
Epidermoid → High

2) ADENOID CYSTIC TUMOUR

Low grade
Slow growing
A/C → Perineural Invasion
→ Hematogenous spread.

Also known as CYLINDROMATOUS TUMOUR

ACT

- SOLID
- PAPILLARY
- CRIBRIFORM

M/C malignancy → Submandibular gland
Sublingual "
Minor salivary "

On Microscopy → SWISS CHEESE
→ [HIV PAROTITIS]

R_x - Radical Resection
RT must

3> ACINIC CELL TUMOUR

→ Low grade Tumour
→ slow growing
→ Tm of pure serous Gland
↓
90%
↓
Parotid

→ a/c Lymphatic spread

Microcystic Type is M/C
other types → Papillary, Follicular, medullary.

Microscopy → ZYMOGEN GRANULES
BUBBLY BASOPHILS

R_x - Radical Gland Resection

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

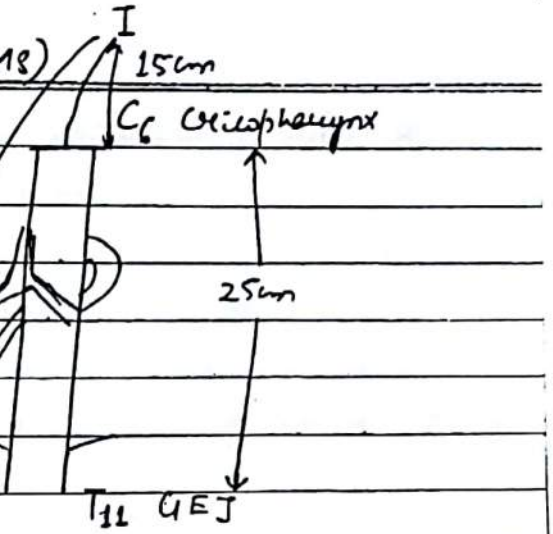
GIT

16/12/17

OESOPHAGUS (PGI, AIIMS)

Length of oesophagus - 25cm

* 3 pt of constriction - from incisor
  - 15cm → Cricopharynx C_6
  - 25cm → ⓛ bronchus T_4
  - 40cm → diaphragm T_{10}



Cricopharynx is narrowest part of whole of GIT.
next narrowest part is ileocaecal jene.

ⓛ Bronchus - 22.5
Aorta - 27.5
} they approx. are at 25cm.

* Opening of Diaphragm -

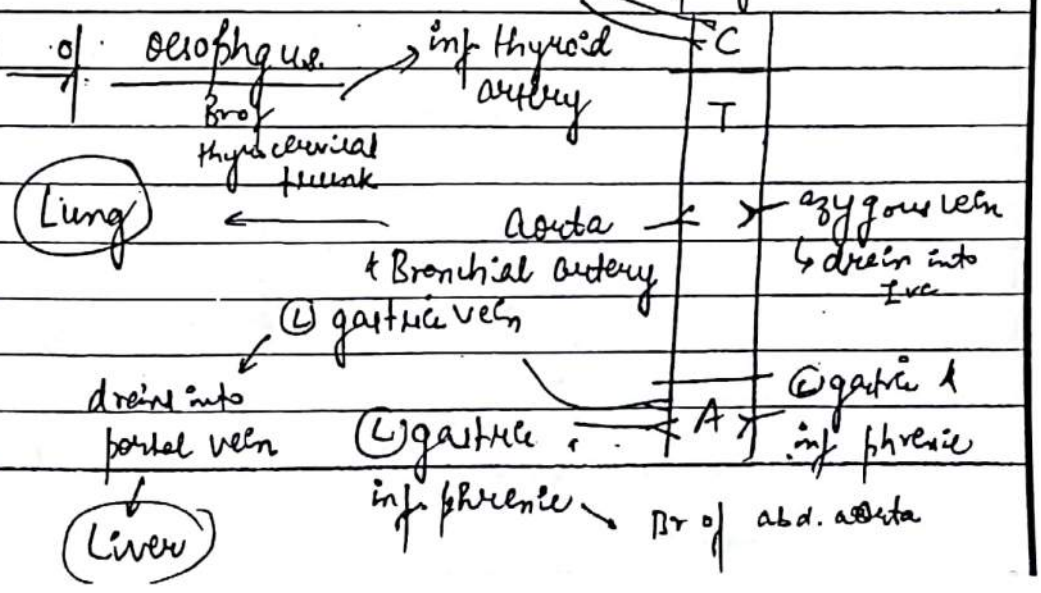
① T_8 - IVC ——— ⓡ phrenic nerve

② T_{10} - oesophagus → B/L vagus
→ Branches of ⓛ gastric artery

③ T_{12} - aorta → azygous vein
→ thoracic duct → drain into Brachiocephalic vein

AIIMS

Blood Supply of oesophagus → inf thyroid artery
→ Bronchial artery
→ ⓛ gastric artery
→ inf phrenic



It has no serosa. → hence there is no subserosal plexus.

↓

they have submucosal plexus.

Q. ∈ organ of GIT has no submucosa ⇒ G.B.

Longitudinal muscle → Helicoidal pattern

↓

① Diffuse oesophageal spasm. (DES)
↳ Cork screw appearance in Ba swallow

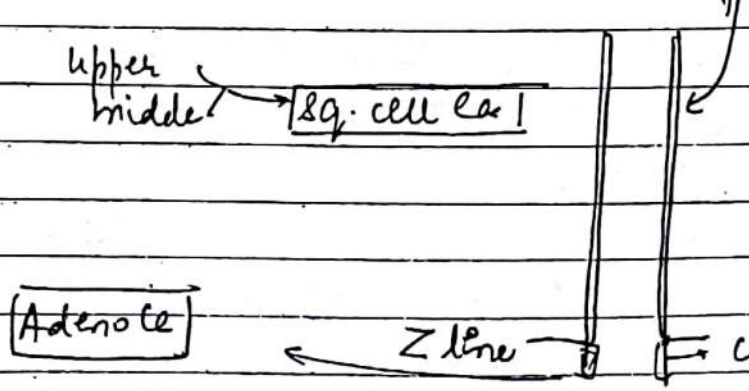
② Distensibility → good pot^{n} of stretching
Dysphagia as a symptom occurs when there is obstruction >75%

↓

Hence Ca oesophagus has late presentation
poor prognosis
5 year survival rate < 20%.

Epithelium-

non-keratinised stratified sq. epithelium.



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Commonest Ca of oesophagus ⇒ Sq. Cell Ca.
Site ⇒ Middle 1/3rd

Adeno Ca ⇒ Lower 1/3rd
common in White ♂

Q. Long segment of Barrett's ⇒ > 3cm

Q. What dye is used for Barrett's ⇒ Iodine (Squamous ↑)
↓ Chromoendoscopy
Earliest Dx for oesophageal Ca.

for columnar ⇒ Methylene Blue
Also Oral cavity ⇒ ✗ Toluidine Blue

For Histology, ① Alcian Blue, ② Alcian Blue, ③ Metallion Yellow

Plus Foreign Body In Oesophagus

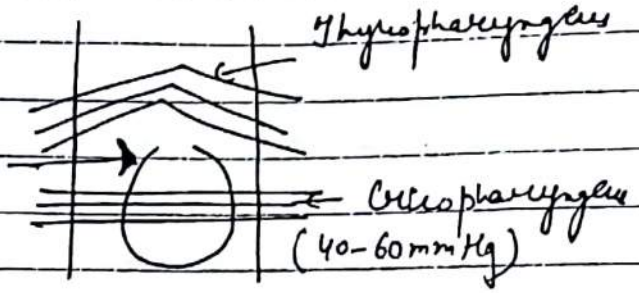
↓

Symptomatic
- Sharp
- magnets, button batteries
⇓
Immediate removal by Endoscopy

Asymptomatic
Smooth F.B.
↓
wait for 24 hrs & repeat X-Ray

ZENKER'S DIVERTICULUM

- Pulsion Diverticula from Killian's Dehiscence
- Acquired



Killian's Dehiscence
- common in ♂, old age

Pressure ↑
Ach

Pressure ↓
VIP
Nitric oxide

Congenital	Acquired
- True	False
- all 3 layers	only 1 layer

(P) ⇒ Pulsion diverticula.

(T) ⇒ Traction diverticula

Killian's Dehiscence is posteriorly (hypopharynx)

Diverticula is common in (L) side

- Zenker's (Pulsion)
- Traction
- ← epiphrenic diverticula (Pulsion)

2nd swallowing is found in Ba meal studies in Zenker's diverticula.

C/F -

① Regurgitation (old/undigested)

② Dysphagia (intermittent)

M/cc of Intermittent Dysphagia ⇒ DES

other cause ① Schatzki's ring
② Zenker's
③ Eosinophilic esophagitis

⑤ Halitosis

④ Aspiration pneumonitis (M/c complication)

⑤ Lung abscess next common

⑥ ~~Lung~~ Ca oesophagus. 5% Mlk.

Mortez Classification -

< 2 cm ⇒
2-4 cm
> 4 cm.

Von Overbeek
compare ī vertebra

< 1 vertebra
1-3 "
> 3 "

Ix OC ⇒ Barium Swallow

M/c site of iatrogenic perforation ⇒ Cervical oesophagus

* Indications for Ba swallow :-

① Complete Dysphagia
② Liquid dysphagia
③ anatomical delineation
Structure
Diverticulum
Stomach - hiatus hernia
volvulus

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Rx

≥ 4cm ⇒ Diverticulectomy
+ cricopharyngomyotomy
(cervical myotomy)

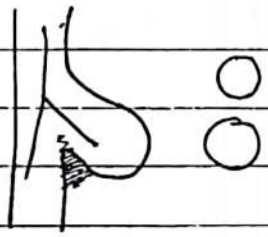
If z-D is <2cm ⇒ cricopharyngomyotomy or
Botulinum toxin injection.
↳ ⊖ release of Ach

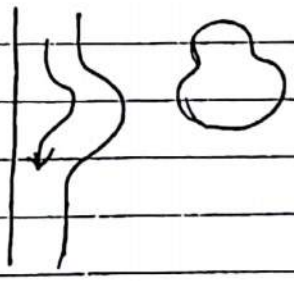
2-4 cm ⇒ myotomy or Bot. toxin injection.
+
Diverticulopexy

Dohlmann's Procedure
- endoscopic procedure
- staplers used
- not done for very small diverticule

these days CO_2 lasers are used
↓
any size can be done

Von overbeak done it 1st





If odynophagia → candidial (monilial) or herpes esophagitis or pill induced esophagitis.

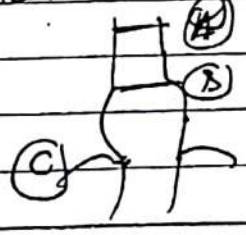
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

OESOPHAGEAL WEBS & RINGS

* Plummer Winson Syndrome / Patterson Brown Kelly Syndrome
  - Asymmetrical mucosal web
  - seen at the level of cricopharynx (Post. cricoid).
  - ♀.
  - Mid. aged / Perimenopausal / Edentulous ♀
  - associated c Fe Deficiency Anaemia
  - Asymptomatic, rarely may cause Dysphagia
    ↓
    Sideropenic Dysphagia
  - Cancer ring ↑
  - I x O c- Barium Swallow.
  - Rx ① Asymptomatic ⇒ Fe supplementation.

    ② Symptomatic
    - Balloon Dilatation.
    - Savary Dilator, rupture web.
    - CO_2 laser.

* Rings → Schatzki Ring / B Ring
  - Symmetrical
  - Submucosal fibrous thickening
  - at Z line, above diaphragm.
    seen ↓ along c sliding hiatus hernia.
  - Non-progressive Ring
    ↳ happens due to GERD.
  - Asymptomatic
  - Pt will never has dysphagia for liquids



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

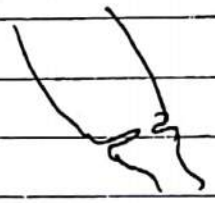
- Only dysphagia for solids (mild - moderate)
- Sudden aphagia

Ix OC → Barium swallow

Rx - Asymptomatic - t/t reflux.

Symptomatic -
Balloon Dilation, rupture the ring
Hiatus Hernia ⇒ Fundoplication

Q. True statements reg. Schatzki's.



Ring is/are

① dysphagia predominantly to solids
② Symmetric
③ ↑ risk c GERD
④ involve muscle → No, submucosal

SPONTANEOUS RUPTURE / BOERHAAVE'S SYNDROME

- caused by Barotrauma

It is spontaneous rupture of ⓛ lower oesophagus (97%) due to vomiting / retching against closed glottis

⇓

Pleural effusion.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Meckley's Triad ⇒ ① vomiting / Retching
② Retrosternal pain
③ Surgical Emphysema (air in subcutaneous plane)

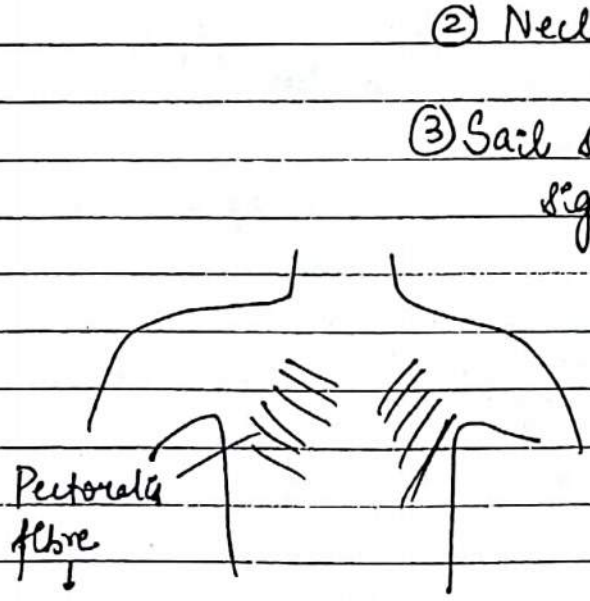
Hamman's Sign ⇒
Sign of pneumomediastinum.
auscultatory finding
↓
Air Crunch & Heart Beat

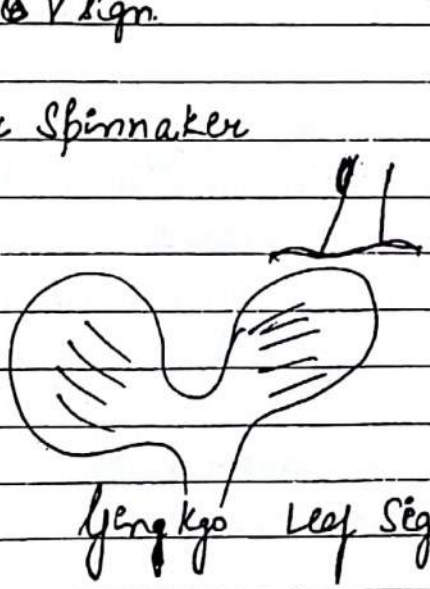
Ix of ⇒ X-Ray ⇒ CECT ← Most accurate

Don't prefer Barium in case of perforation as Barium is water insoluble
↳ (R) Lateral Position. is best for visualization.

Gastrografin → Water soluble but Hyperosmolar

Plain X-Ray ⇒ ① air shadow btw (B) diaphragm
↳ continuous diaphragm sign
② Neclerio-Ⓐ V sign.
③ Sail sign or Spinnaker sign.





seen in surgical emphysema

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Rx - Post lateral (L) thoracotomy & 1° closure
↑ ↳ for lower oesophagus
1° closure ≈ Vicryl

< 48 hrs ⇒ 1° closure

> 48 hrs ~~[illegible]~~ ⇒ ~~[illegible]~~ ⇒ No 1° closure
Thoracotomy → ligate above & below the tear
+
- Lavage + Drainage
- Feeding jejunostomy
- Cervical oesophagostomy
↳ for suction, aspiration.
⇓
Discharge after recovery
↓
After ~~3~~ months
Excise the diseased part
↓
Bowel Interposition
(Jejunum > colon (L))

MALLORY WEIS TEAR -
- Barotrauma
- Longitudinal tear
↓
Below GEJ (70%)
- Commonly seen in ♂
+
② alcoholic binge
③ Hiatus hernia

- Partial thickness tear (Mucosa, submucosa involved)
  H/o - vomiting initially → Haemetemesis.

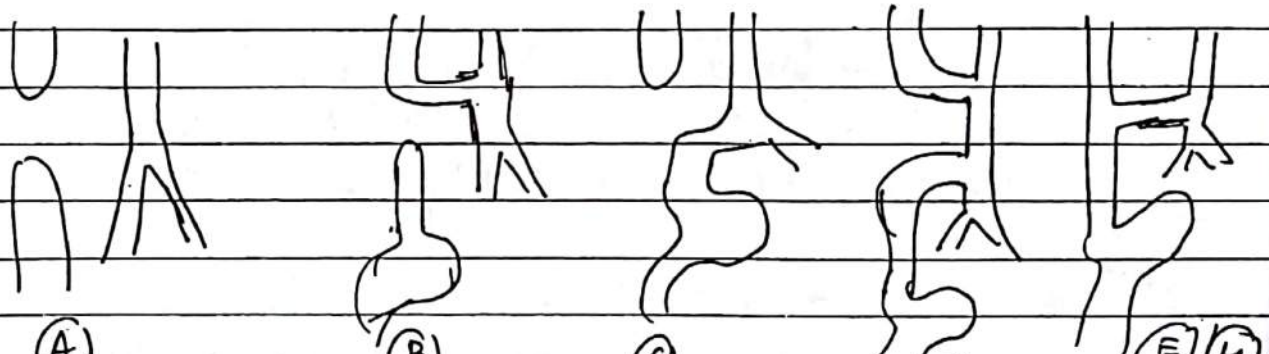
Ix O c → Endoscopy

Rx - ① conservative

② Sx - sclerotherapy

Q. Which artery bleeds in Mallory-Weiss Tear?
Ⓛ gastric artery

TRACHEO-OESOPHAGEAL FISTULA



5-10%

M/c type
>80%

Gross

C/F -

① Continous dribbling of saliva

Type A & B ⇒ Scaphoid abdomen & air can't enter

② Choking while feeding

VOGT → @ → 36.

- Incidence 1:5000
- ♂ > ♀
- common ∈ Down's Syndrome

- Cong. malformation
- Polyhydroamnios (50%)
  - GIT obstruction → Poly
  - Renal " → oligo.
- 50% → multiple congenital anomalies VACTERL
  - V → Vertebral
  - 2nd M/c A → anorectal
  - M/c → C – cardiac VSD, PDA, TOF.
  - T, E → TEF
  - R → Renal
  - L → Limb → Radial Hypoplasia

Relative CI to BMV

Ix of choice →

① NG tube → take X-Ray.
↳ Coiling of tube in upper oesophagus 10cm

if tube in lungs → Proximal fistula

AIIMS 2012

H type fistula → Most accurate Ix.
Tracheobronchoscopy

Safest contrast for tear ⇒ Dianosil:
- Water soluble
- Low osmolarity

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Rx. ① O_2 ~~flood~~. I.V. fluid. Antibiotics

① Feeding gastro-ostomy for sick babies.

② (R) posterolateral thoracotomy (for middle oesophagus)
ligation of fistula & blo oesophageal
Anastomosis (end to side anastomosis)
↳ ↓ risk of stricture

Waterston's Criteria :-

① Birth wt	>5.5 lb	In Btw	<4 lb.
② aspiration pneumonitis	-ve		+
	⇓	⇓	⇓
	Thoracotomy	IV fluid make pt fit for Sx.	Feeding gastrostomy

ACHALASIA CARDIA

→ Improper Relaxation of LES.

Submucosal → meissner's
Muscle → Auerbach's or myenteric
(Motor ganglion)

Cause -
→ absence of ganglion - inhibitory ganglion

2° Achalasia → Chago's Disease (Trypanosoma Cruzi)
common in S. America

Pseudoachalasia → by cancer

- young age (20-40yr)
- ♀ ≥ ♂
- C/F - ① Dysphagia - for liquids > solids
  - progressive
  - ↓
  - Both for liquids & solids
  - Non-progressive

② Regurgitation
- Aspiration
- halitosis
- wt. loss.

③ Cancer ⇒ Sq. cell carcinoma

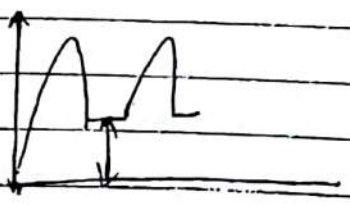
Triad → ① Dysphagia
② Regurgitation
③ wt loss

* Triple A syndrome / Alacrimia Syndrome -
A - achalasia
A - alacrimia
A - ACTH ⓡ adrenocortical insufficiency

~~Tx~~ ⇒ Tw

① Plain X-Ray - ① absence of fundal gas shadow
② Widened mediastenum
③ Air-fluid level in mediastenum.

② Manometry - gold Std.
→ Non- relaxation of LES
→ ↑ pressure of LES



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Amyl nitrate inhalation test is used to detect → Achalasia Cardia

- ~~Non~~ Atonic Oesophagus or high pressure non propagatory.

③ Barium swallow- Bird Beak appearance
Rat tail deformity
↳ Oesophageal Cancer
- irregular margin
- filling defect

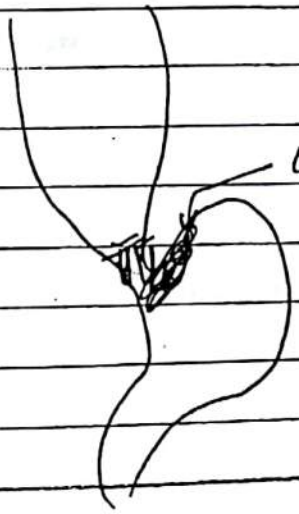
Rx - ① Medical Rx - 10% efficacy - CCB
Nitrate.
Highest pressure
Rx Inj^n of Botulinum Toxin → recurrence rate > 50% in 6 month

⑤ Balloon Dilatation.
45 F - 60 F
48 F ⇒
5% risk of perforation.

3 Fr = 1 mm.
↳ outer diameter of tube

④ Heller's Myotomy
By Laparotomy or Laparoscopy.

So, comp^n → GERD



↓ prevent GERD
collar sling
Helvetius collar fabre

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

So, we do Heller's Myotomy + Partial Fundoplication.

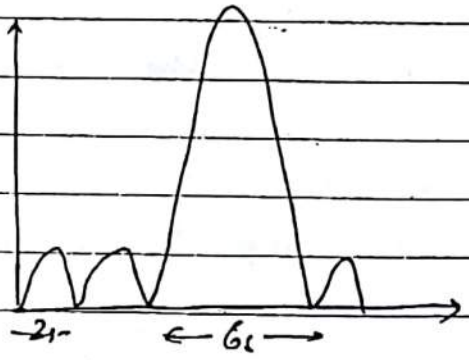
NUTCRACKER OESOPHAGUS / SUPERSQUEEZER OESOPHAGUS

- Middle aged
- ♀
- C/F → (1) Retrosternal pain.

M/c motility disorder of oesophagus
↳ nutcracker

M/c " " " " presenting ± Dysphagia
↳ Achalasia cardia

Inv - Manometry



O' Castell Criteria
- pressure > 180 mm Hg
- duration of wave > 6s

⇓

s/o nutcracker oesophagus

Rx - Medical Rx → (1) CCB
(2) Nitrates

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

* scleroderma is associated c GERD.

GERD - MAJOR TOPIC

Pathophysiology -

pH of stomach - 1-3.

pH of oesophagus - 5-7.

if pH of oesophagus < 4 ⇒ Pathological.

* Protective Factors

(1) LES.

(N) pressure - 20 ± 5 mm Hg.

physiological sphincter

(2) Intra-abdominal length

should be >2-2.5cm.

if <1cm → reflux occurs

(3) Intra-abdominal pressure

↳ ↑ sphincter pressure

(4) Supine position. ↑ sphincter pressure

(5) TLESR (Transient LES relaxation)

more frequent.

LES ↑ by	LES ↓ by
(1) Protein diet	(1) Fat
(2) Gastrin	(2) Alcohol
(3) Ach	(3) Smoking
(4) Secretin	(4) β stimulation
(5) PGF	(5) Somatostatin
(6) α-stimulation	(6) CCB, Nitrates
	(7) Atropine
	(8) Theophylline
	(9) Morphine
	(10) Diazepam.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

(II) Low Intragastric pressure -
reflux ↑.

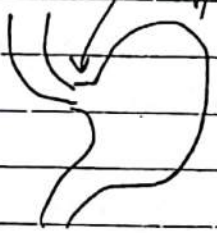
(III) 2° Peristalsis. -
↳ starts from cricothyroid
Results from reflux, propagatory
1° peristalsis → in response to swallowing
propagatory

ATIMS
3° peristalsis → non-propagatory

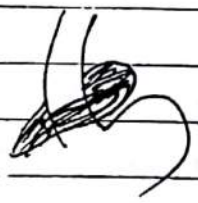
Presbyoesophagus → motility disorder
3° peristalsis.
seen in old age

IV Angle between GEJ
if ∠ becomes 90° ⇒ reflux occurs

∠ of His → 60°-70°.



V Mucosal folds at GEJ. (gastric rosette)
helps



VI Crus of Diaphragm. Pinch.
(R) crus prevents reflux Cock effect

Allison Repair → tightening of (R) crus of diaphragm.

Btw (R) & (L) crus of diaphragm, → Medial arcuate lig is present at T_{12}
Below it Coeliac trunk + AA

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

When medial arcuate lig goes below, it compresses Coeliac trunk ⇒ Medial Arcuate lig Syndrome.

CF -
① Heart Burn / Epigastric pain
② Water Brash.

↓ laryngeal spill over ⇒ Aspiration. } Complicated Reflux
Vocal cord nodule
Dental caries
CSOM.

M/C presentation in child ⇒ aspiration.

Other Comp^n of reflux -
① ulcer → Bleed → structure → Dysphagia.
② Barrett's oesophagus → ~~lung~~ Cancer
③ Schatzki Ring

Inv
① Ba swallow - Deep ulcer
Structure
hiatal hernia

② Manometry → TLESR
2° peristalsis

I Ist inv → Endoscopy. → very helpful

Gold Std → 24 hr PH monitoring

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Where exactly pH is measured ⇒ 5cm above GEJ"

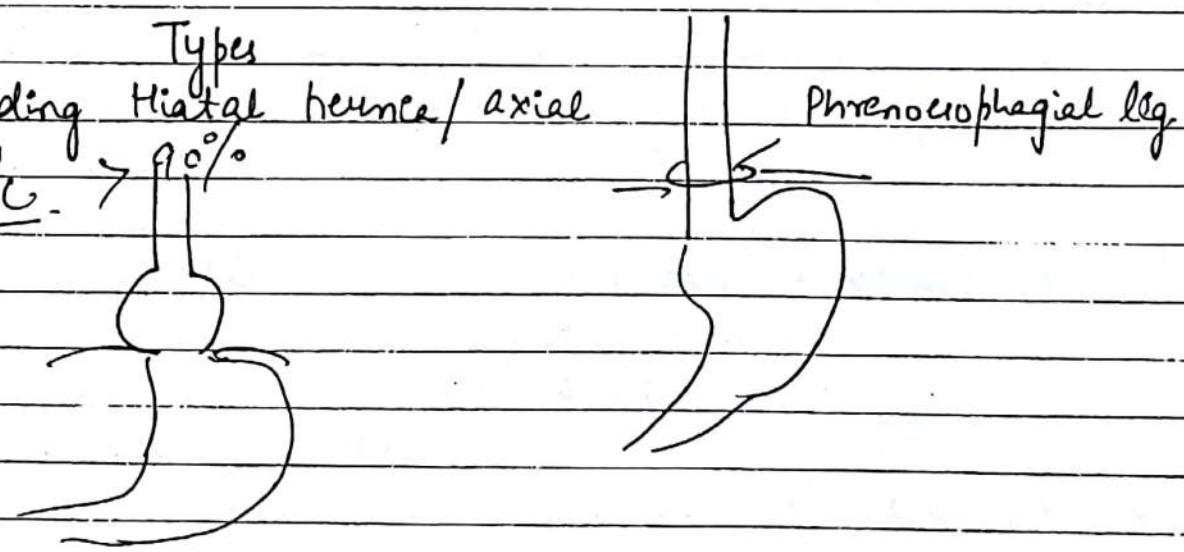
De Meester Criteria – 6 parameters for diagnosing GERD
when Score > 14.72 ⇒ s/o GERD.

Bernstein test → obselete Now.

Rx – ① Lifestyle modification
② ↓ obesity
③ H_2 blaker + PPI + Prokinetics.

HIATAL HERNIA

Types
▷ Sliding Hiatal hernia / axial
M/C. > 90%



- No tear in ligament (phrenoesophagial lig)
- Peritoneum covers only ① side.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

② Rolling Hiatus Hernia/ Para-oesophageal 5%

- Ligament is torn
- Complete fundus is covered by peritoneum
- Fundus goes up.
  Camerlot ulcer seen.

③ Mixed - Both. → most complication.

④ Other Bowel parts herniate

C/F -

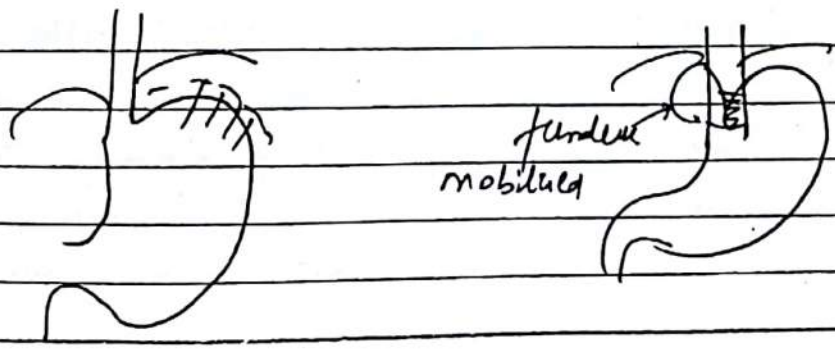
① sliding hernia ⇒ Reflux. GERD

② Rolling hernia ⇒ pain/ dysphagia
Necrosis, ischemia more common

Rx - Ix OC ⇒ Barium Swallow in trendelenburg positon.

DNB 14 Plain x-Ray ⇒ ~~Fluids~~ Retrocardiac air-fluid Level
↳ fundal gas shadow.

Sx - ① Nissen's Fundoplication - 360°



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Length Wrapped → 3-4 cm
Wrap should be loose ⇒ Floppy Wrap
M/C Comp^n. of fundoplication ⇒ Gas Bloat Syndrome
earlier times - pneumothorax
Dysphagia

② Belsey
270° Wrap
done by thoracotomy

③ Toupet
<270° post. Wrap

④ Dor
<270° ant. Wrap

⑤ Watson
180° ant.

Allison Repair → approximate crura of Diaphragm.

Hill's Repair → Stitch cardia of stomach & lower oesophagus posteriorly to median arcuate ligament

Collis & Gastroplasty → done for short oesophagus
using of flap of stomach.
lengthening of oesophagus done

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

OESOPHAGEAL CARCINOMA (P4I

1) ♂
2) Old age
3) M/c site → Middle 1/3rd
4) M/c type → Sq Cell Carcinoma
5) ♂:♀ = 2-3:1
   Adeno Ca → common in lower 1/3rd
   " in white ♂
   ♂:♀ : 10-15-1

AIIMS

Risk Factor :-

① Diet - Vit C Deficiency
   Hot Beverages
   Smoked fish → > of (E)
   Nitrosamine compounds → > for stomach
   Smoking & alcohol.
   Vit A Deficiency
   Calcium "
   Molybdenum "

② Zenker's Diverticulum
③ Plummer Winson Syndrom
④ Achalasia Cardia
⑤ H. pylori → CAG-A
⑥ HPV (16), 18, 31, 33
⑦ Tylosis → AD inheritance
   Chr. 17.
   Howel Evans Syndrome
   Palmo-plantar Hyperkeratosis
⑧ Alkali stricture
   ↳ caustic → NaOH. (lye)
⑨ Geotrichum candidiasis.

Adenocarcinoma -

R/F

① Barrett's Oesophagus
② obesity (↑ fat)
③ Scleroderma → causes reflux →
④ ~~H. py~~ H. Pylori (Protective)
⑤ p53

Presentation -

Gen. symptom - ① wt loss
② loss of appetite
③ Cachexia

Metastasis - Nodes > Blood

Local - ① Dysphagia
- late feature
- >75% lumen blocked
- starts ⇒ solid
- progressive
- short duration

Paraneoplastic Syndrome -
Hypercalcaemia

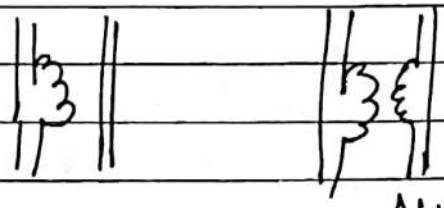
Inv

① 1st / Best → Endoscopy + Biopsy
Earliest Diagnosis

② Stage T / N / M | PET-CT → for metastasis
CECT. N > NTT

(3) For T ⇒ depth. ⇒ Endoscopic USG (15-17 mHz)
Node — Biopsy.
Higher frequency → less depth → high resolution.
Low " → more penetration.

For M ⇒ 18 FDG PET Scan.
↓
$t_{1/2}$ → 110 min.

Ba swallow 

Apple core
↳ (L) Colon.

Rx -
SCC → Radio (S)
Chemo (S)
Cervical oesophageal Ca → can be Rx by RT ± CT.
Thoracic " → RT ⇒ can affect ♡, lung.
↓
Hence, surgery is imp.

Neoadjuvent → Before Sx.
to ↓ the size of tumour → make it operable

Adjuvent → after Sx
to prevent recurrence

CT. → Cisplatin ⇐ DOC + 5 FU.
↳ ATN (nephrotoxic)
Initially hydrate the pt. + give cisplatin infusion given along ↓ manitol.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

- vomiting
- ototoxic.

Sx → ① Ivor- Lewis Oesophagectomy (for lower, middle oesophagus)
2 step procedure

1st Laparotomy → for mobilising stomach
thoracotomy → for removing Tx

Remove Cancer → gastric pulling → gastro-anastomosis in ~~thorax~~ thorax.

H/e cause of mortality ⇒ Leak

Safe Margin for oesophagus ⇒ 10cm due to oesophageal lymphatics

Best substitute for oesophagus → Stomach. in cancer

② Total Esophagectomy / McKeown Oesophagectomy
↓ Laparotomy > ② thoracotomy > Neck.
En Block Oesophagectomy.

③ Trans-Hiatal Esophagectomy / ORRINGER
(for lower & middle oesophagus)
Laparotomy > Neck incision.
No thoracotomy → ↓↓ lung complication.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Flap is based on.
Lesser curvature – ① Gastric artery
greater " – ② Gastroepiploic artery

Palliation → To improve quality of life
Relief for Dysphagia
① Stent – endoprosthesis
• MB tube → obsolete
• SEMS – Self Expanding Metallic Stents
↳ less chance of perforation
Made up of Nickel + Titanium alloy
is called Niti alloy.

Complication → ① Blockage
Now, coated SEMS are made – PTFE

② SEPS
They are smooth, hence they
② Migrate. → M/c comp.

② RT
③ Laser
④ Photo Dynamic Therapy
Feeding gastrostomy
jejunostomy
→ Not done becoz they don't improve quality of life

⑤ Cryo

Q. Malignant TEF ⇒ Rx – Stents
or Surgical Bypass.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Stain → Alcian Blue

Barrett's oesophagus - - Medical Rx
- yearly endoscopy for 2-3 mnths

(*)

Mild Dysplasia → 6 monthly endoscopy

High grade Dysplasia → Excise Mucosa by
- Laser PDT
- Submucosal Resec".
↓
Best → Radio frequency Ablation

Anaplasia → oesophagectomy

MENETRIER'S DISEASE

Hypertrophic Protein Losing Gastropathy

- Mainly involves proximal part of stomach
- mucosa becomes thick
- giant rugal folds
- Deep clefts
- Foveolar hyperthrophy → Mucous prodn ↑
- all chief & parietal cells → Mucous cell
↓
produce mucous containing protein.
↓
Protein lon. causes Death

↑ TGFα → ↑ Cancer risk

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Adults → associated ~ H. pylori
Children → " , CMV.

Dx → Endoscopy → Biopsy → CECT

Rx - ① Replenish protein
② PPI
③ In severe case → Gastrectomy
④ Cetoximab → Colon & cancer with RAS.
Head Neck - Cisplatin Resistant
Irinoteran Resistant

TRICHOBEZOAR → Hair ball in stomach
or RAPUNZAL SYNDROME. young ♀ psychiatric.

PHYTOBEZOAR → Veg. fibres.

17/12/17

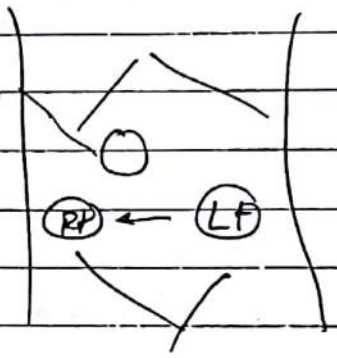
CONGENITAL HYPERTROPHIC PYLORIC STENOSIS

- Incidence 3:1000
- ♂ > ♀ = 4:1 , 1st born male child
- Familial Predisposition. , mother - 20%
- White > Black.
- Erythromycin ↑ risk of the cond"

C/F- ① Gastric outlet obstruction

② Non-Bilious vomiting + projectile
③ presents 3-8 wks after birth (4-6 wk most common)
④ Antenatal + postnatal child is normal
⑤ Stomach empty.
⑥ Hungry child.
⑦ No feature of PEM.

Examn -
① Olive shaped lump
② Peristaltic wave L → R.
③



Inv.
X-Ray - Single Bubble Sign
Flouroscopy - String Sign
or Mushroom Sign
or Caterpillar Sign
IOC - USG - ① Length of pylorus > 16mm.
width " " > 4mm

② Empty Stomach
③ Antral Nipple Sign
④ Cervix ~~sign~~ sign

Rx -
Electrolyte imbalance - ~~Hypo~~ Hypokalemic hypochloremic met. alkalosis +
Paradoxical aciduria due to presence of aldosterone

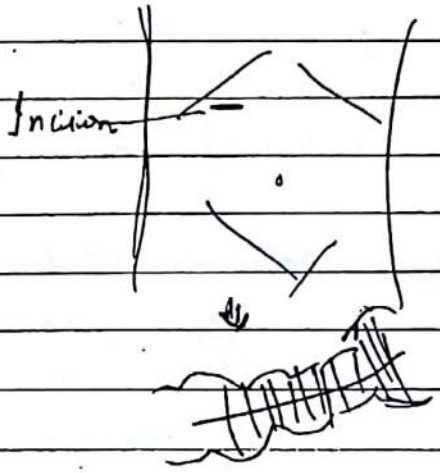
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Fluid- ① N/2 → 0.45% NS
+ 2.5% Dextrose
+ KCl

② RL. - Na^+ - 130 mEq/L. , K^+ - 4 mEq/L Ca^{++} - 100 mEq/L.

Sx - Ramstedt Pyloromyotomy

Muscle splitting incision.
↓
Pyloro-myotomy

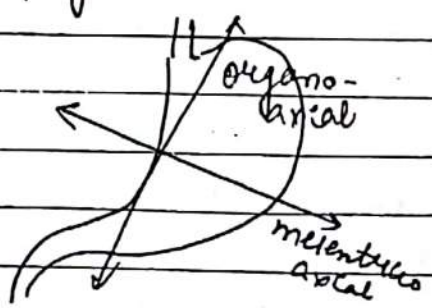


Medical Management - Atropine.
Not very effective.
Can start feeding after 6 hrs.

GASTRIC VOLVULUS

Solid organ → torsion
Hollow " → volvulus

Organoaxial ← → Mesentericoaxial



① More common — More

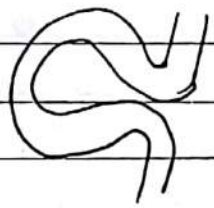
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

- Predisposing factor

Present	Absent
- Presentation - acute	chronic
- Complications are common.	Rare

* Borchardt's Triad -
① Epigastric pain
② Retching ~~out~~ vomiting
③ Inability to pass Ryle's tube

IOC Barium meal - cup & spill sign
- cascade sign.



Rx ~~Expire~~ Exploratory laparotomy
↓
Derotate stomach
↓
Gastropexy.

GASTRITIS

TYPE A	TYPE B
① Autoimmune	① H. Pylori - Antrum.
② Proximal part - fundus	↓ Atrophic gastritis
③ (Ab) → parietal cells	

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

HCl ↓ → Fe Deficiency anemia
I.F ↓ → V't B_{12} deficiency
↓
Pernicious Anaemia
↳ Atrophic gastritis
• HCl
• Gastrin ↑

ULCER

GASTRIC	DUODENAL
↓ Mucosal Resistance	↑ acid produ^n
H.Pylori 75%	90%
Pain – epigastrium.	Seasonal variation
Meal → ↑ pain	Meals → ↓ pain.
Lean thin pt.	Hunger pain.
	Obese
	Blood grp – 'O' HCK factor
• Complication-	
Peforation.	Bleeding.
(L) gastric artery bleed	Gastroduodenal artery
Haematemesis- melena 60:40	40:60.
Cancer – found	Rare.
Rx- Gastrectomy	Vagotomy + Drainage

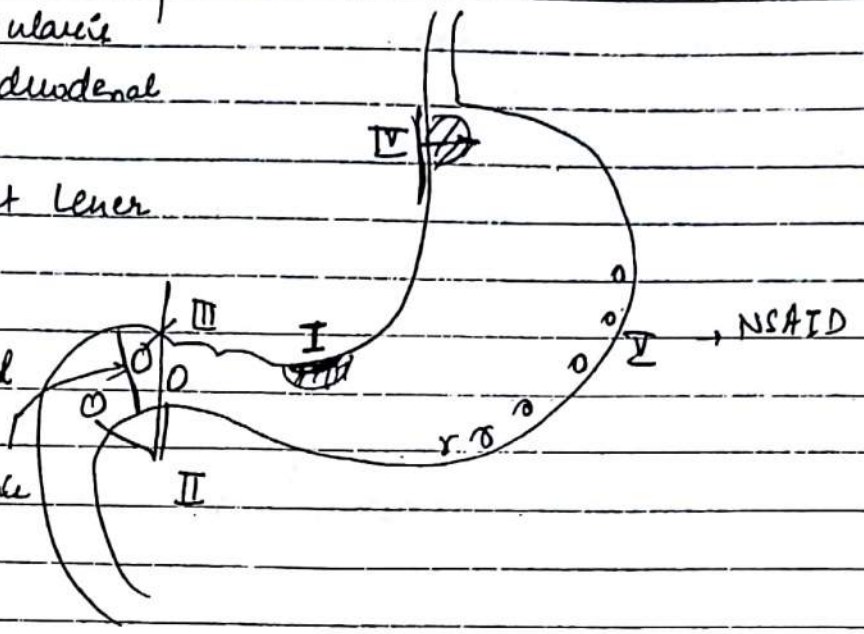
* Curling's ulcer are found in gastric, duodenal, oesophageal
* Dye used for H.pylori is WARTHIN-STARRY STAIN

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

* Etiology of Peptic ulcer (R)

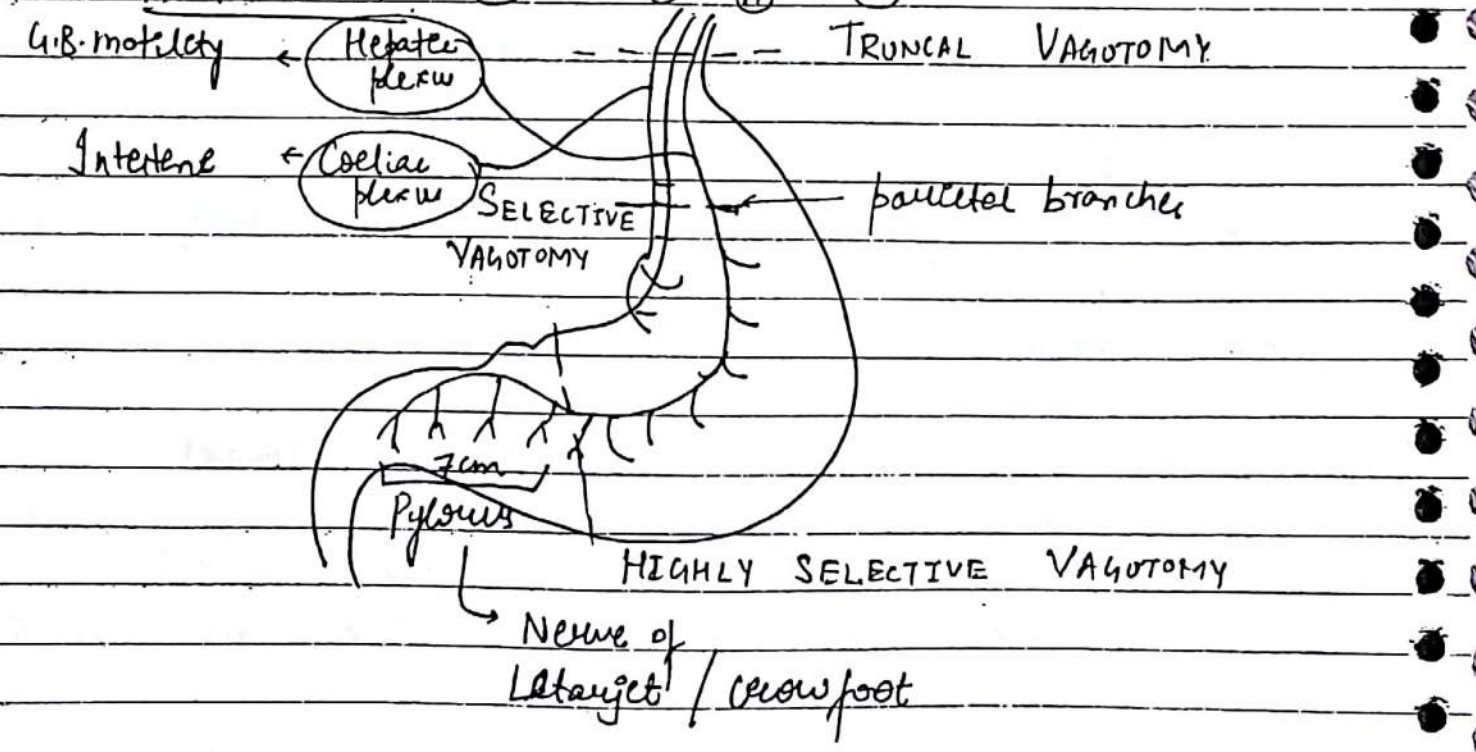
Johnson's Classification

I → Incisura angularis
II → (B) gastric + duodenal
III → Prepyloric
IV → Proximally at lesser curvature
V → Diffuse NSAID induced



Q. Which are the ulcers associated ↑ acid produc
↳ Duodenal (II + III).
Q c gastric ulcer bleed → IV (↳ gastric artery)

VAGOTOMY (R) → (P) (A) ← (L)

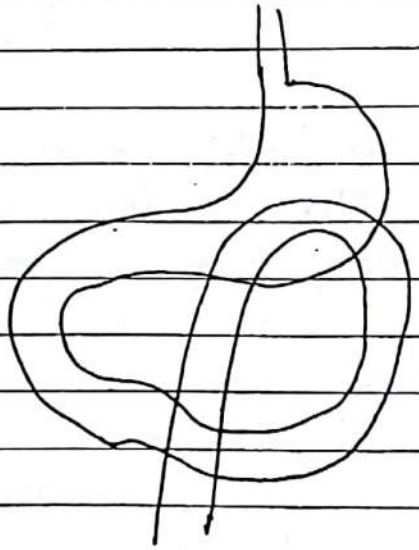


Truncal vagotomy → ① GB stone
② Post vagotomy Diarrhoea.

50% of pts. i Truncal Vagotomy + Selective vagotomy
↓
Lead to GO.O.
↓
So, drainage operation required

① Pyloroplasty → Finney's
→ Heincke Mikulicz

② Gastrojejunostomy



③ Antrectomy
Antrectomy + TV ⇒ Least Recurrence <1%

Highly Selective Vagotomy ⇒ No drainage Required

Q. Best Vagotomy for chr. duodenal Ulcer?
↳ HSV.

Q. ℓ has least recurrence → Truncal Vagotomy. (1-5%)

Recurrence in HSV → 6-8%

* Criminal Nerve of Grassi-
Responsible for recurrence
These branches originate in thoracic region

Hence while doing HSV -
extent → 8cm proximal to GEJ. (Incisal point)
7cm proximal to pylorus (end point)
↓
to preserve N/V of Latarjet

* Hill & Backer Operation -
Ant. HSV + Post. Truncal Vagotomy.
↳ Prevents recurrence

* Seromyotomy -
Anti Seromyotomy + Post. Truncal Vagotomy
Taylor operation.

GASTRECTOMY — Billroth I
Billroth II
Polya

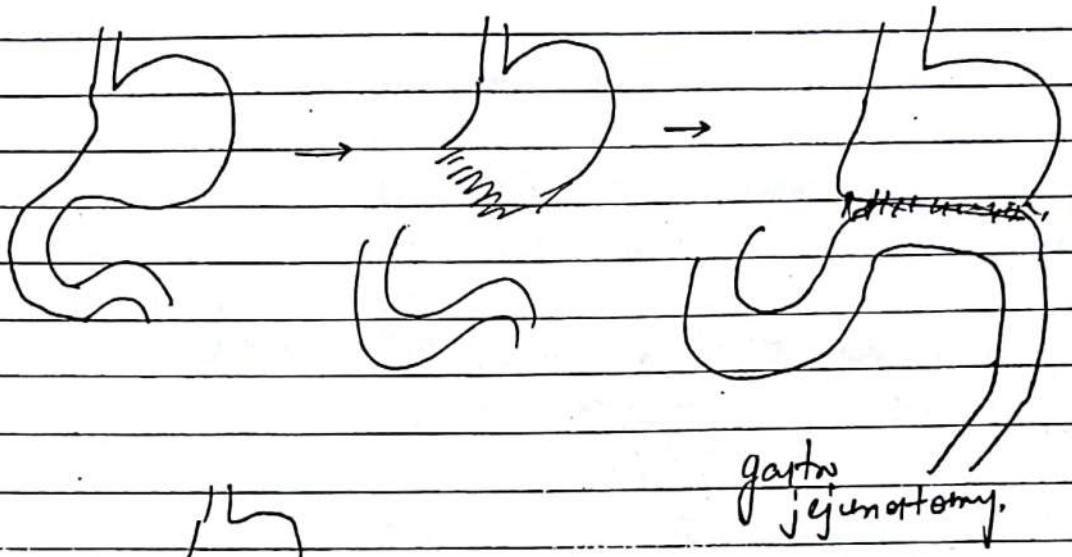
Billroth I → Obselete now
Done for gastric ulcer

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Kocherization → Mobilisation of duodenum.

Billroth II

Done for ① Gastric Cancer — Preferred in cancer.
② Duodenal ulcer



gastro jejunostomy.

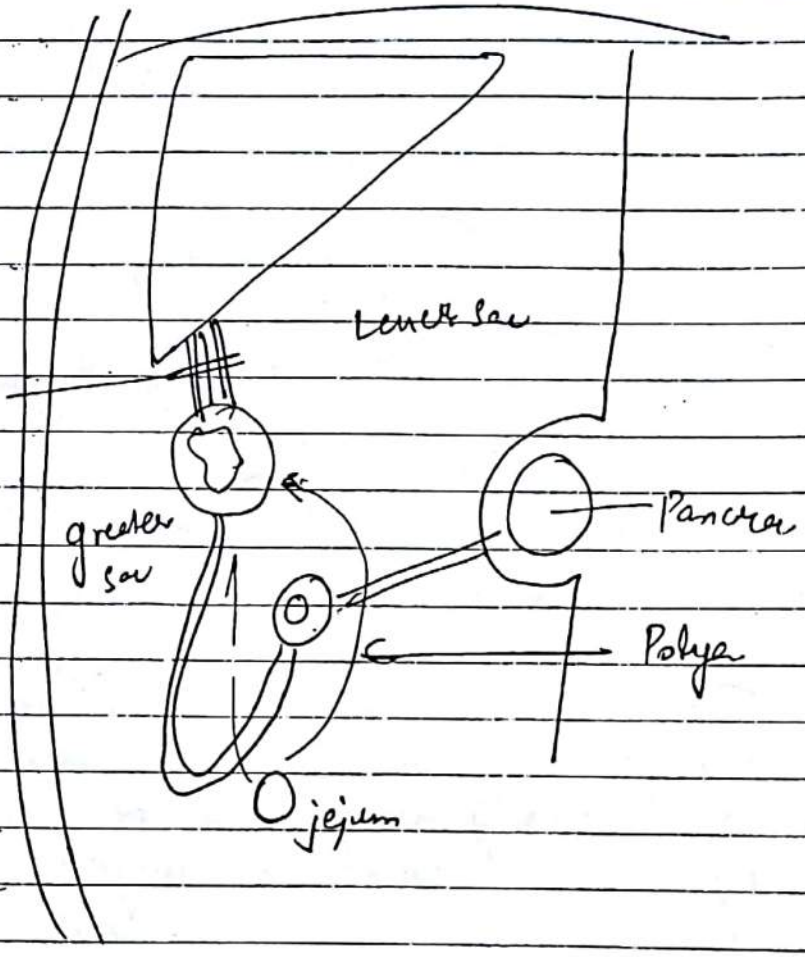
→ If we go in front of Transverse colon — length ↑.

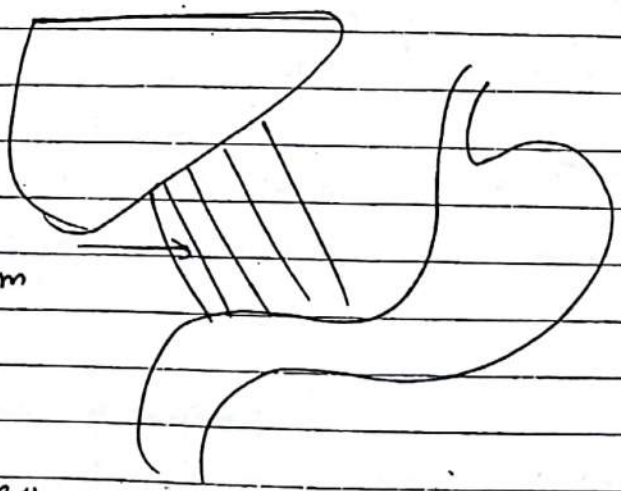
Polya →
- Retrocolic Procedure
- Preferred in case of Ulcer

→ Length of ascending limb ↓

Ascending colon & Descending colon ⇒ Fixed.

Post. Duodenal artery perforate ⇒ Bleeding.





Lesser omentum
Contains
① Portal vein
② Bile duct
③ ④ Hepatic artery

Pringle's Manoevre-
- clamp the lesser omentum
- It clamps the Portal vein, hepatic artery together
- to control bleeding gastric.

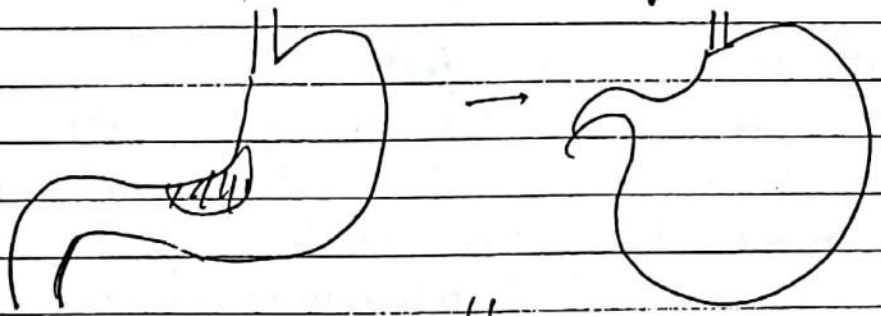
If It can't stop bleeding from Hepatic vein.

- Pouchet — When ulcer is proximal
- Clenders ← When pt is stable
- Kelling Madlenen — When pt is unstable

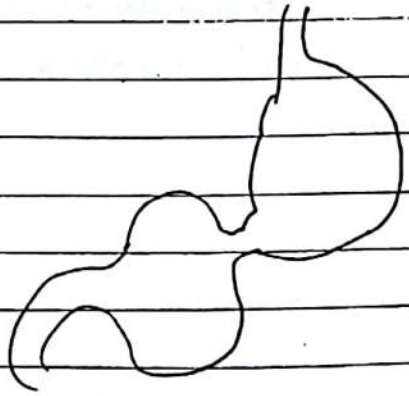
COMPLICATION OF ULCER

Ulcer is deep → hence when it heals, it cause scarring

erosion is superficial → on healing no scarring



Tea Pot stomach



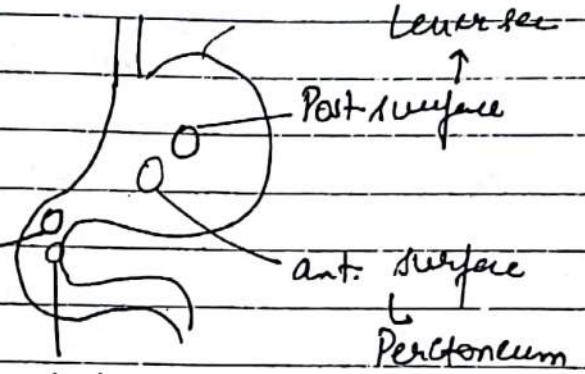
Hour glass stomach
↳ If ulcer is on both ant & post. surface.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

PUD is M/C caused by Ulcer in 1st part of duodenum

M/cc of PUD → Cancer

1) Perforation.



C/F -

① Sudden diffuse pain.
↓ in 4-8 hrs.
↳ dilution by peritoneal fluid
(phase of dilution)

② Guarding
③ Board like Rigidity
④ Tenderness, Rebound Tenderness → Blumberg Sign
⑤ Pain on coughing → Dumphey sign
⑥ Masking of Liver dullness

Inv → ① X-Ray Chest under Erect posture - 80%
↳ Gas Below ® Dome of Diaphragm

② X-Ray Abd. ~~under~~ in ① lateral Decubitus :
↳ Most Accurate (75%)
in erect posture - 70% accurate

CT Scan → Most Accurate.

- Cupola Sign
- Football Sign
- Doge Sign → A ler cap like shadow due to air in Morrison's pouch

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Telltale Δ
Falciform ligament sign

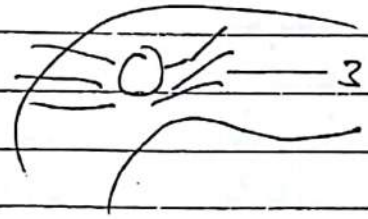
D/D of Pneumoperitoneum -
Chilaiditi Syndrome / Pseudopneumoperitoneum
Bowel interposition. btw diaphragm & Liver

Rx - Resuscitate
↓
Exploratory laparotomy

I - Graham's Omental Patch Repair + H. Pylori Eradication.
M/c ly performed Sx.

II - Graham's omental Patch Repair + HSV
done ~~c~~ in 4hour of perforation.
in young pts

III - TV + Antrectomy

In Gastric Ulcer Perforation  3 sutures

① Omental Patch Repair +
H.pylori Eradication +
Biopsy (malignancy pot^n)

② Gastrectomy
- not preferred

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

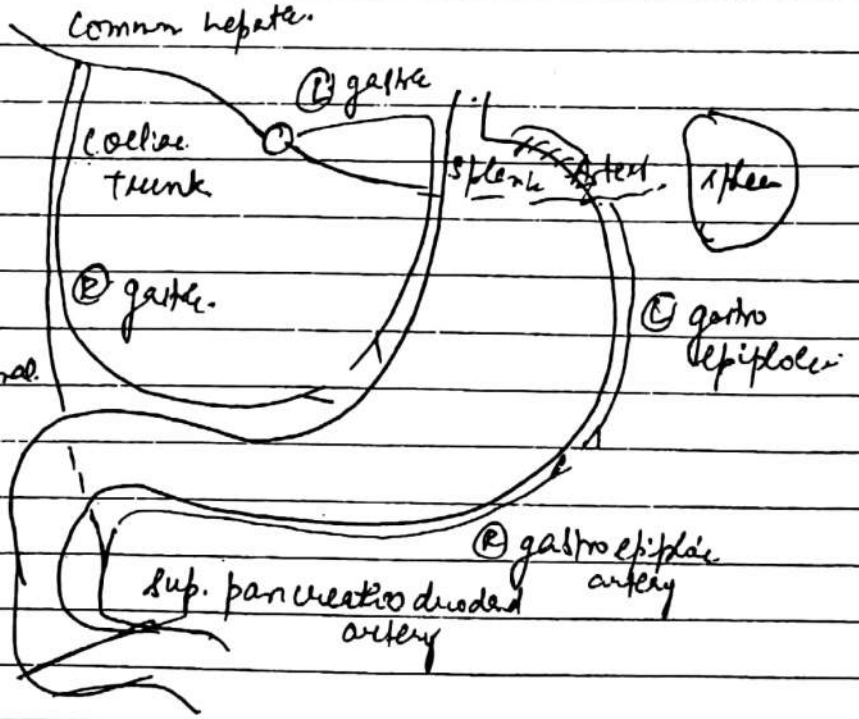
perforation.

Post-duodenal ulcer may present as appendicitis
Valentino syndrome

Renal Veil Sign
Air around kidney seen in X-ray or CT due to pneumoperitoneum.

Bleeding

Blood Supply of Stomach



25% of Blood → from ① gastric artery

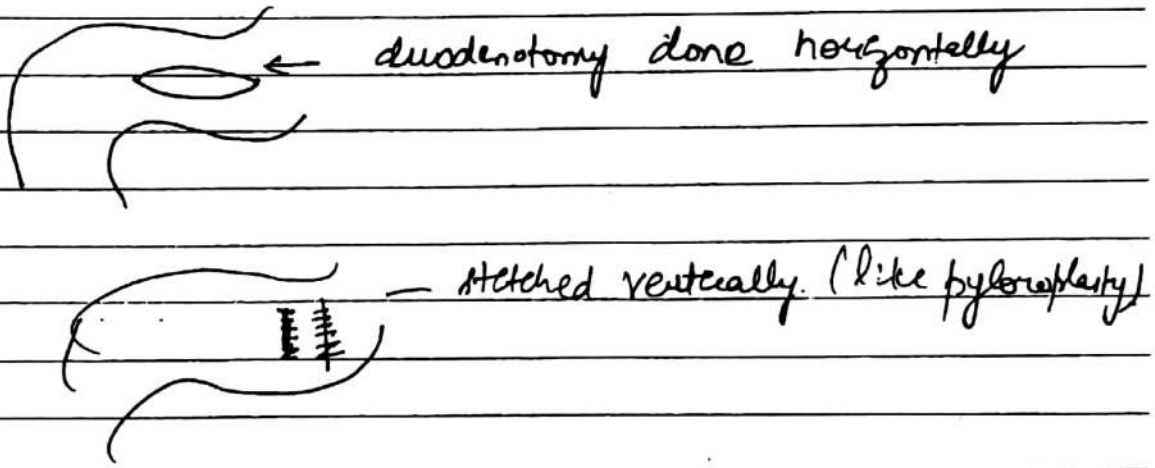
Coeliac trunk applies till ampulla of vater
This is the site of Duodenal Atresia

Sup. Mesenteric Artery supplies till 2/3rd of Transverse colon.

M/c of upper GI Bleed → Peptic Ulcer

Post Duodenal Ulcer diagnosed by Endoscopy + Hld by sclerotherapy ± adrenaline (arterial)

Sx -



Longitudinal duodenotomy

↓

Undersunning sutures of Bleeding

Close the ulcer

↓

Close duodenotomy like Pyloroplasty.

↓ Recurrence rate >50%.

If pt is fit
Truncal vagotomy

unfit
H. pylore eradication

* ↑BUN is a clue to the diagnosis of upper GI bleeding.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

COMPLICATIONS OF SURGERY

Vagotomy -

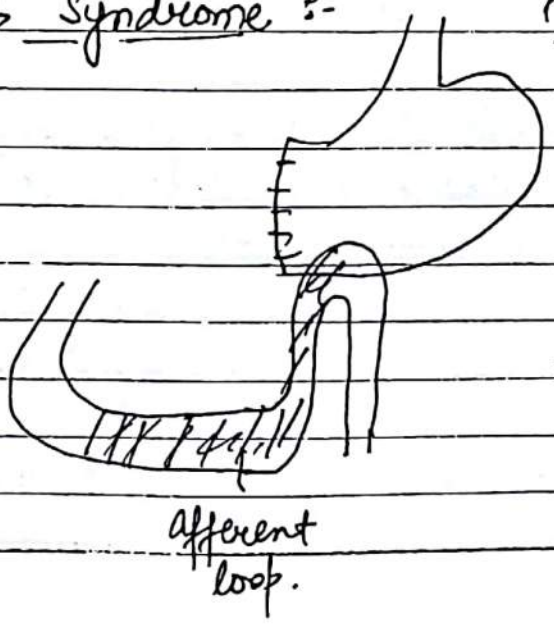
1. Gall stone
2. Post. Vagotomy Diarrhoea
3. Loss of relaxation → early satiety.

Gastrectomy -

1. Loss of reservoir
2. Fe deficiency anaemia → duodenum is bypassed in Billroth II
3. B_{12} deficiency
4. Calcium deficiency
5. Steatorrhoea
6. Recurrent ulcer - GJ. site → Stomal ulcer towards jejunum ~~site~~.
7. Gastro-jejunocolonic fistula
   - Best Dx by Barium enema
8. Water absorp"
   - 75% → small intestine (jejunum > ileum)
   - 25% → large "

* Afferent Loop Syndrome :-

Stasis of bile



afferent loop.

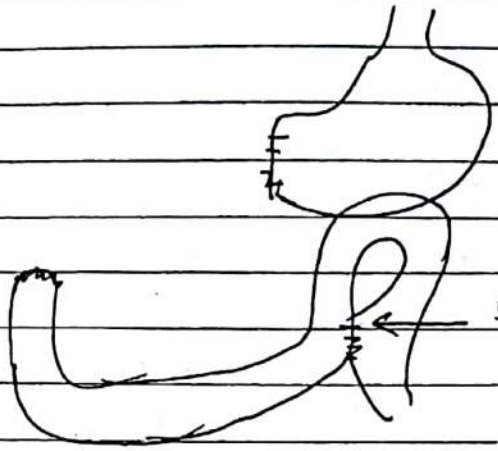
Pathology.
- Kinking
- int. herniation.
- Adhesion
- twisted
- stenosis
- food entering in afferent loop.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Duodenal Blow out

M/c. seen on 4th Day Post-operative

Avoid. →



Side to side anastomosis
jejunojejunostomy.
↓
to bypass bile

Dumping Syndrome

Food remains in stomach for 4-6 hrs after eating due to pylorus.
↓

10-15mL released. + rest → Milling occurs.
↑ each contrac^n.

(Gastric Emptying is significant)
↳ duodenum makes it hormonal

When pylorus is removed
↓

Rapid Gastric Emptying
↓

Hyperosmolar fluid enters S.intestine
↓

Diarrhoea
↓

↑ in 30-40 min. pt. goes into Hypoglycemia.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

• Rapid exposure of Hyperosmolar food into S.I

↓

C/F Diarrhoea
Tachycardia
Theat
Vasomotor changes

Symptoms appear in 15-30 min.
<15 min → last for 30 min

↓

Relieved by supine position

↓

Hyperglycemia

↓ Insulin release

(Reactionary hypoglycemia) Hypoglycemia [LATE DUMPING]

↓

Last for 30 min., food can relieve

Rx - Diet → small frequent meals
avoid carbohydrate
avoid water in meal (dry meals)
Octreotide [somatostatin analogue]

Sx - Roux-en-Y

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

FORREST CLASSIFICATION (on basis of Endoscopy)

I → Bleeding Ulcer [a → spurt
b → Oozo

II → Past Bleeding → a visible vessel (DD)
→ b adherent clot
→ c coffee ground base

III → No bleeding

BLEED CLASSIFICATION

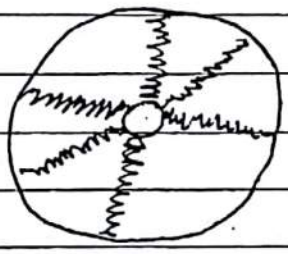
BL → ongoing bleeding
E → ↑ PT
E → Errate Mental state
D → Unstable commorbid Disease.

WATERMELON STOMACH / GAVE (Image)

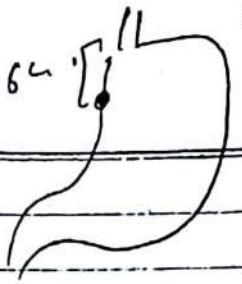
Gastric Antral Vascular Ectasia

→ Degenerative Cond"
→ ♀ > ♂
→ associated ⊂ CLD.
CRD.
Collagen vascular Disease

Endoscopy →
longitudinally dilated
tortuous vessels.



Rx – Conservative → Argon Plasma Laser
Sx → Antrectomy



DIEULAFOY LESION :-

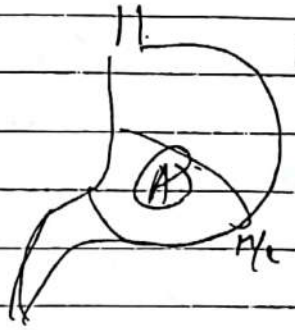
- Congenital malformation / Developmental.
- Submucosal artery → Keeps on dilating, then rupture
- Site - 6 cm of GEJ.
- Present ε fresh haematemesis, melena, anaemia
  Recurrence is common.

Endoscopy → ~~Active~~ spurting or clot

Rx - coagulation by endoscopy
  endoscope thermo probe coagulation.

GASTRIC CARCINOMA

1) ♂ : ♀ = 2:1
2) Age > 55 yrs.



SEIWART CLASSIFICATION
for GEJ Cancer

I
II
III

* Risk Factors-
  - Diet - Vit C Deficiency
    ↑ salt Diet — Precursors
    Smoked fish → (B)
    Nitrosamine compound (B)
  - Refrigeration is protective factor

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

- Vit A, E, Ca deficiency
- Defective carbs diet

• Fresh fruits & Veg → are protective

2) Pernicious anaemia
3) Biliary gastritis → either by partial gastrectomy or drainage
4) ERY
5) Menetrier's Disease
6)

Premalignant Cond" -
1) Atrophic Gastritis
2) H. pylori infec"
3) Adenomatous polyp.
4) Intestinal Metaplasia III
5)

M/c Polyp of Stomach → Hyperplastic
Fundic gland polyp
↳ Metaplastic (B&L)

LAUREN CLASSIFICATION

Intestinal	Diffuse
♂ > ♀	♀ > ♂
Old age	younger
Distal part	Proximal part
Sporadic	Familial
H. Pylori is Risk factor	Blood Group 'A' Risk factor
Metastasis - Blood Borne	Lymphatic metastasis
Intestinal Metaplasia + goblet cells	Signet cell
Good Prognosis	Poor Prognosis

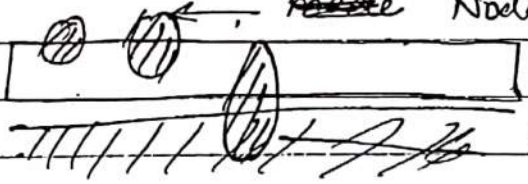
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Oncogene APC (adenomatous polyp) ① E-Cathedrin ↓
MSI (micro satellite) p53 ↓
p53 ↓ p16 ↓
P1C ↓

BOREMANN (
on growth pattern

I → Exophytic or Cauliflower
II → Ulcerated, elevated ~~margin~~ edges, well defined margin
III → Diffuse margin
IV → infiltrative

EARLY GASTRIC CANCER –
Cancer involving Mucosa or Submucosa ± L' Node

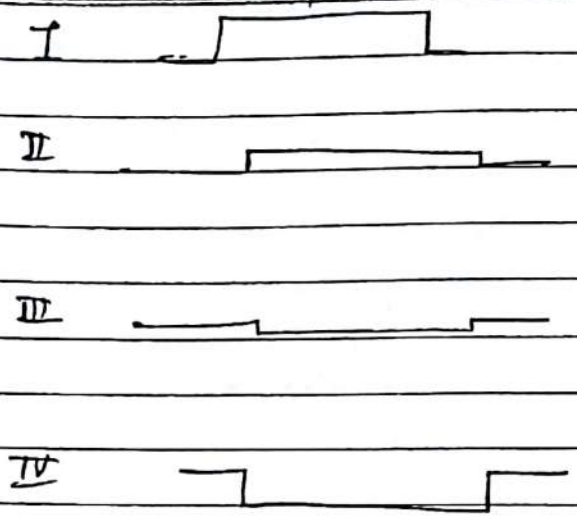


SUPERFICIAL SPREADING
- common in JAPAN
- good prognosis

- For oesophagus & stomach ⇒ Imp. prognostic indicator is DEPTH
- For colon ⇒ Nodal status is imp. prognostic indicator
- M/I indicator for Metastatic Potential ⇒ DEPTH (T stage)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Japanese Classification



C/F

General – Anaemia
Loss of wt.

Local – Pain
Dyspepsia

Metastasis. Node > Blood → Liver (through portal vein)

1) (L) Supraclavicular Node – Virchow's node
Troisier's sign

2) (L) axillary node – Irish node

3) Ovary → Krukenberg tumour

4) Pouch of Douglas → Blummer shelf

5) Umbilicus → Sister Mary Joseph Nodule
Not pathognomic of upper GIT Ca

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

6) Liver → Nodular Liver / jaundice

smooth → 1° umbilicated → 2°

7) Peritoneum →

Laparoscopy is best way to see peritoneal metastasis

Paraneoplastic Syndrome-

1) Lesser Trelat syndrome - Seborrhoeic keratosis on back.
Not pathognomic of Gastric Ca

2) Tripe Palm syndrome-
Hyperkeratosis + Pigmentation.
Not pathognomic of Gastric Ca

Inv.

① Endoscopy + Biopsy

② Stage T / N / M → PET - CT

③ Depth → Endoscopic USG

④ For Metastasis → 18 FDG PET Scan

⑤ Ba Meal -

Benign	Malignant
Lesser curvature	greater curvature
Exoluminal	Endoluminal
Mucosal folds	

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Hampton Line Ulcer

Translucent line

Carmen Meriuse Kinkling complex

Staging -

N_1 < 3 — a = 7-14

N_2 3-6 — b = >15 = ATLMs

N_3 >7

↑ Min. L.N. removed while radical gastrectomy for staging

Rx

M/c site for local recurrence ⇒ Gastric Bed Anastomosis

Chemo.

5FU + Leucovorin (folinic acid) ± Cisplatin / Oxaliplatin for 5 days.

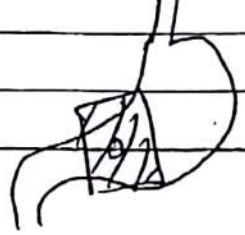
FOLFOX → for colorectal Ca

↓ continuous infusion

(S-1) chemotherapy → Oral
for 1 year
for advanced case
used in JAPAN → good results
Oral derivative of Fluoropyrimidin
Tegafur + Gemeracil + Oteracil

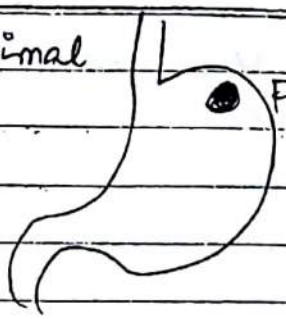
Sx

① Radical Gastrectomy -



Distal → Partial / subtotal / Distal Gastrectomy
+ → Billroth II

Proximal → Total Gastrectomy



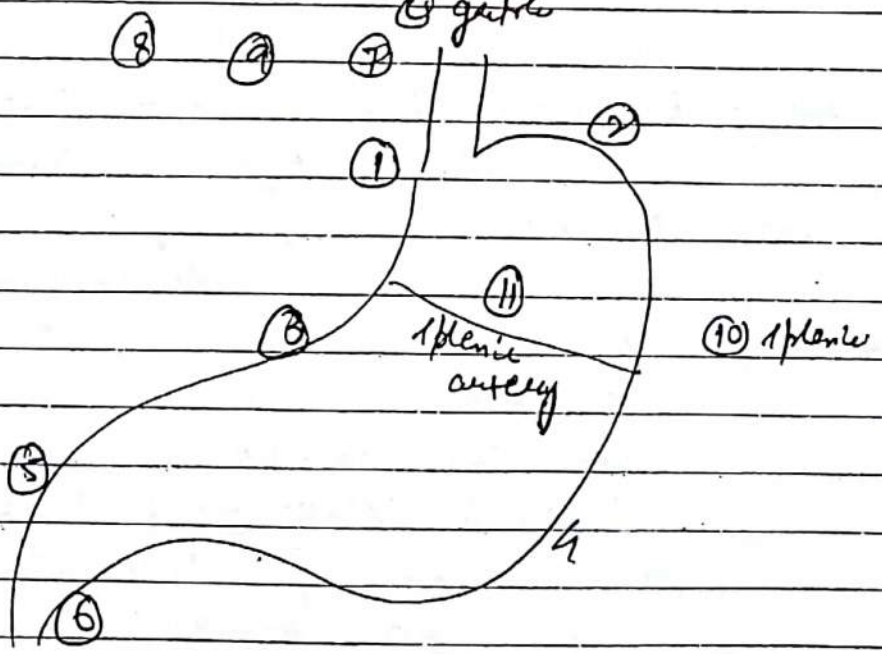
↓

Roux en Y anastomosis
(oesophagojejunostomy)

Radical → Lesser omentum
+ greater "
↳ L_1 L_2 (L_3) nodes
tell coeliac trunk.

D_2 gastrectomy

Beyond coeliac trunk ⇒ D_3 gastrectomy



R_0 → No residual tumour
R_1 → microscopic disease Left
R_2 → Macroscopic / gross disease Left - [PALLIATIVE]

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

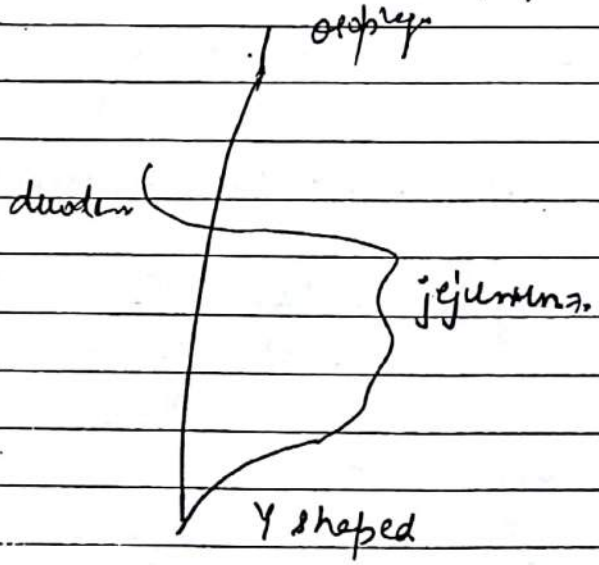
If tail of pancreas, spleen involved.

↓

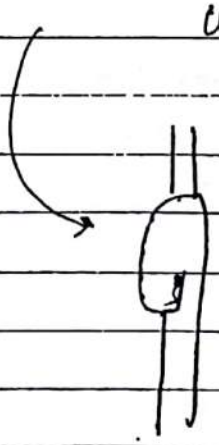
Do Splenectomy + Distal pancreatectomy + D_2 gastrectomy.

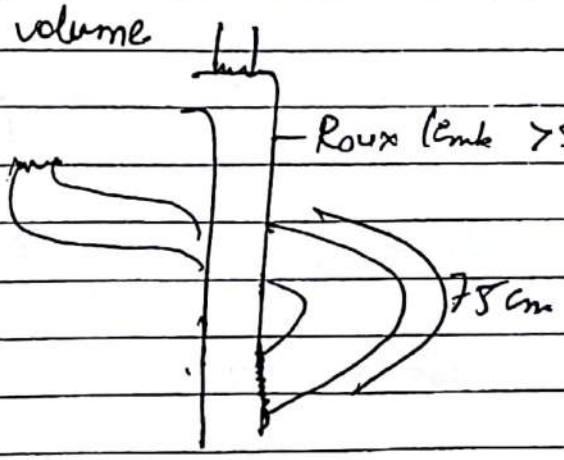
ROUX-EN-Y ANASTOMOSIS.

Gastrectomy +
Jejum is divided. +
Distal jejum segment anastomosed to oesophagus
Jejunum-jejunostomy



Lawren Hunt pouch-
when there is less volume





Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

LYMPHOMA

2nd M/c stomach Cancer.

M/c type → MALTOMA (Mucosa associate lymphoma)
associated ε H. Pylori

NHL → B cell DLCL

GIST (Gastro-Intestinal Stromal Tumour)

- 4%
- earlier called as Leiomyosarcoma.
- Origin - Interstitial cell of Cajal

- 95% → CKit +ve → act through ~~Tyrosine Kinase~~ Tyrosine Kinase

5% PDGF +ve → Better Prognosis

Atypical / Wild GIST

CKit -ve
PDGF -ve

50% → stomach
25% → ileum
Rare site - Rectum
esophagus

M/c Benign tumour of stomach = Mesenchymal tumour or Leiomyoma

M/c presentation → Bleeding

Metastasis → Blood Borne → Liver
↳ Direct → Surrounding area
Node → rare

Types

SPINDLE CELL (70%) ← → EPITHELOID (30%)

FLETCHER CRITERIA

① Size > 5cm.
② Metastasis
③ Mitotic index >5/50 HPF

IxOC - CECT

No Biopsy → ↑ dissemination / Bleeding

IxOC for Recurrence → PET SCAN.

Tumour Marker → CD117
DOG-1 (Detected on GIST)
CD34
BCL 2
Protein Kenase c theta

Rx Surgery - 2cm Margin. (>1cm)
Radioresistant

Adjuvent therapy → Tyrosine kenase Inhibitors III
Imatinib Mesylate (Glevac)

↓

For Imatinib Resistant case
Sunitinib.

↓

For Sunitinib ® case
Regorafinib

Cause
hypophosphatemia

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Carney Triad → 1) GIST
2) Paraganglioma / Extra adrenal Phaeochromocytoma.
3) Pulmonary Chondroma

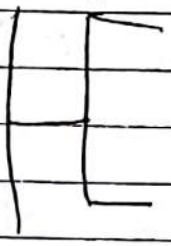
Carney dyad / Stratakis dyad
① GIST
② Paraganglioma

DUODENAL ATRESIA.

- 1:2500
- Site - just distal to ampulla of Vater
- Presentation → recurrent bilious vomiting
- associated w/ Down's Syndrome
- 50% → Polyhydramnios

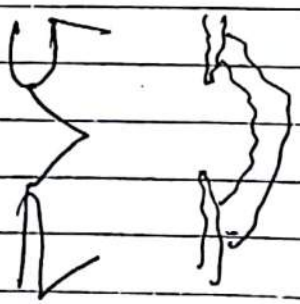
TYPES

Type I
wall intact
Mesentery intact



Type II
wall & gap
Mesentery intact

Type III
wall & gap



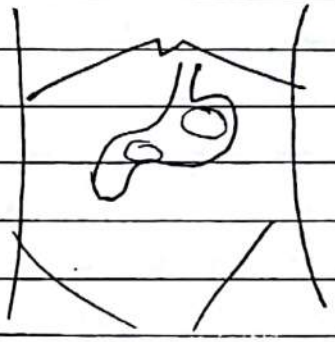
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Wind Sock Deformity → false appearance of Distal deformity inspite of proximal

Appel Peel Sign → seen in 3b type

Inv

* X-Ray abd in erect posture
  Double Bubble sign. (Image)
  in case of long. obstruction of
  2nd part of duodenum
  1) Duodenal atresia
  2) annular pancreas
  3) Ladd's Band

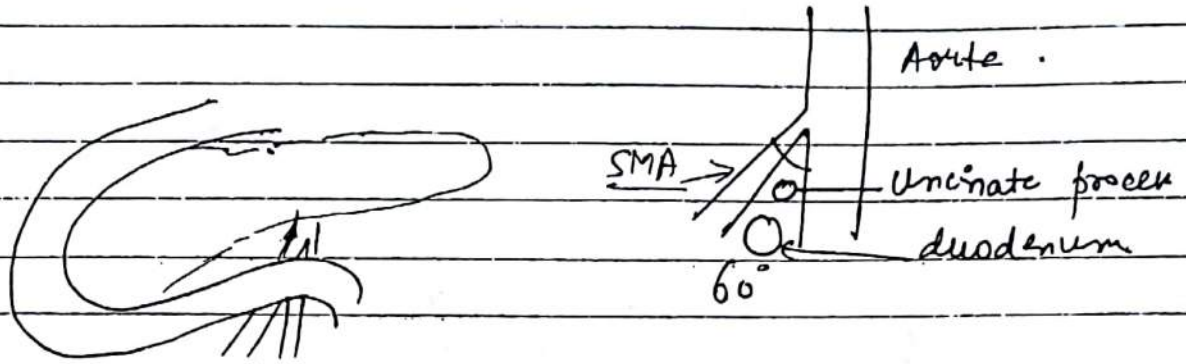


Rx- Diamond shaped Duodeno-duodenostomy

Annular Pancreas → Duodeno-duodenostomy (D-D)
Duodeno-jejunostomy (D-J)
↓
Retrocolic

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

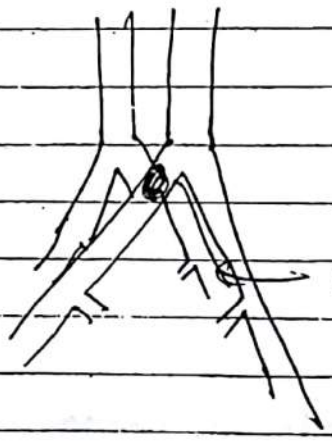
SUPERIOR MESENTERIC ARTERY SYNDROME (CT Image)
or WILKIC SYNDROME
or CAST SYNDROME



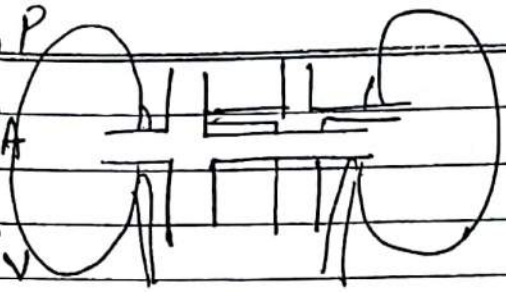
- young, lean + thin lady
  → due to loss of fat around duodenum
  If $<20^{\circ}$ ⇒ SMA syndrome

Dx → CECT.

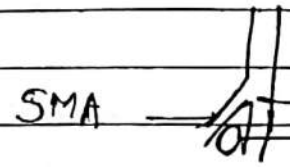
Rx - Duodeno-jejunostomy



- May Thevner syndrome
① common iliac vein by ②
common iliac artery



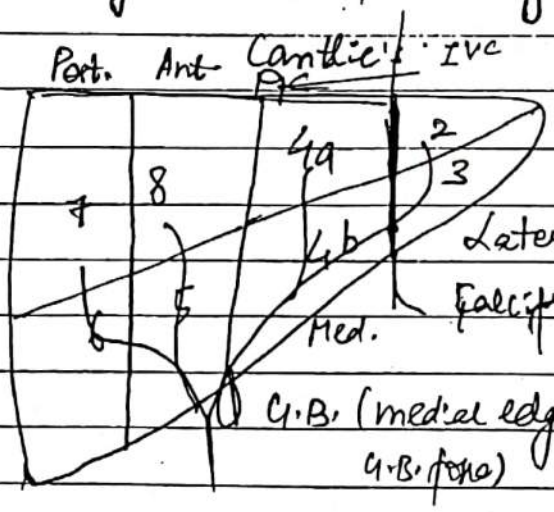
(L) Renal artery > (R) Renal artery
(L) Kidney is preferred for transplant



Renal vein. obstruⁿ
Nut Cracker Syndrome

LIVER.

Anatomy was proposed by Couinaud.

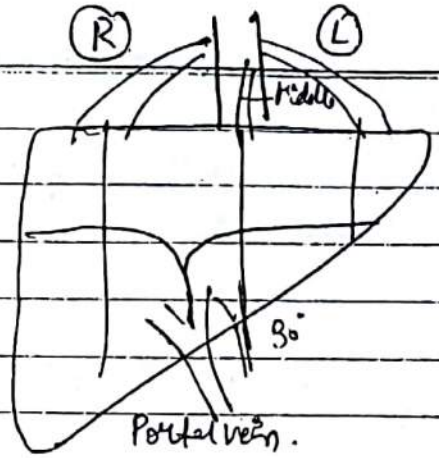


Liver has 2 Lobes.
4 ~~Sectors~~ Sector
8 Segment

Bismuth → Antero medial — 4a, 4b, 3.
Posterolateral → 2

3 Major Fissure (Vertical line)
2 Minor " (Horizontal line)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp



Cantlie's line ü middle hepatic vein.
Horizontal line ü based on Portal vein.

Bare area of Liver
3 parts.
- Spigelian
- Paracaval
- Caudate process

Segment 1 → behind 4a
Caudate lobe

Segment 4 → Quadrate lobe

Segment 1 has blood supply on both lobes (B/L)

Segment 1 drains directly to IVC

BUDD CHIARY SYNDROME

- Hepatic vein Thrombosis
- M/c cause → Polycythemia Vera
- Segment 1 ü spared due to direct drainage to IVC.

↓

so it undergoes compensatory hypertrophy

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Falciform Legament : Btw (2)(3) ⟷ (4a), (4b)

Riedel's Lobe –
In few persons, extension of (R) lobe is present
It is palpable.

- (L) Lateral Hepatectomy → only (2) & (3) removed
- (R) Extended /
(1a), (4b) + (R) lobe of Liver ±1.

- (R) Hepatectomy → (5), (6), (8), (8)
(L) " → (2), (3), (4a), (4b), ±1

Indication of (L) Lateral Hepatectomy –
Liver transplant from Donor – 1/3rd.
Regeneration of Liver → ~~2/3~~ 2/3rd ~~3 wk~~.

LIVER ABCESS

AMOEBIC ABCESS

- Liver → (R) lobe → postero-superior quadrant
- ♂ > ♀ 8-10 : 1
- young age (20-40yr)
Prodrome : pain, hepatomegaly

Usually single
- Colour of pus - Anchovy sauce
  ↓ ↳ fish
  culture → no pathogen.
- Scrapping of wall → amoeba
- Lung Compⁿ -
  Serology → ELISA, > Indirect Haemagglutenation Test
  LFT → jaundice 10%
  Alk Phosphatase ↑

- USG → I_xOC CECT → Peripheral Enhancement
Rx - Metronidazole 750mg TDS for 10 days

Drainage is not much required.

Abscess takes approx 9 months to resolve

Follow-up → USG initially weekly
then Monthly

USG guided Drainage
1) Size > 5cm (>10cm - absolute Indication)
2) Impending rupture or Ruptured
3) Immunocompromised
4) DM
5) ♀
6) Ⓛ lobe abscess → rupture into pericardium leading to tamponade.
→) Doubtful Pyogenic Abscess

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

PYOGENIC LIVER ABCESS

Route →

M/C 1) Bile duct → cholangitis (E.Coli)
2) Portal Vein. → portal pyemia
appendix
diverticula
3) Hepatic artery → Staph. aureus
4) contiguous.

M/C causative → E.Coli
M/C " in children → Staph. Aureus
M/C granulomatous → Staph. aureus.

M/C cause in Asians → Klebsiella
M/C cause in pyogenic liver abscess ± endophthalmitis
↳ Klebsiella

M/F → ♂:♀ = 2-3:1
2) >40yrs
3) Multiple. 7/50% - cluster in CT.
4) Systemic Diseases ↑
5) Fever >> Pain.
6) Serology -ve.
7) LFT deranged
Bilirubin ↑. (30-40%)

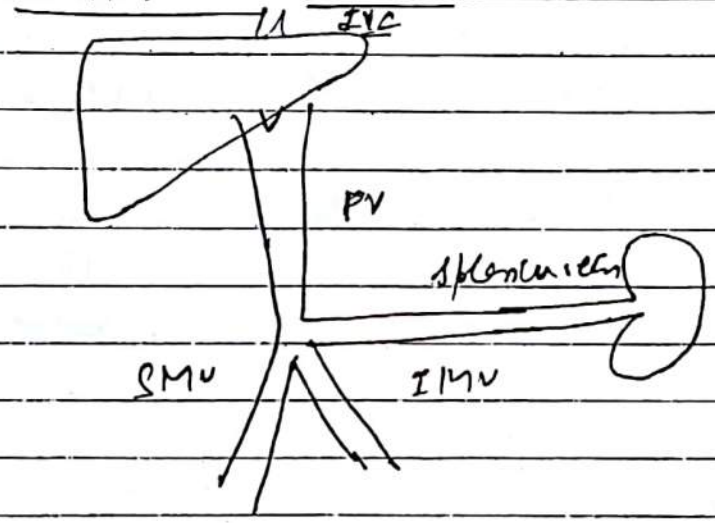
Rx - Antibiotics + Drainage

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

GRANULOMATOUS ABCESS
- NADPH Oxidase dysfunc^{n}
- CT Scan → enhancement ↑ peripheral
Rx - Percutaneous Drainage + γ- interferon (intradermal)

- autosomal Recessive

PORTAL HTN



P - 5 -10 mm Hg.
>10 → Portal HTN
>12 → Varices develop

M/c of P. HTN in children

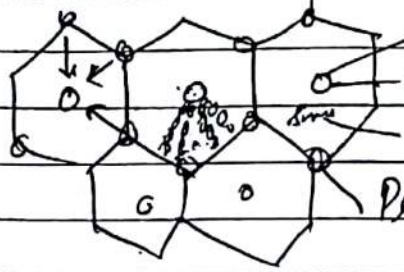
Causes
Pre-hepatic → ① Portal Vein Thrombosis.
② Extra hepatic portal fibrosis

Hepatic
Pre-sinusoidal - schistosomiasis (M/C)
sarcoidosis
Sinusoidal = Cirrhosis

Post-sinusoidal - Central Vein Thrombosis
Veno-occlusive disease
Budd Chiary

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Portal Triad - ① Hepatic arteriole
② " venule
③ Bile ductule



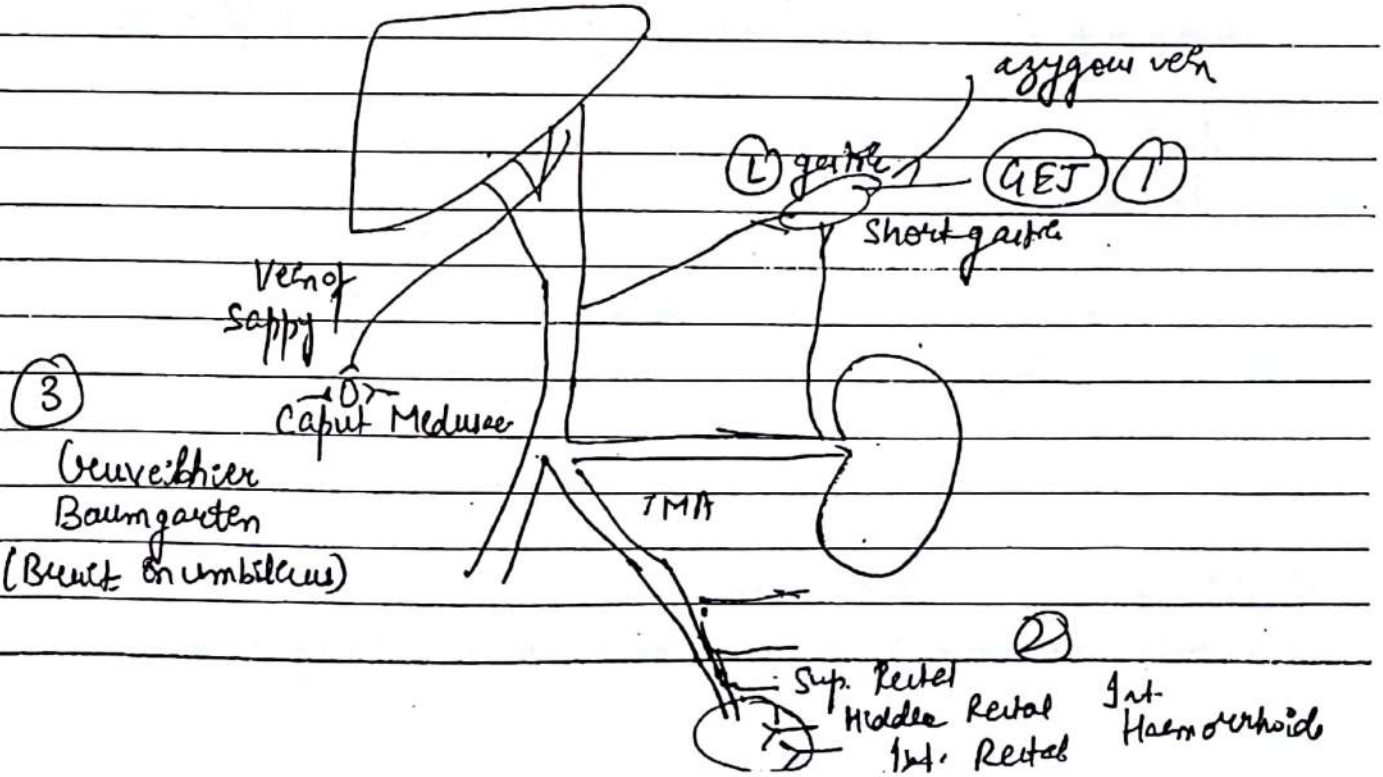
Necrosis initiate from central part.

Integrin / Necrosis spread from centre to periphery.

Post - Hepatic → Budd - Chiary

C/F

1) Splenomegaly (Rule in P. HTN)
2) Ascites (↑ Hydrostatic acid)
3) Varices



(3)
Veneibier
Baumgarten
(Bleed on umbilicus)

④ Vein of Sappy ⟷ Retzius
↓
Back (Retroperitoneal)
They ↑ the incidence of Hepatic Encephalopathy

Inv
1) Varices → endoscopy
Earliest → Ba swallow.
↑ Risk → cherry red dot
whipleh appearance
Blue wheal marking

2) USG. → PV diameter (N) - <1.3cm. = 13mm
if >15mm ⇒ P. HTN.

CHILD'S PUGH SCORE → Read

Rx - End to Side Porto-caval Shunt

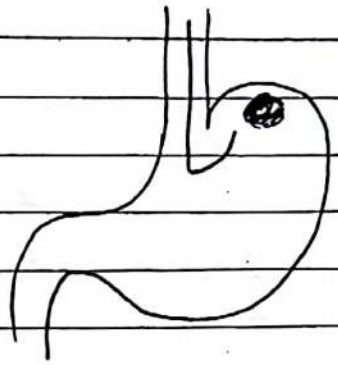
Emergency | Prophylaxis | Definite

1) ABC.
2) Drugs - • Octreotide (DOC)
Somatostatin.
• Vasopressin → potent vasoconstrictor
• Terlipressin ↓
cause Mesenteric Ischaemia
↓
If it has to given + NTG

3) Endoscopy → Sclerotherapy
(Degrade/therapeutic) Band ligation (EVL) - Safer

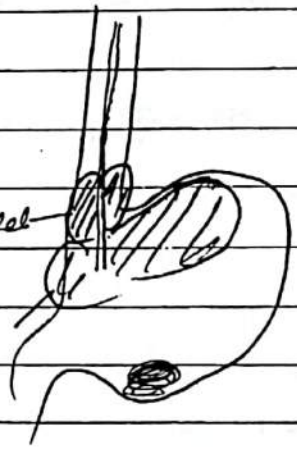
Sclerotherapy → Ethanol amine oleate
Sod. tetra decyl SO_4
Sod. Morrhuate

* Balloon Tamponade



When we Hetroflex Endoscope, Sclerotherapy is difficult.
↓
So Balloon Tamponad by Sangstaken Blakemore tube

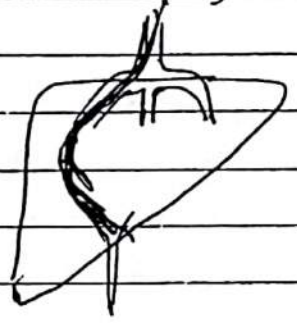
→ Gastric Balloon - 200 mL - 300 mL
→ Oesophageal " 25-40 mm Hg.
→ 1 more tube → for aspiration



Max Permissible time is 24 hours
If > 24 hr → cause ischaemia

Minnesota Tube → for saliva
↳ 1 more port

TIPSS (Transjugular Intrahepatic Portosystemic Shunt)



- Using CO_2 veno graphy.
- It is temporary as it gets blocked in 1 yr
- Rosch needle is used

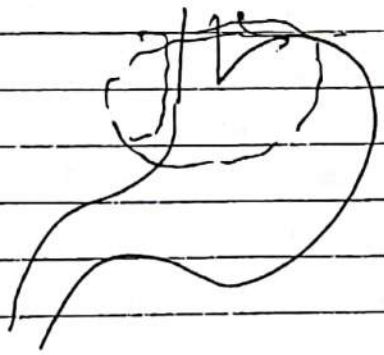
* Indicate of TIPSS- (Image)
1) Intractable Bleeding
2) " Ascites
3) Before transplantation, if risk of varices +nt

Complications S/E - ① Encephalopathy
② Bleeding Risk.
③ ~~For~~ Not done for Pre-hepatic.
Post-hepatic.

• Devascularisation + Transection = Sugiura Procedure

20% Mortality

(Image)



s/plenectomy
+

Transplant

<1yr. TIPSS

>1yr Sugiura

Prophylaxis - ① Propanolol
② Isosorbite mononitrate

↳ In High Risk → EVL.
↳ Sclerotherapy has no role

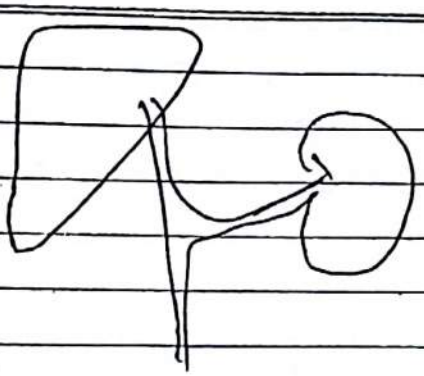
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Definitive T/t

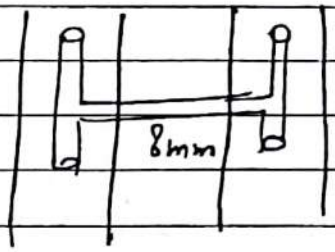
Total Shunt -

① End to Side Portocaval Shunt

② Side to Side portocaval shunt

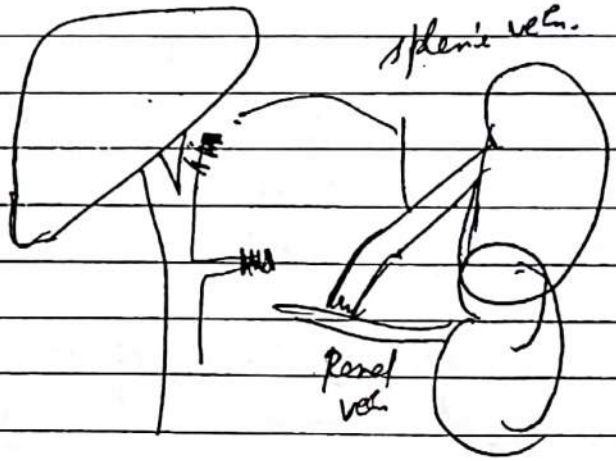


If shunt < 1cm ⇒ Partial Portocaval / Mesentericocaval H graft

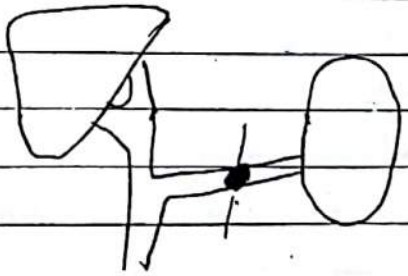


Selective Shunt -

Distal splenorenal shunt (Warren shunt).



(L) sided Portal HTN :-



Cause - Splenic Vein Thrombosis

Presentation - ① Splenomegaly.
② gastric fundal varices due to short gastric artery.

Rx - ① Splenectomy
② Distal Spleno-renal Shunt.

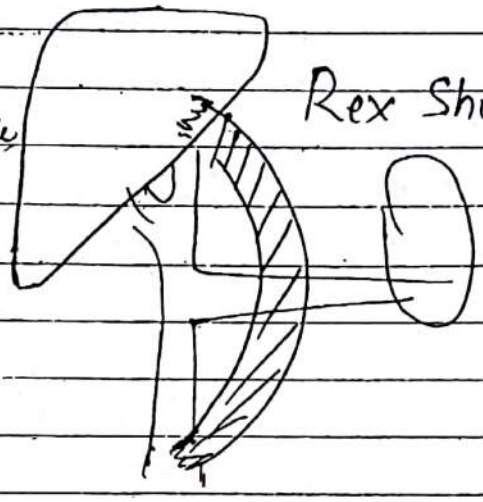
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

M/c cause of Portal HTN in children →

① Non-cirrhotic Portal vein Fibrosis
② Extra-Hepatic Portal vein obstruction
↓
<15yrs

Splenomegaly

Indication of Rex shunt
- shunt for Pre-hepatic



M/c Benign Tumour of Liver - Haemangioma

HAEMANGIOMA
- Benign
- ♀
- Middle age
- Honeytomb
- Incidentaloma (tumour found by incidental scan without any clinical symptoms)
- Encapsulated
- Estrogen associated
- Asymptomatic
- Giant: >5cm → cause thrombocytopenia

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

	FNH	ADENOMA	FIBROLAMELLAR
Capsule	-nt	+nt	25% +nt
Central scar	+nt	-nt	-nt
Haemorrhage	rare	+nt	+nt
Steatosis	Variable	+nt	Variable
Kupffer cell	+nt	-nt	-nt
Histosis	-nt	-nt	+nt
Clonality	Poly	Mono	Mono

Kasabach Meritt Syndr
Haemangiome Caus

Ix of → CECT.
↳ Peripheral Enhan

Rx -
- asymptomatic → under

- Symptomatic -
- enucleation
- Bleeding → Angioembolization

ADENOMA
- ♀ > ♂
- 20-40yrs
- encapsulated
- single
- OC Pills
- only supplied by Hepatic A
- consist of Hepatocytes
  - ↑ glycogen
  - ↑ fat
- ↑ risk of Bleeding & Cancer.

FOCAL NODULAR HYPERPLASIA
- ♀ > ♂
- 30-50yrs
- Not-encapsulated
- multiple
- OC Pill association very poor
- Haemorrhage Risk low
- Cancer - Nil
- consist of all liver cells
  - Portal Triad
  - ~~Liver~~ Kupffer cells

Only Liver Tumour i Kupffer cells

(*) stellate scar.
CT scan.

Angio → spoke wheel pattern.

OC pills do not cause FNH, but may ↑ the size/lesion

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

* Spoke-wheel Pattern in CECT
  1) Renal oncocytoma
  2) Serous Cystadenoma
  3) FNH. (Liver)

* Test to Differentiate FNH. Adenoma -
  - HIDA Scan.
  - Kupffer cell scan. → Sulphur colloid Scan

Cold	Hot
Adenoma	FNH

Rx -
* Adenoma → stop OC Pills + excise adenoma

M/c Haemoperitoneum ↑ Out Trauma → Adenoma in ♀ taking OC Pills ↑.

* FNH → stop OC pills
  Keep under observation.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

HCC / HEPATOMA

- ♂ > ♀
- old age
- East Asia ⇌ East Africa → Taiwan. [Hep B]

Risk Factors -

1) Viral - Hep B > C
2) Cirrhosis 4% - Viral, alcohol, Cryptogenic - Mod., 1° Biliary cirrhosis } High Risk
3) Chr. active Hepatitis - High
4) Metabolic -
   - Haemochromatosis - (High)
   - Tyrosinemia - (High)
   - α_1 antitrypsin deficiency
   - Wilson's - low
   - Orotic aciduria
5) Aflatoxin. - B
6) Alagille Syndrome
7) DM II
   NASH
8) ~~Polyvinyl~~
   Polyvinyl Chloride → causes angiosarcoma

C/F

1) Vague
2) Hepatomegaly, Jaundice } all are seen late s/o inoperability

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Paraneoplastic Syndrome
- Hypoglycemia
- Hypercholesterolemia
- Polycythemia
- Hypercalcaemia

Inv
- USG → follow-up

- CECT → IOC - Triple phase.
  Initially Tumour gets hyperdense
  ↓
  then Liver gets hyperdense
  ↓
  Tumour gets hypodense
  } Early uptake, early release.

∴ Multiple Hypodense Liver Tumour ⇒ 2°.
Less vascular

Tumour Marker.
① AFP - t½ - 5-7 days.
- Non-seminoma
- HCC.

for follow up.
Nowadays used for diagnosis

If AFP > 400 + CECT diagnostic
↓
No Biopsy Required for Diagnosis of HCC

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

(2) PIVKA → Protein Induced by Vit K Absence)
Des gamma carboxy Prothrombin.

(3) AFP(L3) — Lectin fraction 3

(4) Hep PAR-1

Rx - Radioresistant
Chemo.

Surgery → inoperable Tx
↓
SORAFENIB (oral)
↓
Rigorafinib

Liver func" is required.

Hepatectomy
↓
Residual function.

>30% → Hepatectomy

<30% → Iatrogenic PV thrombus
↓
induce liver Regeneration (NIMURA TECHNIQUE)

poor
↓
① Child's criteria
↳ Bore
PV thrombosis

② Indocyanine green washout
③ LiMdx
Methacetin + C^{13}
↓
CYP1A2 (Liver) → PCM. + $C^{13} \rightarrow CO_2$ in Breath

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

* Transplant

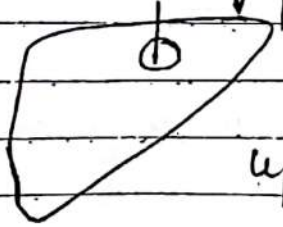
MELD Score → End Stage Liver Disease
>19

MILAN
Criteria for transplant in Cancer.
1) Single <5cm (T1)
2) Multiple tumour <3 in no.
<3 cm in size
3) No Major Vascular invasion

Other T/t Modalities.
(1) USG guided acetic acid injection.
Obselete now
(2) USG guided absolute alcohol injection
In case of <3cm Tx can be done
Rarely used

(3) Cryo → Rapid Freeze + Gradual Thaw
Laser
Microwave

(4) Radiofrequency Ablation.
alternating current used
probe in lever → ↑ Temp
= 350-450 kHz frequency Probe



Upto 2cm.
Tx <5cm can be used

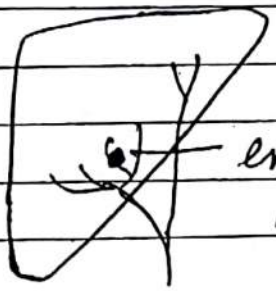
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

In case of vessel in proximity → it may affect heart rate
↓
Neuroabsetion

⑤ TACE (Trans Arterial Chemo Embolisation)

C/I to TACE

① PV Thrombosis
as liver will not get supply as (B) source will be blocked.



- Cisplatin
- Adriamycin

② LFT Abnormal

③ Encephalopathy

⑥ TARE (Trans arterial Radio Embolisation)
SIRE (Systemic Internal Radio Embolisation)
↳ Yttrium 90 is used

PROGNOSTIC INDICATORS

OKUDA	CLIP	BCLC
• Tumour Size	Tumour Size	Tumour Size
• Bilirubin	Child Score	LFT
• Ascites	α-FP. - child clip	Performance status
• Albumin	PV Thrombosis	Or Child Pugh

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Karnofsky Score
ECOG (Eastern Cooperative Oncology grp).
0-5 about performance status

5year survival Rate - ~~0-5yr~~ %

FIBROLAMELLAR CANCER

- ♀ > ♂
- 20-40yr
- Cirrhosis is not a risk factor
- Tumour is well circumscribed
  not encapsulated
- 50% - show calcification
  internal scar may be a feature
- Tx Marker-
  ~~a~~ (1) Neurotensin
- Metastasis late. L.N. involve
- Tt - only surgery
  ↓
  Nodal excision

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Q. Liver 2° show calcification?
① Colorectal } mucinous Ca
② Breast
③ Ovary }

HEPATOBLASTOMA

1) Tx of children < 3yrs
2) ~~R~~ Chemo Responsive.
3) Rx - Neoadjuvent Chemotherapy → Surgery

SIMPLE HEPATIC CYST

- Congenital
- Risk factor for Ca
- It is sequestrated Bile duct not communicating with Bile duct
- Lined by cuboidal cell
- fluid → Plasma
No Bile

CT Scan → Hypoechoic

Rx
If asymptomatic → aspirate + sclerosing agent filled
Symptomatic → Deroofing Laparoscopically

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

QUINKE's TRIAD - HEAMOBILIA

Cause - Iatrogenic / Biopsy

Pain
Jaundice
Bleeding → Malena → > 60mL
↳ occult blood stool
↳ Guaiac Test

Diagnosed by Angiography.

T/t → Angioembolisation.

00 AIIMS 2017

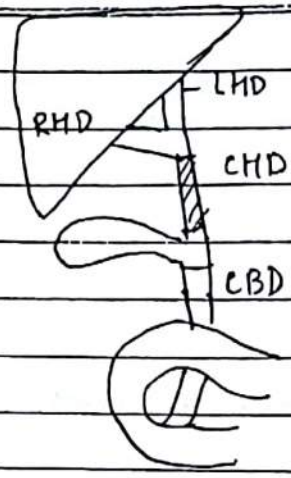
BILHEMIA

Inv - ERCP

T

GALL BLADDER

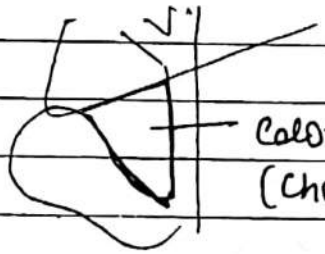
23/12/17



CBD Length - 7.5cm.

* Part of CBD -
1) Supraduodenal
2) Retroduodenal
3) Infraduodenal

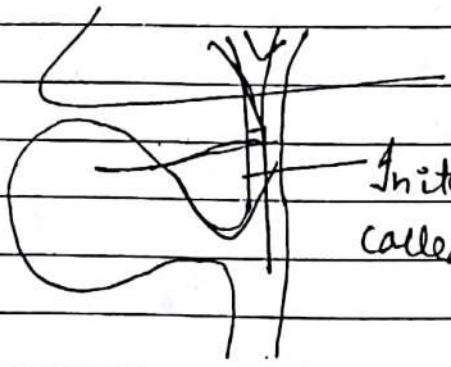
Retroduodenal & Infraduodenal part are inaccessible.



Calot's Δ
(Cholecystohepatic Δ)

Boundaries -
1) Inf. Border of Liver
2) cystic duct
3) CHD.

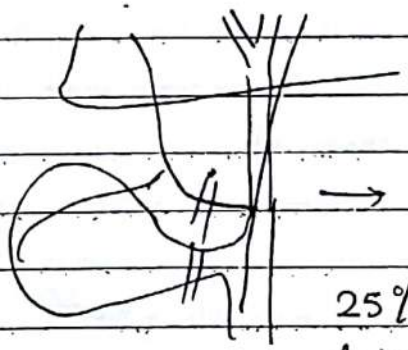
Content -
1) ~~Fat~~ Fibrofatty tissue
2) Cystic artery
3) L.N. of Lund / cystic node



Initially this was called Calot's Δ.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

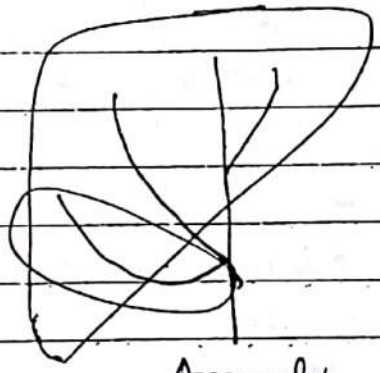
* Anatomical aberration → ~~Moyhi~~ Monyhian's Hump / Caterpillar Hump



→ Prone to injury in cholecystectomy

25% of individual have anatomical defect

M/C Congenital anomaly



Anomaly

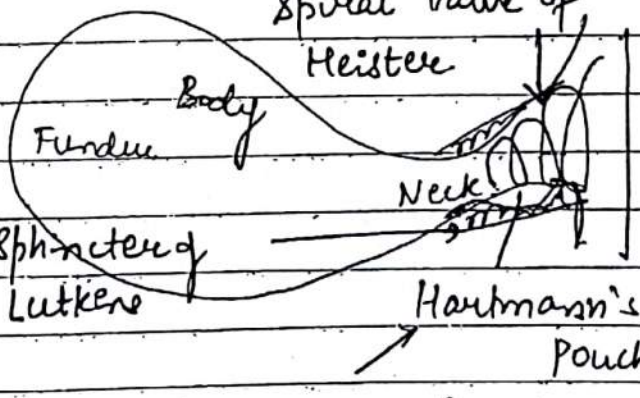
- shape - Globular

→ Vol. of GB → 30 cc

→ Bile is concentrated 10 times in GB.

→ absorption ⌐ Na^+ Cl^- H_2O.

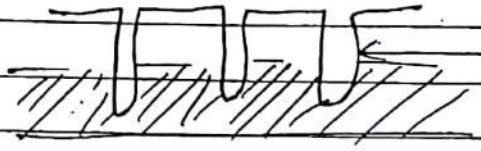
- Epithelium → Columnar (simple)



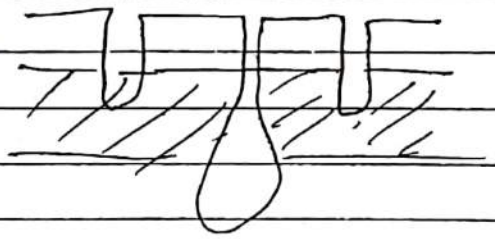
M/c site for Gallstone lodgement

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Histology → • No submucosa
• NO muscularis mucosae
• Crypts reaches upto muscle
(other GIT organs, crypts are only upto mucosa)



Rokitansky Ashoff Sinuses. (RA sinus)
↓
• crypts of Luschka
• Gland Proliferation in muscle → Adenomyomatosis.
• Cholesterol deposits in crypts → Cholesterosis / Strawberry GB.
• If sinus goes out → GB diverticulum



CHOLELITHIASIS

Types-

1) Mixed ↑ M/c type.
↑ M/c type in India

2) Cholesterol ↑ M/c type in caucasians
Cholesterol content >70%
Haemolytic anaemia

3) Pigment
Black ↓
• Infection
• More common in Asia
• Recurrent Oriental cholangitis / Recurrent Pyogenic cholangitis.
Brown ↓

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

* Pathology of Brown Pigment stone.

E.Coli, Klebsiella → produce β glucuronidase

↓

it unconjugate the conjugated Bile

↓

produce stone

* Etiology :-

1) Supersaturation of Bile -
Cholesterol ↑
Bile salt or Lecithin ↓

↓

Crystallization

↓

Nucleation

↓

Growth

2) Stasis

3) Pro Nucleation.

Causes of cholesterol ↑ →

Fat, fertile, female or forty → most prone

- Obesity
- Clofibrate therapy
- Rapid wt. loss
- fat
- ↑ age

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Bilio-pancreato diversion. → Bariatric surgery for morbid obesity

Causes of Bile salt ↓

1) Malabsorption syndrome (↓ Enterohepatic circulation)
2) UC
3) Crohn's
4) Coeliac sprue
5) Ileal resection
6) (R) Hemicolectomy
7) 1° Biliary Cirrhosis
8) CYP 7A1 deficiency mutation
9) MDR → ↓ Lecithin.

Causes of Stasis -

1) Truncal Vagotomy
2) Prolonged Starvation
3) Total Parenteral Nutrition
4) Somatostatinoma
5) Octreotid therapy

Causes of Pronucleation -

A lipoprotein → ↓ nucleator.

1) A Lipoprotein deficiency
2) ceftriaxone

C/F-

1) Asymptomatic
   ↳ Keep under observation

2) Biliary Colic

3) Cholecystitis → all feature of inflammatory disease
   - Pain Ⓡ Hypochondrium
   - Radiating to back, Ⓡ shoulder
   - Hyperesthesia posteriorly at 11th or 12th I.C. space (BOAS's SIGN)
   - MURPHY'S SIGN- Tenderness on deep inspiration in Ⓡ Hypochondrium

4) Acute cholecystitis
   ↳ recurrent
   ↳ Chronic → Thick walled, contracted
   ↳ Empyema → Thick walled, pus
   ↳ Mucocele
      ↳ stone proximally ~~located~~ impacted
      wall thinned
      Enlarged

95% → calculous cholecystitis.
5% → Acalculus cholecystitis
   Cause - Burn
   Shock
   Dengue
   Immunocompromised
   Typhoid
   by Gas forming organism - Clostridium
   E. coli
   ↳ cause emphysematous cholecystitis

prone to gangrene necrosis perforation

Emphysematous Pyonephrosis → E. Coli

Inv.

USG → IOC. Hyperechoic, acoustic shadow behind stone.
Most accurate

CT scan → Not a good modality.

Cholecystitis →

USG → IOC

HIDA scan → Most accurate
Non-visualisation of GB.

CT Scan →

On basis of accuracy → HIDA
↓
CT scan
↓
USG
↓
WES triad / sign
1) Wall oedema
2) Echogenic shadow of stone
3) acoustic shadow.

Adenomyomatosis. →

USG → COMET TAIL SIGN OR (Image)
ROSARY BEAD SIGN → MRI (Image)
PEARL NECKLACE SIGN. (Image)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Emphysematous GB →

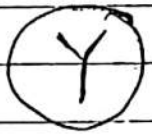
CT Scan → Best modality

CHAMPAGNE SIGN in USG, CT (Image)

multiple effervescence

In X-Ray → only 10% stone are found (radio-opaque)

• MERCEDES BENZ SIGN -



• SEAGULL SIGN -

To Differentiate Renal Stone & Gall stone

↓

Take Lateral View.

On the spine (Renal stone)

In front of spine (Gall stone)

Management of Ac. Cholecystitis -

Old Protocol - Conservative Rx

↓

Discharge

↓

>6 weeks

↓

Interval Cholecystectomy

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

New → Immediate Cholecystectomy

↓

in 2-3 days

Acalculus / Emphysematous Cholecystitis -

↳ Cholecystectomy (Fit) | Unfit → ~~Choledochostomy~~ Cholecystostomy.

Not advised in Dengue.

A 75yr old lady was case of asymptomatic gallstone & case of terminal cancer. Life expectancy 3 month she develops. Cholecystitis ?

↓

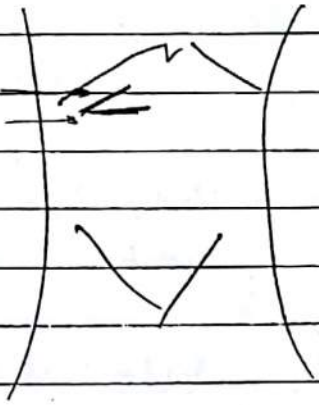
Cholecystostomy

CHOLECYSTECTOMY

1) OPEN

a) approach through cystic duct (Calot's Δ)

Kocher's Kehr



b) approach through fundus

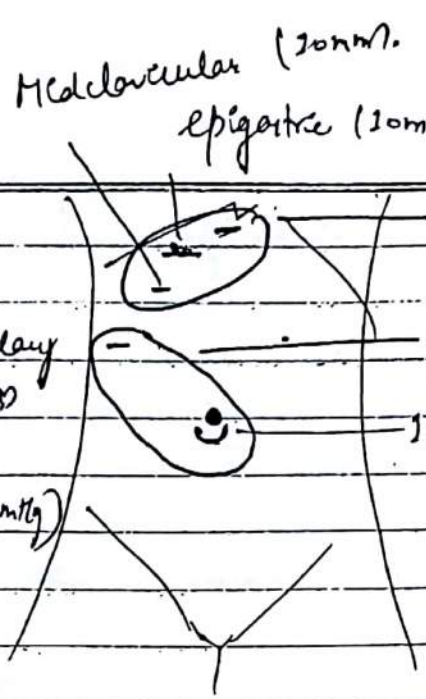
↳ Fundoscopic retrograde cholecystectomy

2) Laparoscopy

1st laparoscopic surgery → ERIC MUHE

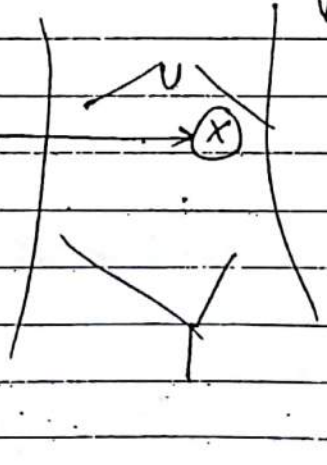
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Umbilical incision 10mm
↓
Veress Needle
↓
CO_2 used
Pressure of abd ↑ (10-15mmHg) 12mmHg.
↓
Take needle out ✓
~~Put~~ Put tube inside.
Meryland ~~Merkiland~~ tip forceps (artery forceps)
Gall Bladder is removed from Epigastric Port
OPEN to occlude air entry.



Hasson's canula (Image).

When umbilicus is not available we approach through palmer's
Midclavicular line 3cm below rib.
Palmer site



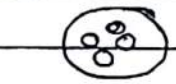
Veress needle (Image)

SILS - Single Incision Laparoscopic Surgery

DNB 15

NOTES - Natural Orifice transluminal endoscopic Surgery

↳ flexible endoscope
Scarless procedure



Physiological Changes & Comp' of Laparoscopy -

1) Perforation
2) Rapid stretch of peritoneum can cause Vasovagal attack → leading to Bradycardia.
3) CO_2 is rate → < 1 Litre/min.

If IVC is compressed → ↓ Venous Return
↓ Preload
EF ↓ / ↓ CO.
↑ HR
↑ JVP.
After load ↑ bcoz systemic Resistance ↑

4) Diaphragm elevated
↳ ↓ Vital Capacity
↑ Pulmonary Resistance
paO_2 ↓ $PaCO_2$ ↑

5) If Aorta compressed → ↓ tissue perfusion
↓ GFR
↓ Urine output

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

↑ aldosterone / Renin ↑ → ↑ Peripheral Vascular Resistance
↓
↑ Afterload

6) If ↑ retention of CO_2 → Resp. acidosis
↓
Cerebro - vasodilatation.
↑ICP.

Complication of Gall Stone

Gallstone Ileus.
- 100% case → Cholecysto-duodenal Fistula / Cholecystenteric fistula
- Commonly seen in old pt
- ♀
- Pt have had many attacks.
- Size of stone >2.5cm
- Stone get struck → 2 feet proximal to ileocaecal junction (Distal ileum)
or
Ileocaecal junction

Pt presents ⓘ Small Bowel Obstruction.

Inv → CECT

RIGGLER'S TRIAD → • Radio-opaque shadow in ileum
• ~~multi~~ Bowel distention
• Air in GB (Pneumobilia)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Tx → Surgery → Relieve obstruction.
Cholecystectomy ~~done~~ immediately not done. routinely ~~may~~

Open ileum at mid-ileum.
Distal ileum not opened due to leak.

*BOUVERET SYNDROME-

Stone gets stuck in 1st part of duodenum
↓
Present like Gastric Outlet Obstruction.

*MIRIZZI SYNDROME-

In chronic cases, Gall stone ~~not~~ lodged in Hartmann's pouch. may compress CBD from outside
↓
Obstructive Jaundice
↓
may lead to formation of fistula.

Type IV in Sander's classification denotes fistula.

SAINT'S TRIAD → 1) Gall Stone
2) Diverticulosis
3) Hiatus Hernia

Cholecystectomy in.

* Indication of Asymptomatic Cholecystitis -

1) Size > 3-4cm
2) Multiple small stone ī wide cystic duct
3) Immunocompromised pt
4) ~~Pregnancy~~
5) Typhoid Carrier
6) GB Polyp
7) If Sessile > 10mm.
8) Porcelain GB → calcified (Pre-malignant).
9) Hemolytic anaemia ī Gallstone
10) Bariatric surgeries (few of them)
11) ~~Pregnancy~~

Medical Rx -

Ursodeoxycholic acid or chenodeoxycholic acid for 6 month to 2 yrs

Indication -

1) Size < 2cm / single
2) Functioning GB
3) Non-calcified stone
4) ~~Pregnancy~~

BILIARY DYSKINESIA -

- Group of Conditions
- Cholecystopathy → Improper Contraction of GB.

Inv → USG.

But Inv → HIDA Scan.

Ejection Fraction < 35% → Motility Disorder

↓

Cholecystectomy

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Sphincter of Oddi Dyskinesia -
fail to relax.

AIPG NARDI Test - Obsolete Test Now

Administer Neostigmine + Morphine

↓

Induce pain

↓

Measure S. amylase, Lipase

↓

if ↑↑ → test +ve.

Manometry → IOC

T/t → sphincterotomy by ERCP.

CHOLEDOCHOLITHIASIS

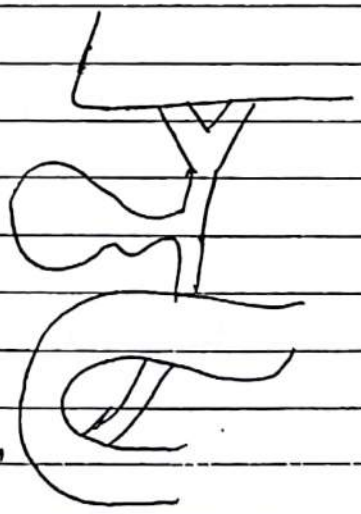
1° 2°

formed in CBD — from gall Bladder.
M/C

↓

Brown pigment stones are M/C in CBD

Recurrent Retained



After GB removal if
CBD stone >2yr → Recurrent
<2yr → Retained

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

QF →

1) Present ~ c Cholangitis (Infn of Bile of CBD)

Org → E.Coli, Bacteroid

① CHARCOT'S TRIAD.

a) Pain
b) Fever } Intermittent
c) Jaundice

Causes of Intermittent Jaundice

① Cholangitis
② Periampullary Ca

~~27 M~~. Rx

1) Pt Responds ~ c Antibiotics >70%

In Few pt, it progresses to septicaemia.

↓

RAYNAULD'S PENTAD – Charcot's triad
+ Shock
+ Coma

2) Drain Pus. by [ERCP + Decompression] –
• papillotomy
• sphincterotomy

IOC → MRCP. (Non-Invasive)

ERCP – Equally good but due to invasive procedure, no diagnostic role.

- CBD stone
- Stricture
- Choledochal cyst

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Biliary Leak → ERCP

For Cancer → PET stage

Microlith → EUS

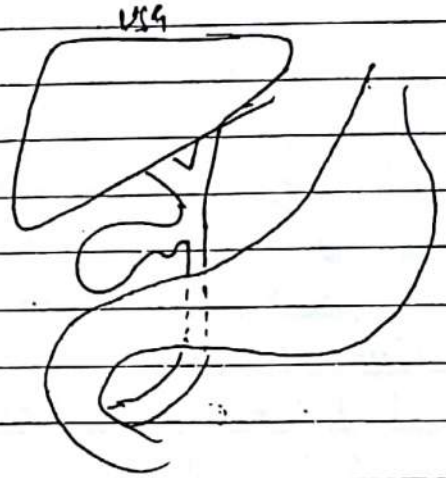
Hepatobiliary

- USG
- LFT.

USG

① Supraduodenal stone
↓
Stone visible

② Infra/retro duodenal stone
↓
CBD dilated



LFT. → conjugated hyperbilirubinemia
Alk Phosphatase > 2.5 times (N)
↳ also ↑ osteoblastic bone 2°

① USG (+), → CBD (N), LFT (N) → Cholelithiasis
② USG - gall stone, CBD dilated, LRT altered →
↓
go for MRCP.

①	②	③
USG - Gallstone.	USG - Gallstone	USG → Gallstone
CBD (N)	CBD dilated.	CBD - CBD stone
LFT (N)	>1cm.	LFT - obstructive jaundice
↓	LFT - obstructive	↓
Cholecystectomy	jaundice	1st ERCP done
	↓	↓
	MRCP.	later Lap. cholecystectomy
		↓
		If ERCP ↓ → Choledocho-lithotomy

* Choledocholithotomy -

Lap. → has <60% succes rate & tough.

~~Supraduodenal~~

① Cholecystectomy

② Supraduodenal choledochotomy

↓

Desjardin's forceps

↓

T-Tube insertion

↓

≥ 8 days, it can be removed

mostly in India 10-14 days.

↓

Before Removal (after 7 days)

we perform T-tube Cholangiogram

↓

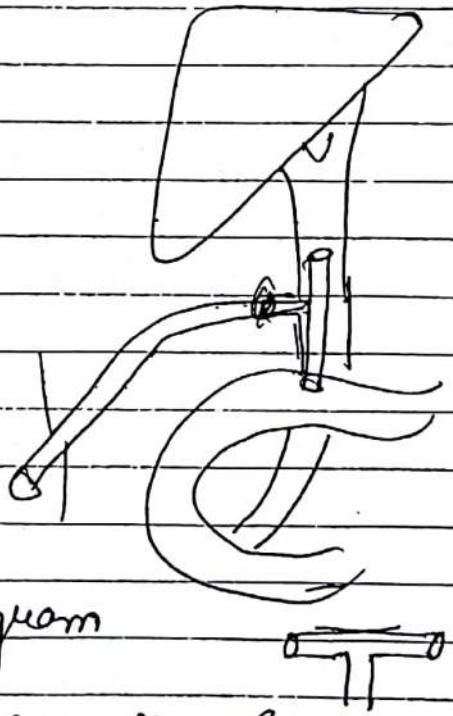
if stone itself ↓ → Meniscus sign Seen.

↓

after 24 hours, T-tube is removed

↓

Hole epithelize by itself in 24-48 hrs



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

* How to ~~Remain~~ Remove Retained Stone when T-tube is in-situ?

T-tube cholangiogram shows Stone (filling defect)
↓
Leave T-tube for 5 week.
↓
Fibrosed channel is formed.
↓
Choledochoscope or dormia basket through T-tube
↓
Remove Stone
↓ OR AIP4
BURHENNE TECHNIQUE

CHOLEDOCHODUODENOSTOMY -

If there is distal obstruct. in CBD, CBD dilated, open CBD & duodenum & anastomose them.

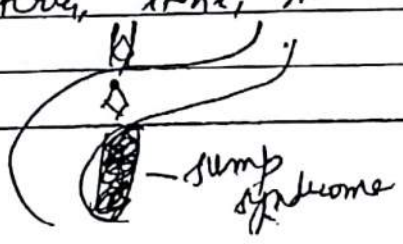
Pre-requisite -
- CBD > 1cm.
- Size of Anastomosis > 2.5cm.

Risk of ascending cholangitis: Very ↑ as there is no sphincter.

SUMP SYNDROME -

The part of CBD ~~C~~ is ~~Left~~ ~~after~~ distal to Choledocho-duodenostomy → growth of bacteria, stone, etc

complication of this surgery



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

If pt. is unstable in case of gallstone + CBD stone + obstructive jaundice

↓

we don't go for MRCP

↓

Procede to ERCP & decompression.

CHOLEDOCHAL CYST

- Q
- Incidence 1:20,000 (variable)
- Etiology - anomalous bileo-pancreatic junction
  sphincter of Oddi dysfunction. - Sphincter

Alonzoley Classification / Todani

I → M/c type

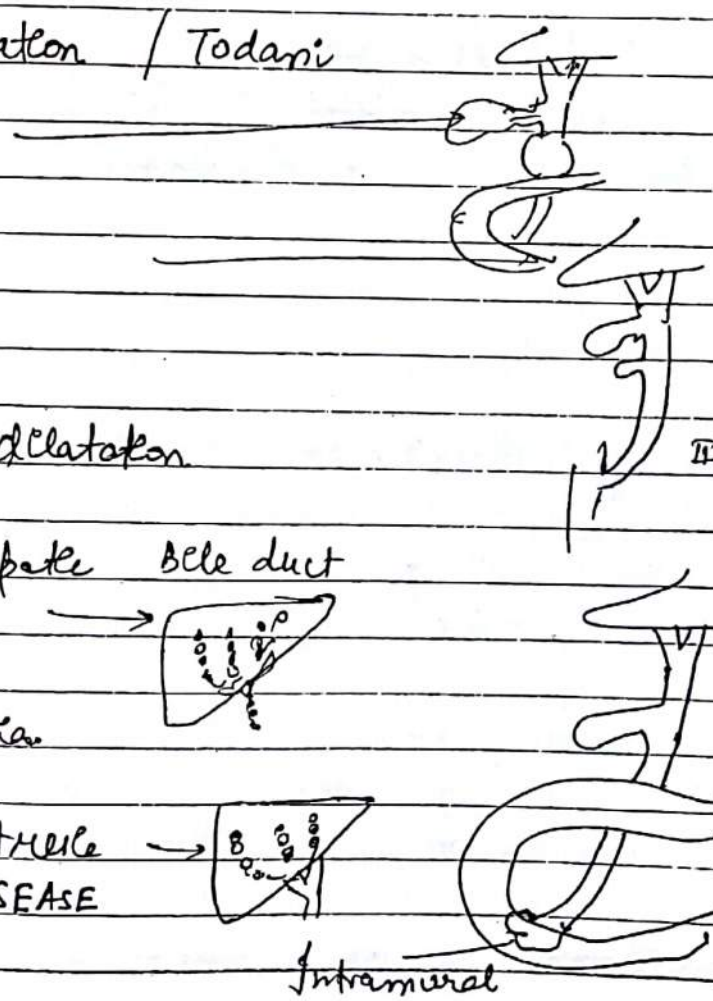
II → Diverticulum.

III → Choledococele
Intramural dilatation

IVa → Extra, intrahepatic bile duct atresia

IVb → Extrahepatic atresia.

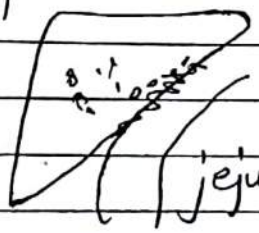
V → Intrahepatic atresia → CAROLI's DISEASE



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Porto-jejunostomy Procedure / KASAI operation
↳ Type IV

AIIMS
Th Caroli's Disease
CT → Central Dot Sign



Q. IOC for Intrahepatic Atresia ⇒ Liver Biopsy

Q IOC for Extrahepatic Atresia ⇒ HIDA Scan.

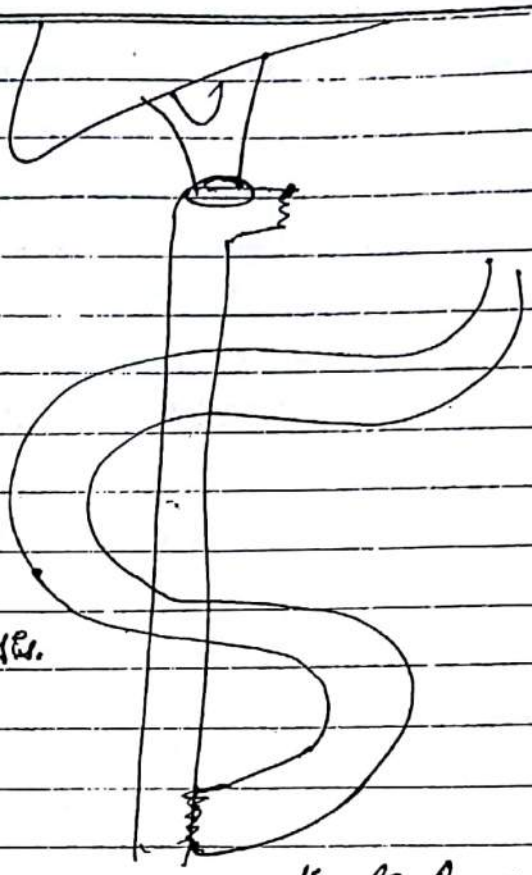
Q USG in Biliary Atresia
→ Triangular cord Sign
→ Ghost Gall Bladder →
↳ atretic GB
<1.8cm.

C/F
1) ↑ Cholangitis → + lump.
2) Pre-malignant - 22% HCK
3) Rupture → can cause Biliary Peritonitis.

Inv
USG followed by MRCP.

T/t
1) Choledochocysto-duodenostomy
Not done nowadays since ↑ chances of infection.
↑ GA HCK

2) Roux-en Y
Hepaticojejunostomy



Remove GB. CBD.
↓
Divide jejunum
↓
Anastomose ī common
hepatic duct
↓
jejuno-jejenostomy anastomosis.

HUTSON LOOP

- Single layer
- use Vicryl

for Recurrent Pyogenic
Cholangitis
↓
Make a Roux-en-Y Hepatico-J anastomosis
↓
take Roux limb to liver

Advantage → to approach easily by endoscope whenever required.

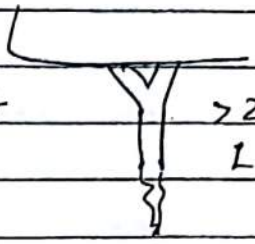
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

CBD Injury & Stricture

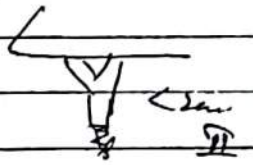
H/cc → Iatrogenic

Bismuth classification-
depends upon length of C hepatic duct

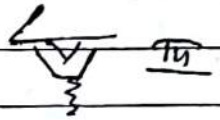
Type I → >2cm



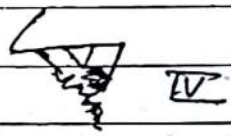
Type II → <2cm



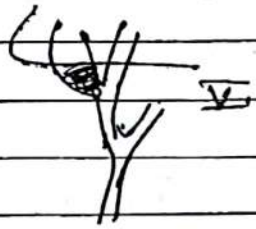
Type III → Confluence is preserved
No length of CHD



Type IV → junc" is gone

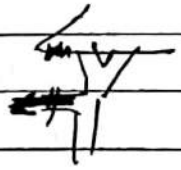


Type V → Post. sectoral duct injury
seg 6 & 7



Strasberg classification

(A) → Cystic stump Blow out
C.B. fossa Leaked
Don't present ī Bile ~~duct~~ leak



(B) → Ligation of (R) hepatic or post. sector duct

(C) → Transection of (R) hepatic / Post sectoral duct

(D) → Lateral injury of main duct.

(E) → Stricture
E_1, E_2, E_3, E_4, E_5 ⇒ Same as Bismuth.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Approach

① USG guided drain CECT gives best impression of collection

Wait for day 1 or 2

↓

Bile leak

↓

ERCP

① cystic lump leak (Bismuth I)

↳ ① put a ERCP stent

② or do open & lap → put clips again re-explore & re-ligate

② If there is niche in CBD.

small neck → Repair over T-tube

③ If CBD is transected at any level

↓

Roux-en-Y Hepatico-jejunostomy

Don't prefer Roux-en-Y - choledocho-jejunostomy since blood supply is from above downwards,

Hence, Higher we go → better results

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

GB Cancer / CHOLANGIO CA.

GB Ca	CBD Ca
- ♀ >> ♂	♂ > ♀
- Poorest Prognosis	Poor

Risk Factors for Both

1) Cong. Hepatic Cyst
2) Caroli's Disease
3) Choledochal cyst
4) Von. Mayenberg Complex → Biliary Hamartoma
5) Worms → ~~Clon~~ Clonorchis Sinensis. (chinese liver fluke)
   Opisthorchis. (asian liver fluke)
6) Sclerosing Cholangitis ← U.C
7) ~~Use~~
7) Toxins → Thorotrast (was used as dye for angiography)
5) Drugs - estrogen
   α-methyl dopa
   INH
6) 1° Biliary Cirrhosis.
7) Cholelithiasis
8) Typhoid · Carriers

GB Ca.

C/F

- ♀
- > 50yrs
- M/C site - Fundus
- M/C type → Infiltrative

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

- 90% cases → Gall stone
→ Nevin classification is for Ca GB.
- Common in India (North)

Inv.

1st Inv → USG → Mass replacing G.B.
late presentation

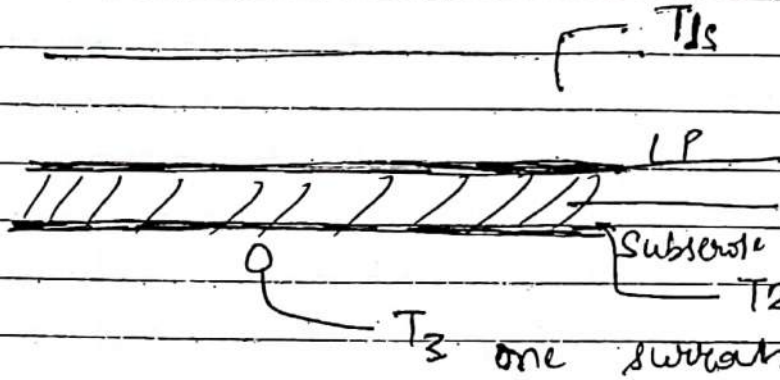
CECT ± PET ← IOC

Tumour Marker

① CA 19-9

↑ in > 70% cases.

Murine monoclonal Ab.



T4 [a Vessel ~~encasement~~ invasion
b Two organ involved

Tis, T1a → • Open cholecystectomy is done
↓
Observation.

• Lap. cholecystectomy → If extraction bag used ∴ ↳ Observation
↳ If extraction not used → Port site excision

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

* Port site excision Rde -
① therapeutic
② staging

T_{1b} → Wide excision
1cm margen of liver tissue excised

$> T_2$ → Extended Cholecystectomy
Remove • GB
• Lener omentum
• Cystic node
• Liver segment 4b & V

↓

If cystic stump +ve for tumour cells
or cystic node +ve

↓

then. CBD is also removed

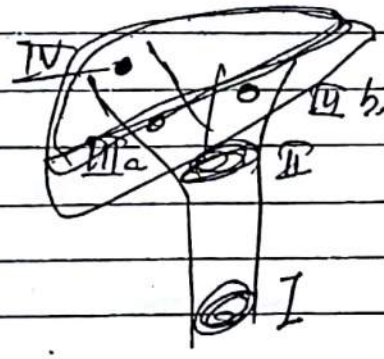
↓

Perform Roux-en Y hepatico-jejunostomy

Poorly Chemo sensitive → 5FU + Gemcitabin

Cholangio Ca

Bismuth Classification for Ca



1) I → Below junc"
2) II → at junc"
3) III → above junc"
4) IV → intrahepatic

Klatskin → Type ~~I~~ II
Better Prognosis

H/c ~~to~~ site → type II.

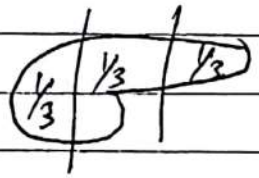
PANCREAS

Ca Pancreas → 3rd H/c cancer in GIT.

Exocrine → 98% → adenocarcinoma (98%) → Head
Endocrine → 2% →
↳ Insulinoma H/c.

INSULINOMA

- 2/3rd of all endocrine tumours
- 90% Benign / single
- <2cm, equally distributed.



- encapsulated.
- Presentation-
  Hypoglycemia

WHIPPLE'S TRIAD - attacks of hypoglycemia
- B. sugar <50mg/dl @ presentation
- Becomes (N) ↑ sugar

Not pathognomic of Insulinoma

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

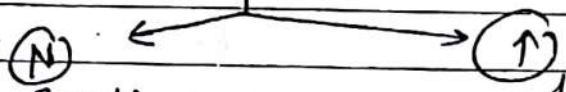
- Insulin/sugar ratio > 0.3

Most accurate biochemical test → 72 hour fasting sugar value

* Insulinoma/ Inj of insulin

↓

go for C-peptide



Inj° of insulin. Insulinoma

* Insulinoma against sulphonylurea toxicity

cpeptide ↑ in both.

1) S. sulphonylurea level

2) Insulin/sugar ratio.

if > 0.3 ⇒ Insulenoma

GASTRINOMA.

2nd M/c Endocrine Tumour

MEN → M/c tumour.

MEN_1 → WERMER SYNDROME

> 50% → malignant / multiple

Enteropancreatic tumour → as it comes from duodenum

Gastrinoma - M/c enteropancreatic Tu.

PASSARO Δ → ① Junc" of cyste duct c CBD
② " " neck & body of pancreas
③ " " 2nd & 3rd part of duodenum

Site of origin -
1st part of Duodenum > 2nd part of D > Head of pancreas

ZOLINGER ELLISON TRIAD -
1) ↑ Gastrin level
2) Multiple ulcers → unusual position, refractory
3) No β cell tumour of pancreas

Presentation -
1) Pain
2) Diarrhoea - due to hypertrophy of gastric mucosa

Diagnosis -
S. Gastrin levels > 1000 → malignant Gastrinoma

(N) level ~ 150

Borderline case btw 150 - 500
↓
& ① Secretin stimulation Test

(N) ↓ gastrin

Gastrinoma ↑ gastrin

② Basal Acid Output
(N) - 5-6 mEq/hour
In gastrinoma > 15 mEq/h

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

(3) BAO : MAO

BAO > 60% of MAO ⇒ Gastrinoma

VIPoma

1) ♀ > ♂
2) old age
3) 70% → malignant potential
4) Presents :-
   Pain
   Steatorrhoea

* WDHA syndrome - / Werner Morrison / Pancreatic cholera
  WD - watery Diarrhoea
  H - Hypokalemia
  A - achlorhydria + acidosis

GLUCAGANOMA

→ Presents :- DM
Anaemia
Stomatitis
Dermatitis
Thromboembolic episodes

Necrolytic Migratory Erythema

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

SOMATOSTATINOMA

① Present ī Gallstone → cause stasis
DM → ⊖ insulin

② Common in MEN1
VHL → cerebellar haemangioma
RCC

Inv.
① EUS →
Ioc for Insulinoma
CECT.
Other tumour — SRS (Somatostatin Receptor Scintigraphy).
- Octreotide In^{111} - earlier used
- Now, Pantetreotide. - $Indium^{111}$
MRI, PET scan not helpful

Tumour Marker -
Chromogranin A

Rx -
- Octreotide - medical Rx.
- Radio (R)
- Slightly Chemo (S) → Streptozocin + 5FU / Adriamycin

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Head –

Sx → Whipple's operation
↳ Pancreato-duodenectomy

Tail → Distal pancreatectomy.

Radical Sx are preferred in case of pancreas ~~xx~~ Tumour except Insulinoma (encapsulated)

If Insulinoma
size < 2cm
Location – away from duct
↓
Enucleation.

If > 2cm, attached to duct ⇒ Whipple's.
If in tail → Distal pancreatectomy.

CYSTIC Tx OF PANCREAS

① Serous cystadenoma
② Mucinous "
③ Intraductal Papillary mucinous neoplasm. (IPMN)

Serous cystadenoma

1) ♀ > 50
2) ♂ > 60 yr
3) arising in Head – microcystic.
bunch of grape appearance
lined by cuboidal cells

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

- ↑ Glycogen +ve
  Mucin -ve

- Benign.

CT scan → Central Scar
& SUN BURST APPEARANCE

Rx:
1) asymptomatic → Observation
2) Symptomatic → Central Pancreatectomy.

MUCINOUS CYSTADENOMA
- ♀ > ♂ 10:1
- > 40 yrs
-

(common) Macrocyte — Head
Microcyte — Body or Tail
↓
- Ovary like stroma ♀
- Estrogen receptor

- Columnar cell → ✗ Mucin +ve ↑
  Glycogen -ve
- Malignant potential
- Tx → CEA +ve

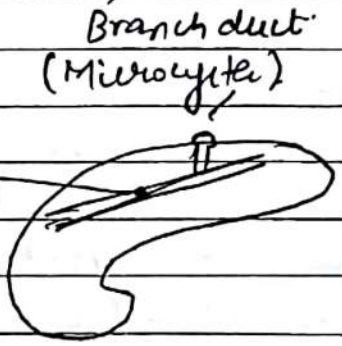
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

CT Scan → Hypodense lesion / Internal septation.
Wall calcification

Rx
Surgery:

IPMN (Tanaka classification)

1) ♀ > ♂
2) old age
3)



ERCP –
- Excessive mucous coming out from ampulla
FISH MOUTH APPEARANCE of ampulla

↑ cancer → PIN. (Pancreatic Intraepithelial Neoplasia)

CEA / CA 19-9 ↑

Rx - Surgery

EXOCRINE Tx

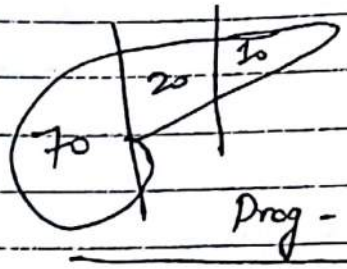
ACINIC CELL TUMOUR
- seen in serous gland tumour

- SCHMID TRIAD - ① Subcutaneous Nodule
② Polyarthralgia
③ Eosinophilia

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

ADENOCARCINOMA

- ♂
- Old age >55yrs
- ~~Head~~ Distribution →



- Black > White

Risk Factor -
1) Smoking
2) Obesity
3) High Fat diet
4) Chr Diabetes
5) Chr Pancreatitis
6) Chr alcoholism.

Protective - fruit + veg

Familial
① Hereditary Pancreatitis → Chr 7 PRSS1

② Familial atypical multiple mole melanoma Syndr (FAMMM ~~X~~ - PC) - Chr 9 P CDKN2A P16

③ Peutz - Jegher - Chr. 19 STK11/LKB1
100 times ↑.

④ Breast Ovary Syndrome BRCA 1 -17
BRCA 2 -13

⑤ Ataxia - Telengectasia Chr 11. ATM.

⑥ HNPCC MSI Better Prognosis

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

APC gene ⇒ Periampullary cancer.

Non-Familial
- RAS → 95-100%
- p53 – 75%
- HER2/Neu

Presentation-
- General Symptoms
  anorexia., wt. loss
- Jaundice
- Palpable GB.
- Pain.
  Back → invaded splanchnic n/v
  so ∅ inoperable Tx.

Courvoisier Law →
Obstructive jaundice + Palpable GB ⇒ Malignancy.
" + Impalpable GB ⇒ stone
If there is obstructive jaundice + Palpable GB, it's not due to stone ⇒ implies Cancer.

Exception → ∅ Mucocele.
↳ Double Impaction of stone.
↳ CBD → jaundice

Trousseau Syndrome
Migratory Thrombophlebitis.
Not pathognomic

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Inv.

① CECT → IOC - No Biopsy.

Pseudotumour → inflammatory

FRANTZ Tx - Pseudopapillary tumour of Pancreas

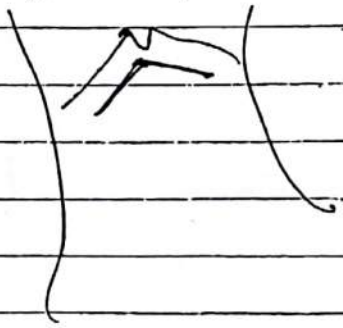
② 18 FDG PET → for metastasis

③ EUS → - Biopsy
- Periampullary Cancer - 99% accurate

ERCP/MRCP ⇒ DOUBLE DUCT SIGN

Tumour Marker-
CA 19-9 > 80%
follow-up.

Roof top / Chaveron Incision → for whipple's operation



If CA 19-9 > 100, then don't go for operation

Pre-operative Lap. for staging can be done

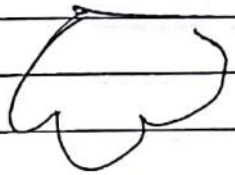
or size of Tx > 3cm

Tx out / fail

Ba ~~swallowing~~ meal: ??

Hypotonic duodenography.

↳ Wide C loop of duodenum
Mucosal irregularity → Rose thorning
Antral Pad Sign.
Reverse 3 Sign of Frostberg.



Rx - Radio (R)

Only 1 minor role → along ī chemo neoadjuvent for downstaging

Chemotherapy → ① Gemcitabin → Capecitabin
- 5-FU
- Erlotinib
- Docetoxel

② Folfirinox - Folinic acid
5FU
Irinotecan
oxaliplatin

Whipple's → Pancreatico-duodenectomy
Initially antrum was also removed
↓
Now pylorus is preserved
Mod. Whipple's / Pylorus Preserving pancreatico-duodenectomy
(LONGMIRE & TRAVERSO OPERATION)

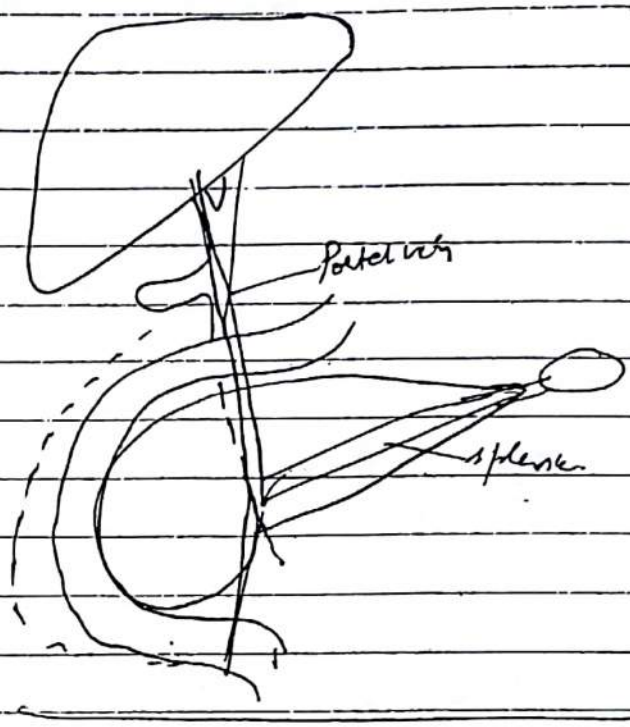
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

24/12/17

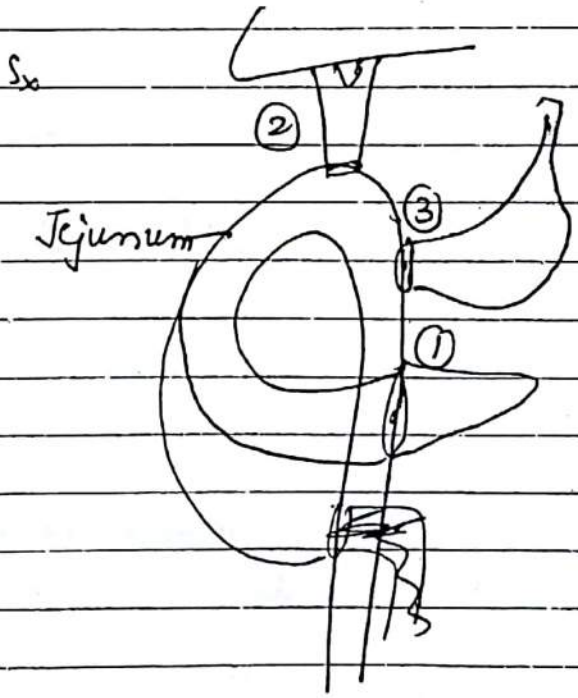
WHIPPLE'S OPERATION

M/c Comp' of Whipple's - ~~Pyelo~~ Drainage problems

↑ Risk of Leak
Pancreas > Bile duct > Stomach



- If origin of artery (SMA) is involved → then operation is C/I
- If < ½ circumference of SMA is compressed ↓ then relative C/I. to Sx



Resectable Tx
Located to Pancreas i.e. no evidence of SMV or portal vein involvement

Palliative-

1) Jaundice
>80%

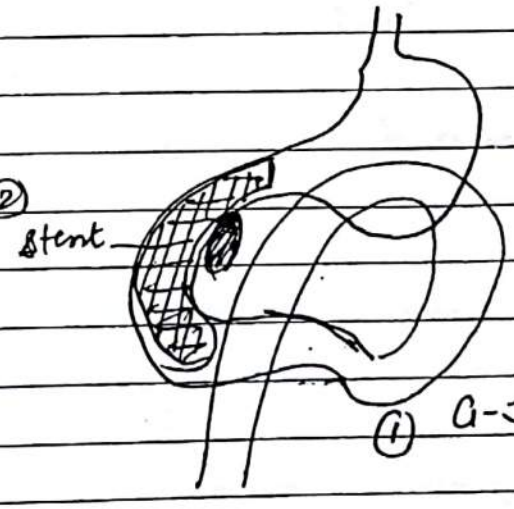
Manage → a) Stenting by ERCP. sometime done Pre-operative when S. Bil is ↑↑↑,
metallic stent used so that tumour doesn't compress
↓
If not by ERCP then PTC.

b) Sx - • Choledocho duodenostomy
It has a tendency to get involved by Tx
Hence not preferred.

• Cholecystojejunostomy

• Roux-en-Y - hepaticojejunostomy

2) G.O.O.
20-30% cases.



→ Metallic Stents
• Oesophagus
• CBD
• duodenum.
• colon

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

3) Pain.
- Celiac ganglion block.
- Splanchnic nerve block → Radio frequency Ablation.
  ↓
  B/L, $T_{12}-L_1$.

Complication-
Early - Hypotension.
Late - Diarrhoea

5 year survival for Pancreas in operated case - 15%
" " " " inoperable cases - 5%

/

SOLID PSEUDOPAPILLARY Tx OF PANCREAS / FRANTZ Tx
- ♀, 10-30 yrs
- 2/3rd in Tail
- Encapsulated
- Large > 8cm
- Solid + cystic composition - centre - cystic
  periphery - solid
- Low grade Cancer
- Metastasis < 15% → Liver
  (Blood-Borne)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

APC, β Catenin +ve
Progesterone Receptor +ve
Vimentin +ve
NSE +ve
S100 +ve

CT Scan → Solid + cystic component
Haemorrhage + necrosis.

Histology - Foamy macrophages
Cholesterol ~~clefts~~ clefts
Hyaline granules.

℞ Surgery

ACUTE PANCREATITIS

Enzymes inside pancreas are inactive
↓
activated in pancreas
↓
autodigestion.

1st enzyme → Phospholipase A.
↓
Lecithin ——→ Lysolecithin

OPIE Common channel theory -
Common channel for Bile
Bile enters pancreas causing Pancreatitis.

Now, Pancreatic Pr > Bile Pr
↳ Hence y do bile enters pancreas

Pressure Theory - / Co-localization.

In the vesicle where enzyme are stored in pancreas Cathepsin D is also found here
↓
Cathepsin D can activate the enzyme
↓
Trypsinogen → Trypsin

M/c site for pseudopancreatic cyst → Retroperitoneal?

QY Haemorrhagic Pancreatitis -?
Blood vessels contain Elastin.
Elastase is released in pancreatitis
↓
damages vessels
↓
Haemorrhage (Diaphragm to pelvis)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

SIRS (Systemic Inflammatory Response Syndrome)

IL_2 (IL_6) IL8 TNF, CAM-1

↓

Vasodilatation
Endothelial damage.

↓

intravascular fluid goes to extra-vascular space

SIRS

↓

Sepsis ⟶ infection.

↓

Severe sepsis ⟶ acidosis
↳ organ failure → lung / heart / kidney
↳ Later liver
haematological
Neurological.

↓

Septicaemia & shock
SBP < 90 mm Hg

Criteria of SIRS

1) HR > 90/min.
2) Temp > 38°C or < 36°C
3) TLC -> 12,000 or < 4000
4) RR > 20/min. or $PaCO_2$ < 32 mm Hg.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Causes

1) Gallstone - M/c } 75%
2) Alcohol
3) Idiopathic
4) Trauma - ERCP → M/c Comp^{n} - Pancreatitis
Cholangitis.
5) Metabolic
Hypercholesterolemia
Hyperlipoproteinemia - ~~Hall~~ Not much Imp.
Hypertriglyceridemia
Hyperparathyroid
CRF
Hypercalcemia
6) Virus - CMV
Mumps
Coxsackie
7) Toxins - Methyl alcohol
Amanita → mushroom toxin
Black ~~&~~ scorpio venum
8) Drugs - DD
Azathioprine
6-mercaptopurine
Pentamidine
L-S perginase
Cytosine arabinoside
Furosemide
Thiazide
Na valproate
Didanosil
Zidomidine
Steroid
Metronoyl
Estrogen
Doxycycline, Tetra etc.
Trimethoprim + sulfamethoxazole

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

9) Tropical pancreatitis
H/C in Kerala
Diet - Cassava / Tapioca associated
SPINK-1 mutation

10) Congenital anomalies.
Pancreatic Divisum.
incidence 10%.

11) Familial type.
Histidine in place of Arginine
Trypsinogen is altered in this type.

Presentation.
1) Pain. - Epigastric region
relieved by ~~moving~~ bending forward
2) Grey Turner Sign.
discoloration in flanks.
3) Cullen's Sign
~~discoloration~~ discoloration around umbilicus
4) Fox Sign
discoloration in inguinal canal

Inv
S. Amylase → early ↑ , early ↓
Persistently ↑ amylase ⇒ s/o Complication
Pseudocyst of Pancreas
Sensitivity - 80%

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Alcoholic
Hypertriglyceridemia } amylase may remain (N)

Specificity – 80%.

* Causes of ↑ s. amylase
1) Parotitis
2) Boerhaave syndrome
3) P. Embolism
4) Duodenal perforation
5) Ac. cholecystitis
6) Ac mesenteric ischaemia
7) Dissecting Abdominal aneurysm of aorta
8) twisted Ovarian cyst
9) Ruptured ectopic
10) CRF
11) Cystic Fibrosis → (N) if No malabsorption, only then s amylase

Never ↑ in Cardiac pathologies.

S. amylase ⇒ No prognostic Role
>3times (N) ⇒ Pancreatitis

2) S. Lipase
Late rise, late fall
More sensitive, specific than amylase
we don't rely due to late rise

No prognostic significance
>3times (N) ⇒ Pancreatitis

3) Urinary Amylase / Creatinine Ratio
Obsolete now
Ⓝ ratio <5
if >15 ⇒ S/o Pancreatitis.
↳ Macroamylasemia or pancreatitis - to differentiate

4) Urinary trypsinogen / Faecal Elastase

Radiology

1) Plain X-Ray -
- Sentinal loop.
- COLON CUF OFF SIGN
- OBSCURED PSOAS SHADOW
- pancreatic calcification
↳ seen in acute on chronic cases.
- Ⓛ Pleural Effusion.
- Ground Glass Appearance ⇒ Peritonitis.

2) USG - 1st inv.
not a good modality for pancreas.
• Oedema
• Collection
• CBD / gall stone
} can be seen

3) CECT → IOC
Most accurate
changes - 12-18 hrs
Necrosis > 72 hrs
↳ 0-10 score, >7 Severe

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Balthazar Score-
Based on inflammation, oedema, collection.
0-4 scoring.

1- inflammation in pancreas
2- inflammation outside pancreas
3- " " " in 1 or 2 organ only
4- many organs

CT Severity Index
after 72 hour - Based on Necrosis

Prognosis

1) CRP →
If after 7 day >110 ⇒ inflammation continued
>130 ⇒ severe

2) Glasgow Score / Imrie
>3 severe

3) Apache II (acute physiology & chronic health evaluation)
>8 severe
Max. Score (72) → Head injury
APACHE - III → Max 299
APACHE - O → obesity
BMI >35 ⇒ Poor prognosis.

4) BISAP Score
for any acute abdomen or critical cond^{n}

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

B - BUN
I - Impaired mental status
S - SIRS
A - Age < 60 yr.
> 60 yr
P - Pleural effusion.

5) Atlanta 2012

	Local Comp^n.	Organ Failure.
Mild	⊖	⊖
Mod.	±	⊕ but Transient < 48 hrs.
Severe	⊕	Present & Persistent, > 48 hrs

6) Ranson's Score

	< 24 hrs.	> 48 hrs
Age	> 55	Fluid loss > 6L
TLC	> 16,000/mm^3	PaO_2 < 60 mm Hg
LDH	> 350	Fall in Haematocrit > 10.
SGOT	> 250	S. calcium < 8 mg/dL
Sugar	> 200 mg/dL	B. urea > 5
		Base Deficit > 4

Score

1-2 ⇒ 1%
3-4 = 15%
5-6 = 40%
> 7 = 100%

> 3 ⇒ SEVERE

Mod. Ranson → for GB stones.

7) Glasgow Score
- Age
- TLC
- LDS
- SGOT
- Sugar
- paO_2
- S. Cal
- S. albumin
- B. Urea

✗ > 3 severe

Glasgow > 3 } ⇒ < 24hrs
Apache II > 8 }

Ranson's > 7 } ⇒ > 48 hrs
ATLANTA }

CT severity index > 72 hours

Rx - Critical care management

- Fluid
- O_2
- Calcium
- PPI
- Nutrition
- give orally, when tolerate orally
- analgesic → NSAID
  - ↳ Opoid - Meperidine, Buprenorphine

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Antibiotics -
Mild - Metrogyl
+ ofloxacin.

Imipenem → DOC

Octreotide }
Aprotinin }

Sx -
1) ERCP -
only 1 indication → Gall Stone Pancreatitis
Golden Period - 48hrs

2) Infected Peripancreatic fluid collection.
Peripancreatic fluid collection ⇒ later pre pancreatic pseudocyst
↳ Percutaneous drainage

3) Pancreatic Abscess. → Drain.

4) Infected necrotising pancreatitis
↳ necrosectomy.

5) Pseudopancreatic cyst
- Fibrous well bound peripancreatic fluid collection.
- seen in lesser sac
- ⊕ > 4wks
- well matures in ~~6wks~~ weeks

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

· Ac Pancreatitis
Chr "

M/cc Pseudocyst in children ⇒ TRAUMA

Chr Pancreatitis / Trauma → Communicate c pancreatic duct

- No epithelial lining
- Lined by - granulation tissue

- M/c complication
Infection > ~~follow~~ Haemorrhage

Inv CECT

Sx - Pre-req
1) Size > 5cm
2) duration > 6 wks
gen 8-12 wks — M/c comp^{n} → Haemorrhage from wall

Cysto-gastrostomy. JURASZ PROCEDURE - TOC

If cyst is below ~~TRANSVERSE~~ Meso Colon
↳ cysto-jejunostomy → lower recurrence

Only 1 indication → low lying cyst

Cysto-duodenostomy can also be done

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

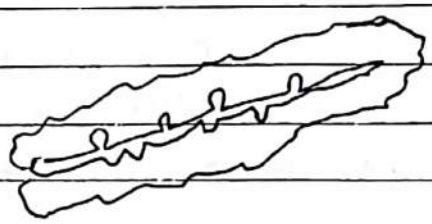
DIGIDO CLASIFICATION -
- Pancreatic duct
- Communicating ī duct

M/c vascular Comp^n of pancreatitis ⇒ Splenic vein Thrombosis

M/c arterial Comp^n of pancreatitis ⇒ Splenic artery aneurysm

CHRONIC PANCREATITIS

Pathology -
① Fibrosis
② calcification.



C/E
- Pain
- Malabsorption
- DM.

Sx has Limited Role.
∴ Drainage can be done to drain the secretions it reduces pain, ↑ malabsorption.

Causes -
T - Toxic & metabolic → M/c - alcohol
I - Idiopathic
G - Genetic → PRSS1
→ SPINK
→ CFTR
A - Autoimmune
R - Recurrent acute
O - obstructive

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Autoimmune Pancreatitis - or Sclerosing

IgG4 RSD/RSS (Immunoglobin G4 Related Systemic Disease)

HISORT

H - Histology
I - Imaging
Sor - Serology
T - T/t
R - Reponse to steroid

Histology → Lymphoplasmacytic
Storiform fibrosis.

I → CT - Sausage shaped pancreas.
Delayed Rim enhancement

E → ANA, Anti-lactoferrin Ab.

Reponse to steroid.

Stellate cell accumulation in Pancreas
↓
Collagen deposition
↓
Fibrosis

Inv.

I - Malabsorption
(a) Steatorrhoea
(b) NBT PABA test / Bentiromide test
↳ Nitro Blue Tetrazolium.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

4) Endoscopy → look for ↓ enzyme deficient

3) Secretin-
measure HCO_3^- in pancreatic juice

4) Lundh.
Protein rich diet → pancreatic juice
look for Trypsinogen

Radiology.

X-Ray- Pancreatic calcification
Not preferred

USG- Not good

CECT → Parenchymal Fibrotic calcification

CRCP → CHAIN OF LAKE APPEARANCE

MRCP → Secretin stimulation MRCP.

EUS →
Rosemont Criteria
Major-
(A) → Echogenic shadow in pancreatic ± post acoustic shadow
↳ Stone in main duct

(B) → Gland lobation ± honeycomb

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Rx

Medical-

Lipase > 30,000 units.

Sx is only indicated when medical management fails

When Duct is not dilated → ERCP stenting

Duct dilated > 6mm

↓

Divide the duct

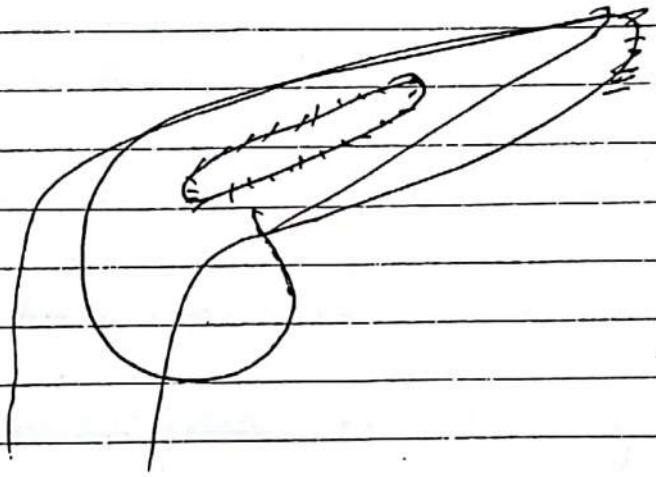
↓

Devide jejunum

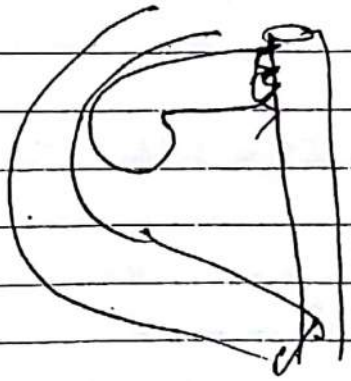
↓

Longitudinal Pancreatico-Jejunostomy.

→ PUESTOW OPERATION

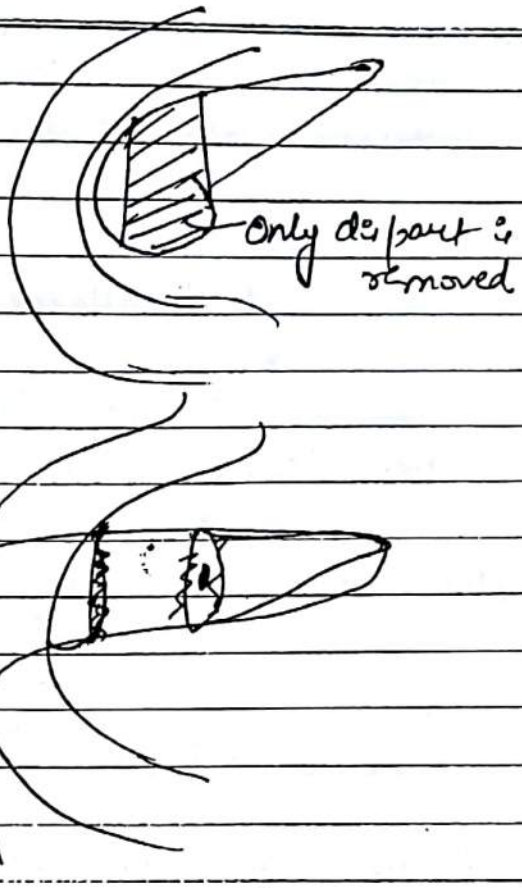


- Bager
- Frey's
- Duval → when tail is involved



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Bager - Duodenum preserving pancreatic head resection.

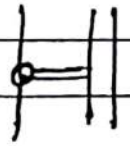


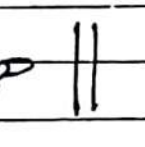
Frey's
Open the duct
↓
Scoop out the contents
similar to Beger's operation

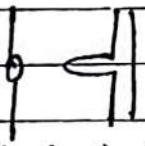
Pancreatic calculi are made up of $CaCO_3$.
Submandibular gland stone
Prostate stone made up of $Ca_3(PO_4)_2$.

MECKEL'S DIVERTICULUM

- True — Proximal end of
- Persistence of Vitello-intestinal duct
- Release of mucus, meconium from it







Meckel's Diverticulum

- Present on Anti-mesenteric Border
- It has independent blood supply

RULE of 2°

- +nt in 2% population
- 2 inches long
- 2 ~~feet~~ cm proximal to ICJ
- Male: female 2:1

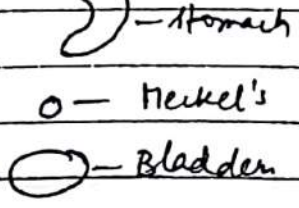
- Ectopic tissue - Gastric (50%)
  Pancreatic
  Jejunal or
  Colonic

- M/c presentation - ① Bleeding
  ↓ due to ectopic gastric tissue
  in children. (50%)

  ② Obstruction (30%)
  seen in adults
  ③ Pain
  ④ Perforation
  ⑤ Diverticulitis

Inv - ① Tc^{99} Scan → for parietal cell (Image)
↳ diagnose gastric ~~no~~ ectopic.
No use if no ectopic tissue

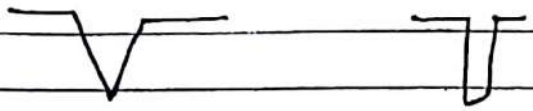
② CECT



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

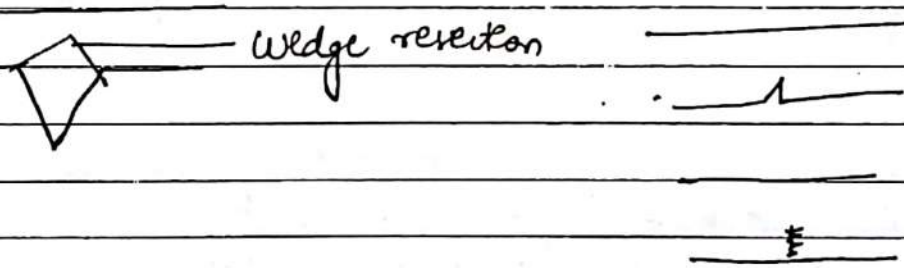
Rx

- If incidentally found diverticula in ~~laparoscopy~~ laparotomy



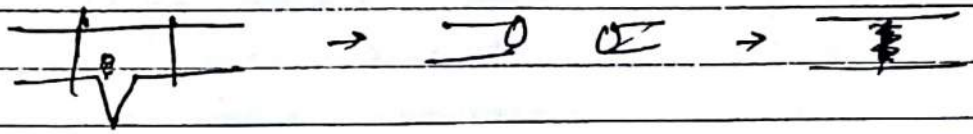
If mouth is narrow or ectopia is +nt ⇒ Remove it.

- If presentation is diverticulitis, no ectopia
  Rx → Diverticulectomy
- If ectopia tenue present
  Rx - resection & anastomosis



It should not be closed longitudinally → stricture
It should be done transversally.

Ectopia tenue



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

INTUSSECEPTION

HCC - < 2yrs.

Rg Peyer's Patch Hypertrophy act as lead point

+ It is due to
- weaning
- lymphoma

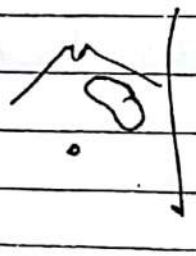
>2yr → HSP.
Polyp
Meckel's.

Intussuscipiens
Intussusceptum
Lead point
L.N.

Types
Ileocolic - H/c type (70%)
Ileoileal
Colo-colic

Presentation -
- Pain - intermittent
- Red mucous → Red Currant Jelly stool

Exam^n
1) Empty (R) Iliac fossa - DANCE SIGN
2) Sausage or banana shaped lump ~ concavity toward umbilicus due to mesentery pull
3) prolapse



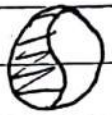
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Inv. USG → Ba enema

USG → Target Sign
Doughnet sign
Pseudo Kidney Sign

CECT → Most accurate
Bowel inside Bowel (Ileo-ileal)

Ba enema →
- Claw sign
- Pincer shaped deformity
- Cup shaped deformity



CT Scan

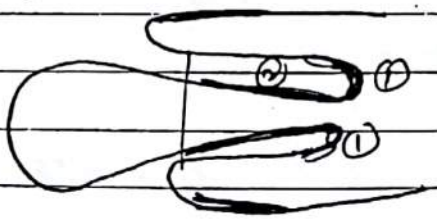
Ying-yang sign

It has therapeutic success of 70%.

Rx -

1) Exploratory laparotomy
Reduce manually → squeeze it out.
never pull it off
↓
look for lead point

Gangrene → resection & anastomosis.



① > ② > ③

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

CARCINOID SYNDROME

come from Kultchitsky cells.
ECL
APUDoma cells (amide precursor uptake decarboxylase)

M/C system involved → GIT > Resp > Genitourinary
↓
Midgut > Hindgut > Foregut

M/C site - Ileum > Rectum > Appendix.

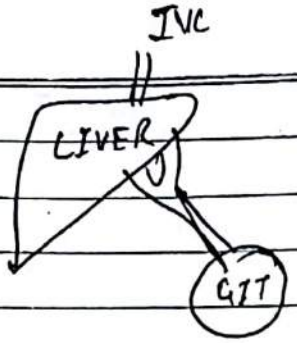
Stomach → atrophic gastritis. } Benign
MEN-1
Sporadic - Cancer ↑

Bronchial Carcinoid
90% Benign → Adenoma

10% Cancer - atypical
Chromogranin A -ve.
Serotonin -ve
Ki 67 ++

GIT → chemical Mediator
↓
Liver ↓
metabolize
↓
Urine → 5HIAA
(Hydroxy indole acetic acid)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp



Syndrome occurs when liver is produce chemical mediator ★ It is occurs due to Liver & 2°:

Pain.
Flushing
Diarrhoea Histamine ↑
Palpitation

Heart - Subendocardial fashion

TR > TS > PS , rarest PR.

M/c

Inv

① SRS (Somatostatin (R) ~~localisation~~) scintigraphy

② if -ve

MIBG (Meto - iodo - Benzyl guanidine)
↳ for Phaeochromocytoma

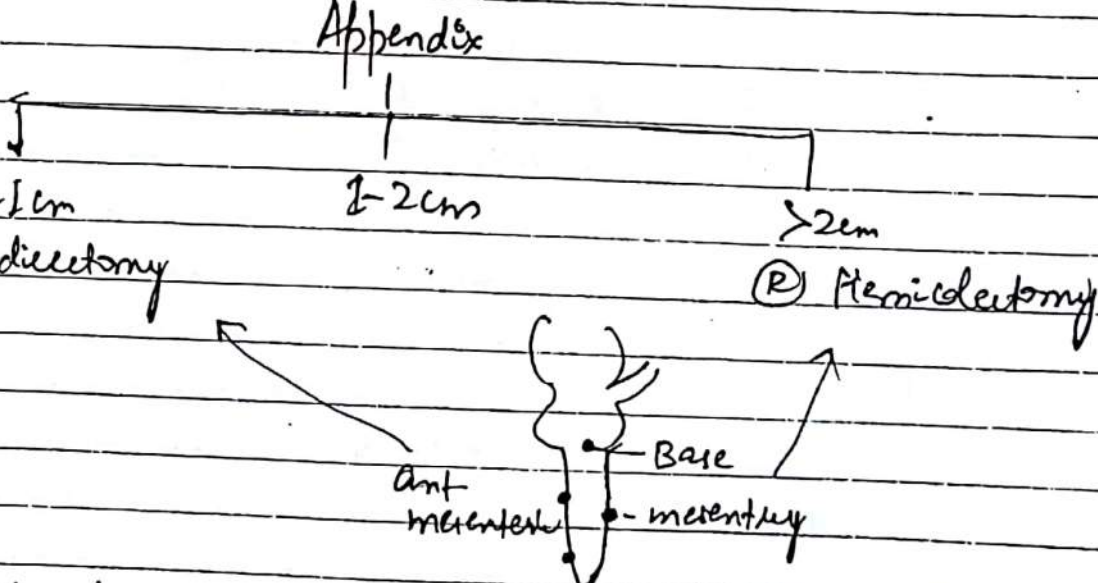
③ CECT

Tumour Marker -
Blood - Chromogranin A
Urine - 5HIAA

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

	Well	Mod	Poor
① Mitotic index	<2	2-20	>20/HPF
② Ki67	<3%	3-20%	>20%
③ Necrosis	absent		present
④ Pleomorphism	absent		Present

Rx
1) Octreotide
2) Radio resistant
3) Chemotherapy — Streptozocin + 5FU / Adriamycin
4) Sx —
> 2cm margin



One of tumour where liver 2° is considered Operable
→ Curative
→ Palliative → Incidence of carcinoid

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

CELIAC DISEASE

Gluten Sensitive Enteropathy

↓

White / Barley / Rye

Gliadin. (alcohol soluble part)

↓ ↑ Main culprit

Int. Rx^n / CD4 (+) IF → Destroy villi

HLA DQ2 - 98%

HLA DQ8 - 2%

Presentation -

1) Malabsorption
   - Diarrhoea
   - Steatorrhoea

2) Dermatitis → herpetiformis

Dx

1) Serological -
   - Anti TTG (tenectrans glutaminase)
   - Anti-endomysial (specific)

2) Biopsy
   1. Lymphocyte infiltration
   2. crypt cell proliferation
   3. villi atrophy
   4. Flat mucosa (Image)

3) CEC Syndrome → Intracranial calcification occipital region
   - cerebral epilepsy
   - calcification
   - folic acid deficiency

Rx 1) Gluten free diet

SHORT BOWEL SYNDROME

ICJ - preserved < 150cm
removed < 200cm

Min length: adult > 60cm
child > 40cm

Causes -
Adults - Mesenteric Ischaemia
- embolus (50%)
- arterial thrombus (25%)
- venous thrombus
- Non occlusive (No MT)

Trauma
IBD
volvulus

→ M/c artery involved ↳ SMA.

Children - atresia
midgut volvulus

Neurotensin, Bombesin, GLP-2 } villi length ↑

Presentation -
1) Malabsorption
Diarrhoea
Steatorrhoea
↑ Gastric Secretion
↑ Gall stone → Cholesterol (↓ Bile salts)

Renal stone → oxalate

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

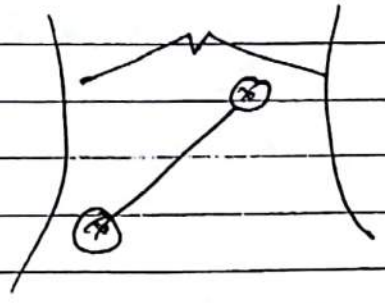
(N) Calcium binds ~~c~~ oxalate → ↓ absorption

In malabsorp^{n} → Ca^{2+} + Fat, So oxalate becomes free
↓
absorption ↑
Hyperoxaluria
↓
oxalate stones

Rx
① GLP-2
② Glutamine

Sx - BIANCHI OPERATION.
STEP (Serial Transverse Enteroplasty)
Intestinal Transplant
↓ ↳ Mid-ileum (150cm)
Max Graft vs Host Disease

MESENTERIC CYST



Mesentery is from-
DJ to "ileo-caecal Jxn"

Chylo Types
1) Lymphatic - H/C ② Enterogenous
↓
- Thin walled, lined by flat endothelial
- clear fluid or chylous
- separate gut supply

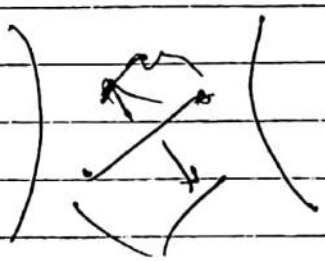
Enterogenous - Thick walled
Stratified epithelium
mucinous.
Common blood vessel

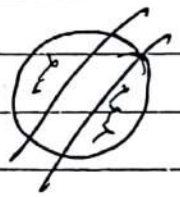
Age - 2nd decade <30 yrs

C/F - Abd. lump

IoC - CECT

Tillaux TRIAD -
1) Mid-abdominal cystic swelling
2) mobile at ⊥r to root of mesentery
3) there is a band of resonance in front of cyst





Rx
Chylolymphatic → Enucleation

Enterogenous → Excision of cyst + Resection Anastomosis of Bowel

00
IPSID (Immunoproliferative Small intestinal Disease)
M/c presentation → Malabsorption
associated : campylobacter jejuni
M/c site → Duodenum > Jejunum

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Ig → Truncated Heavy chain
NO ligh chain.

⇒ Heavy chain Disease

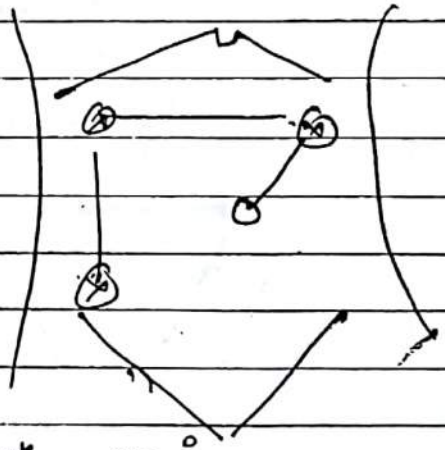
- Can cause Immunoblastic lymphoma, t9:14 involving PAX5 gene
Translocation.

Rx - antibiotics
↳ if not responsive → then Chemotherapy

MALROTATION

- Duodenum, J gets fixed ~ 6-9 wks 90°

- Caecum goes below ~~the~~ liver, gets fixed in (R) Iliac fossa 180° rotation. (9-12 wks).

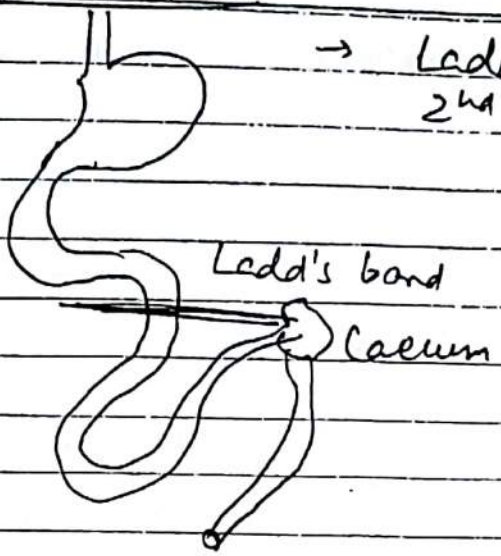


Caecum
(L) hypochondrium - non-rotation
(R) " - incomplete rotation 270° anticlockwise
Mobile - non-fixation

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Non-rotation

(1)



→ Ladd's band obstructs 2nd part of duodenum

↓

Bilious vomiting

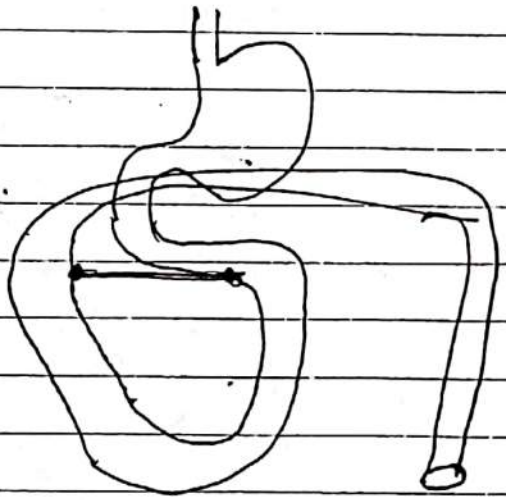
(2) Incomplete Rotation → due to mesentery

↓

midgut Volvulus.

↓

Presents in Lyr



Inv

1) Ba meal follow through

↓

Corkscrew appearance

2) CT Scan.

Whirlpool appearance

Rx - LADD'S OPERATION

Division of Ladd's Band

↓

Widening of Mesentery

↓

+ Prophylactic appendicectomy

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Reverse Rotation - Type of incomplete rotation.
(Ant) Duodenum → artery → colon (Post)

MECONIUM ILEUS

Seen in Cystic fibrosis - AR
- CFTR

Presentation
① Antenatal obstruction.
↓
Perforation
↓
Cause chemical peritonitis

- Intra-abdominal calcification
- SNOWSTORM APPEARANCE on X-Ray

② Pseudocyst.
③ Bowel stricture/ atresia
④ Microcolon.

Obstruction → Mecolium ileus
SOAP BUBBLE APPEARANCE (Neuhauser sign)

Rx - Meconium Plug syndrome
↳ Gastrografin enema - 2 attempts.

Sx - Bishop Koop operation.

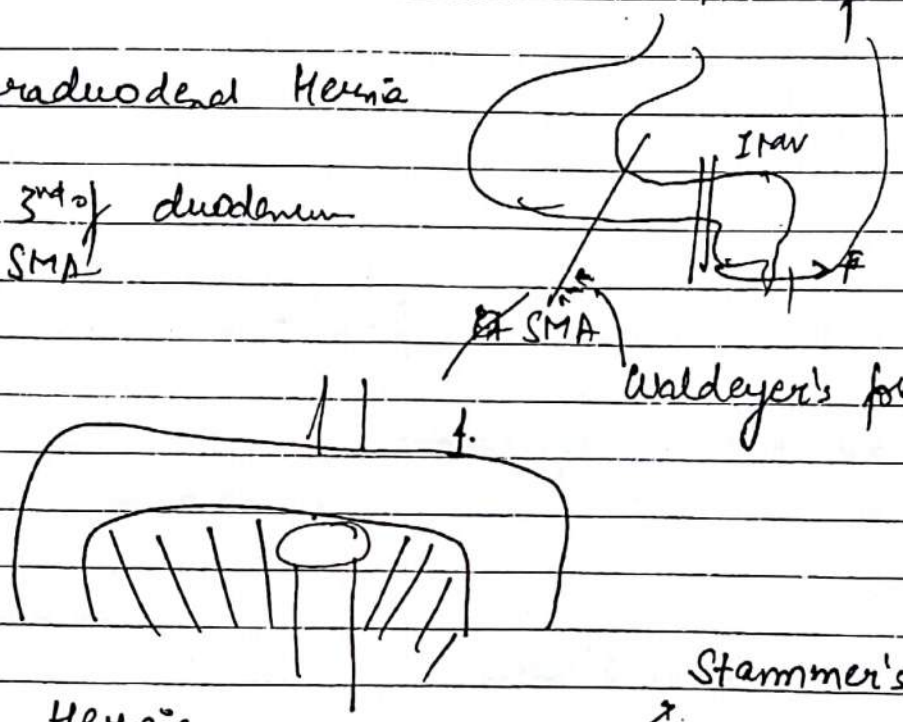
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Swenson.

INTERNAL HERNIA.

M/c- (L) Paraduodenal Hernia
Behind IMV ., 4th of duodenum.
due to lifting of peritoneal fold.
Fossa of Landzert

(R) Paraduodenal Hernia
Behind 3rd of duodenum
& SMA



Paterson Hernia
Complication of surgery
Roux-en Y or Gastric bypass
Stammer's
Paterson.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

COLORECTAL CA

M/C Cancer in GIT
M/C C of Cancer death.

Site :- Rectum > Sigmoid > Caecum
in colon → sigmoid M/C.
colorectal → rectum M/C.

- ♂
- > 55 yrs.
- Risk Factors-

Diet - ① Selenium Deficiency
- ↑ fibre diet (is protective) → not correct now - JIPMER
② ↑ animal fat is causative.
③ UC -
- > 10 yr, long seg. (beyond splenic flexure)
after 10 yrs, risk is 1% per year.
So, yearly colonoscopy is recommended

④ Cholecystectomy → ↑ colon cancer (R) sided
⑤ Familial.

- Polyposis
- Non Polyp HNPCC
  - Adenomatous
  - Hamartomatous

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

ADENOMATOUS POLYP

FAP - AD

Gene - APC on 5q

2nd decade

Polyp no. ↑ c age → by 35 yrs >100 Polyps

Cancer Risk - 100%

c in 40 yrs, pt develop cancer

→ Periampullary cancer

Spigelman classification - depends on
- Histology
- No.
- Size
- Dysplasia

Gardner's Syndrome -

① - soft tissue tumour - Fibroma
Osteoma - jaw, forehead
lipoma
Sebaceous cyst
Dermoid tumour
Ant rectus sheath
♀ > ♂
malignant
wide excision.
recurrent → Radiotherapy

② Intra-abdominal
↑ aggressive

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

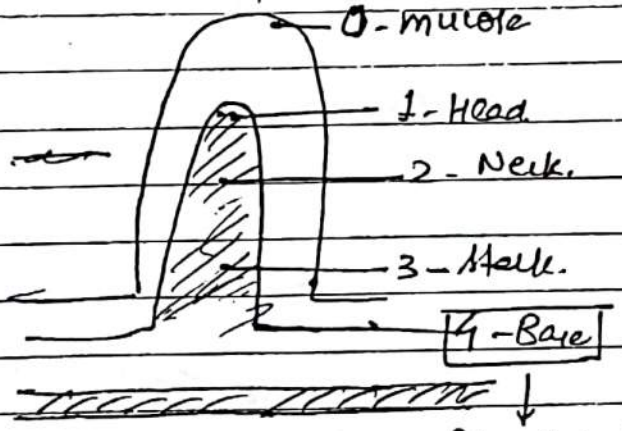
· Turcot's Syndrome - Polyp + CNS
↳ can be AD or AR ↓
Medulloblastoma (APC)
adults → Glioblastoma Multiforme.
↳ & HNPCC

Type of Polyp

Tubular	Tubovillous	Villous
70%	20%	10%
↓		↑ Cancer Risk

Haggitt classification.
On basis of Depth.

All villous adenoma are level (4).



↓
Require Sx

HAMARTOMATOUS ~~POLYP~~ POLYP
- AD ① PUTZ-JEGHER SYNDROME - MODERATE RISK
- Chr 19
- gene - STK11 / LKB1.
- Pol Site - ~~Polyp~~ > Jejunum > Duodenum > Colon
↑ Cancer Risk in Pancreas / Breast / lung

Melanin deposition at muco-cutaneous junction

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Ovary → Granulosa cell Tumour
Testis → Sertoli cell Tumour

COWDEN → LOW RISK
- Chr 10, gene - PTEN
- Polyp - cancer risk ↓
- ↑ uterine leiomyoma
  thyroid Ca
  Breast Ca
  Facial Trichilemmoma → Benign intercow neoplasm

MUIR TORE - MODERATE RISK
  Breast Cancer
  Sebaceous adenoma

BANNYAN RAILEY RUVALCOBA SYNDROME.

NON-FAMILIAL

CRONKHITE CANADA SYNDROME - LOW RISK

- Gastric mucosa
- Deep crypts
- Foveolar hypertrophy
- ↑ protein loss
  ectodermal dysplasia → Nail Dystrophy
  → Skin pigmentation
  → Alopecia

JUVENILE POLYP / RECTAL POLYP

M/c cause of rectal bleeding in children
Benign

Rectal Polyposis → Risk 15%

Pseudopolyp → seen in UC
Benign

HNPCC / LYNCH

I

M/c Colon Cancer

II

Stomach
Pancreas
Uterus — 2nd M/c
Ovary
Skin
Urological

- More common (R) > L
- Prognosis - better

Amsterdam Criteria - (Modified)

1) Age < 50 yr
2) 2 succesive Gen having Cancer
3) Same generation - 2 more family members have Cancer.
   ↓
   2 should be 1° relative

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

ONCOGENES.

Adenoma - Ca - sequence
Fearon + Vogelstein (1990)

APC (5) Deletion
↓
β catenin ↑
↓ WNT pathway
Cyc D1
MYC
Normal mucosa → Aberrant dysplastic crypt
COX Inhibitors ↓ Reversible
Early Adenoma
↓ RAS (12) - TGFβ
Intermediate Adenoma
↓ DCC (18) - BRAF
SMAD - 4.
Late adenoma
↓ p53, chr (17)
Carcinoma

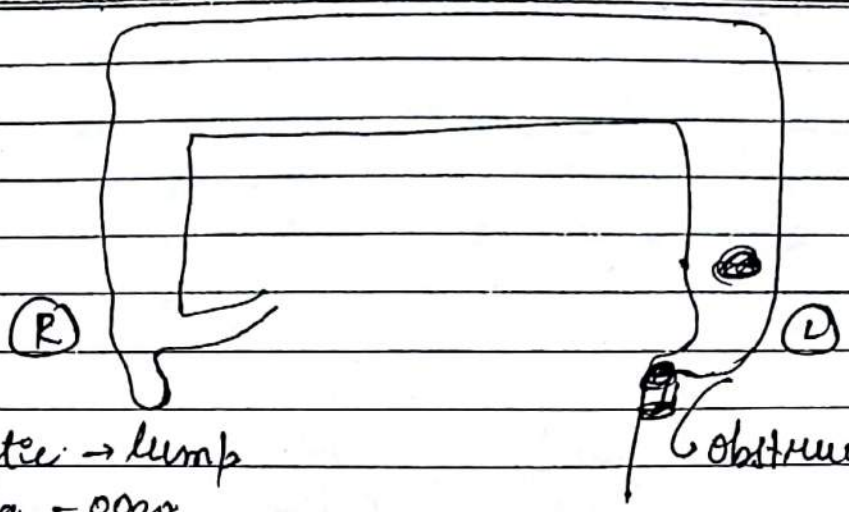
Estrogen + NSAID (COX-θ) are protective

HNPCC
Microsatellite Instability
Mismatch Repair
MSH_2 - 75%
MLH_1 - 15%,
MSH_6 ~~MSH2~~ MLH_2
PMS-1 PMS-2
↓ Suppress TGFβ
Pro-apoptotic (↓BAX)
↓ cell death

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

C/F

L > R



- Exophytic → lump
- Bleeding - occo
  ↓
  occult blood.
- anaemia + RIF lump.

RIF + B_{12} Def. anaemia - Crohn's

Rectal Cancer - Bleeding PR

Rectosigmoid Ca → alternating Bowel habit

Screening

Colon Cancer -

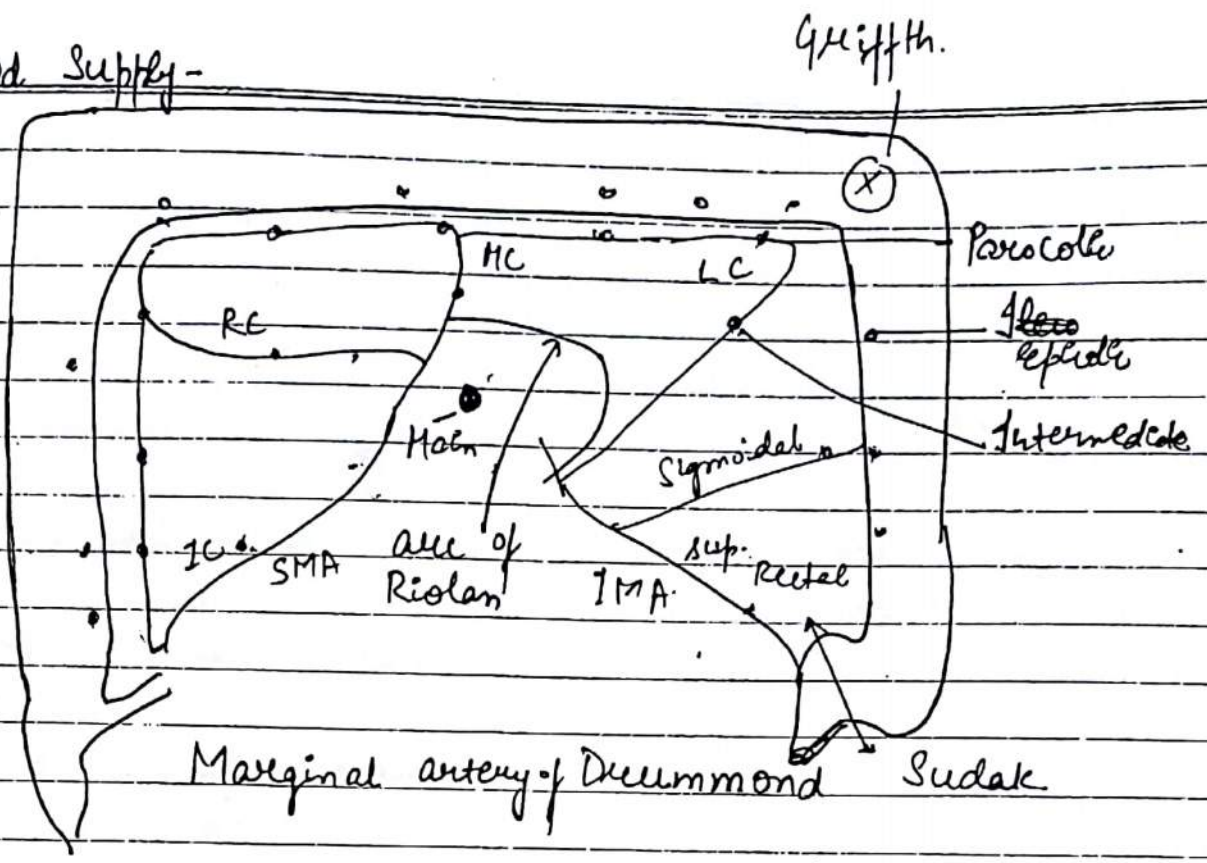
① 5 year colonoscopy ② occult blood in stool - Guaiac Test (↳ 1 year.)

③ Cologuard → DNA alignments in cells

④ Immunochemical Test → Blood

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Blood Supply -



M/c site of Ischaemia in colon → Splenic Flexure (M/c)
↓
Called (Griffth.)

② 2nd → (Sudak) → Rectosigmoid junction

L.N.

- Epicolic → on colon
- Paracolic → on marginal artery
- Intermediate → on Rc, MC, LC IC
- Main → Root of SMA / IMA

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Inv

① - Colonoscopy + Biopsy
Examine whole Colon
Since 5% have multiple lesi.
synchronous - ⩽ in 6 month
Metachronous - >6 month.

② PET - CT for staging

③ Virtual colonoscopy -
abn. in colon → 3D (CT)
↓
>6mm
Only disadvantage → can't take Biopsy.

Tumour Marker
CEA.
- glycoprotein
- >85% - follow up
-
→ Rx - Immunoradiotherapy
↓
anti CEA / I^{131}

Rectal Ca -
Inv 1) TRUS (Trans Rectal Ultrasound)
- for depth T stage
- (node) in mesorectum

2) Endorectal MRI
for local anatomy, * good for node.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Staging - DUKE Stage

A - confined to mucosa
B_1 - in muscle
B_2 - outside muscle
C_1 - in muscle + L.N.
C_2 - outside " + L.N.
D - metastasis

Rx - Surgery

A — Sx
B_1, B_2, C_1 } Sx → CT.
C_2 - CT → Sx — CT
+
RT

CT → FOLFox → Folinic Acid (Leucovorin)
5 FU
Oxaliplatin.
- Cetuximab } → wild RAS. +ve
- Panitumumab }

- Bevacizumab for VEGF

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

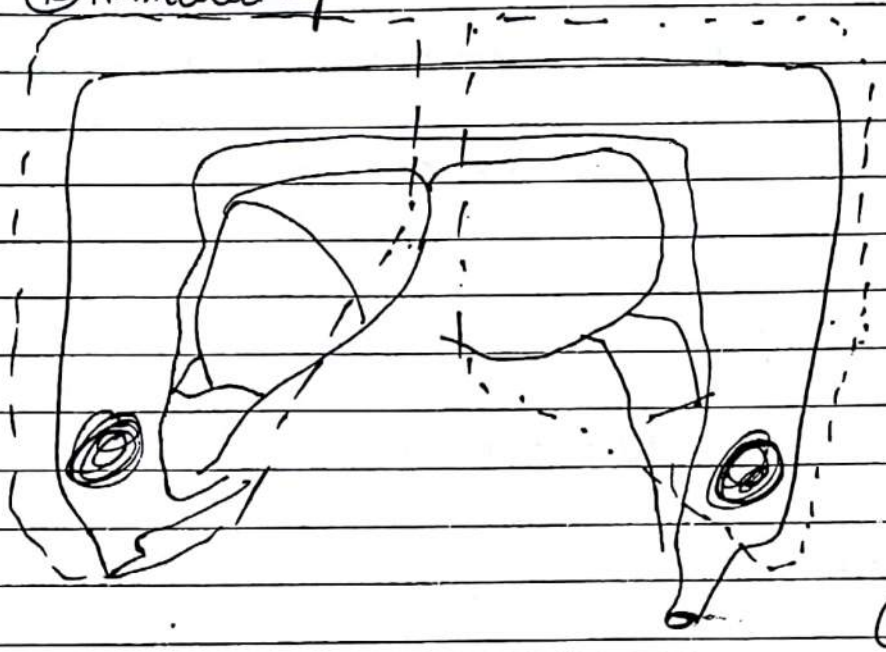
Sx → (R) → (R) Hemicolectomy

(L) → (L) "

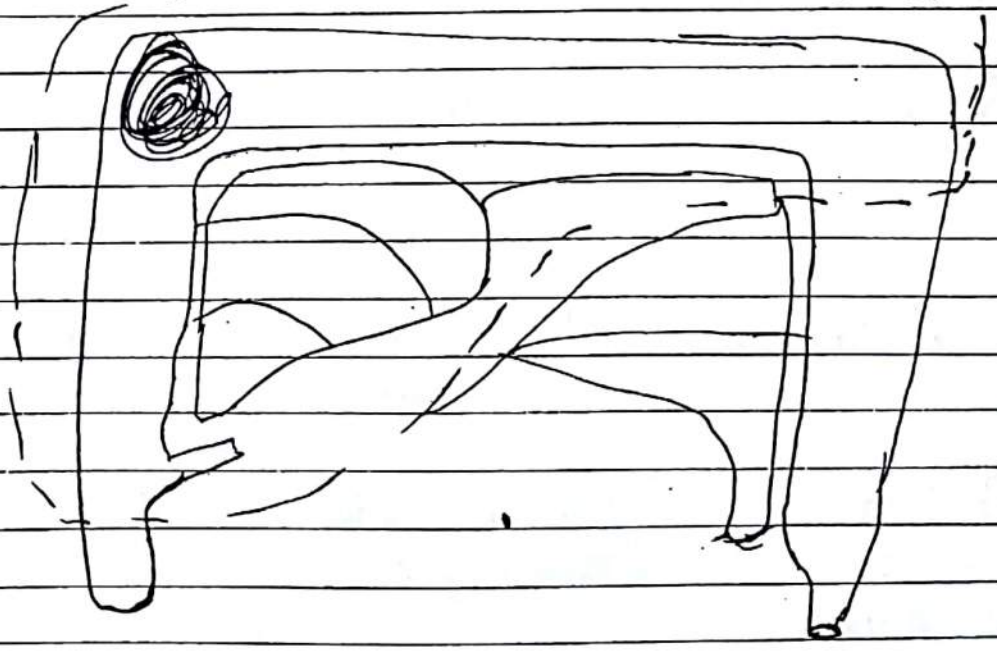
(R) Extendend Hemicolectomy

(R) Hemicolectomy

(L) Hemicolectomy.



(R) Extended Hemicolectomy



Liver 2° are Considered operable in Colon Ca

EKBERG CRITERIA

- <4 in no. } 1cm margin only Liver
- B/L

Late → good prognosis.

Prognostic Indicator-
L. Node

Metastatic Pot^n → Depth.

* KOHNE PROGNOSTIC CLASIFICATION
alk. phosphate
No of metastatic site
WBC
Performance status

* GERCOR PROGNOSTIC CLASSIFICATION-

CRS + HIPEC
(Cytoreductive Surgery) + (Hyperthermic Intraperitoneal Chemotherapy)

↓

T/t of Peritoneal Ca (Carcinomatosis Peritonei)
Pseudomyxoma Peritonei

S_0 - R_2 resection

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

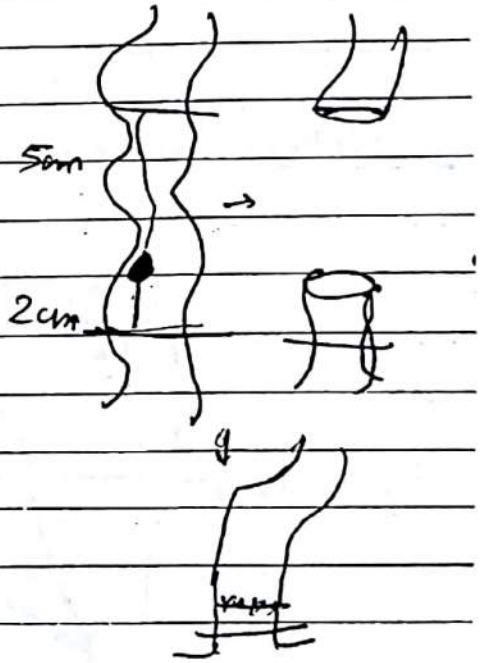
RECTAL CANCER

Rx

① Transanal excision (TEM)
② Ant. Resection
③ APR. (Abdomino Perineal Resection) → MILE's operation Resection.

1> Transanal excision-
- Size < 4cm.
- Anal verge < 10cm.
- circumference < 40%
- T_{is} or T_1. No.

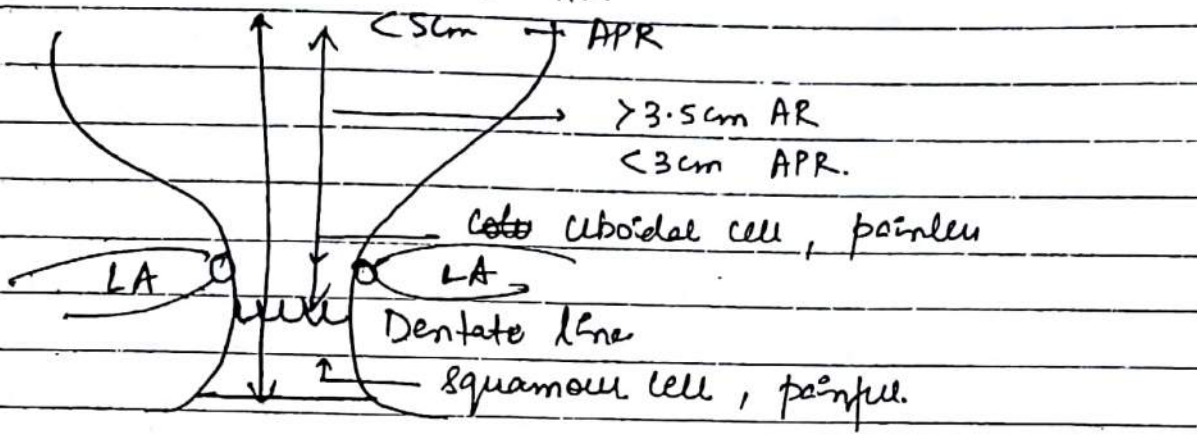
2> Ant. Resection.



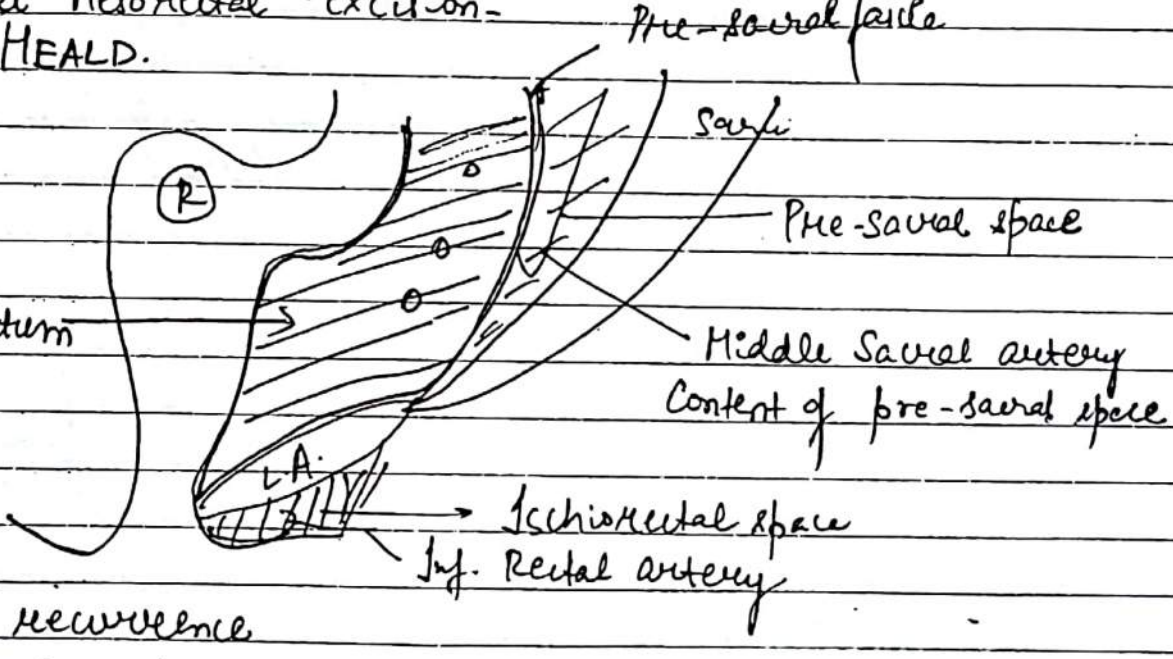
APR

→ followed by End Colostomy

> 5.5 cm → Ant Resection → 5cm → APR.
< 5cm → APR



Total Mesorectal excision- HEALD.



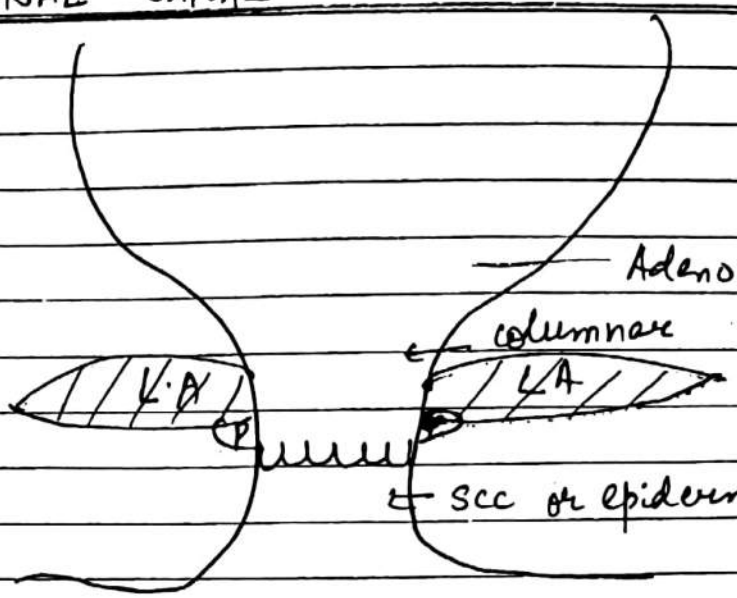
→ ↓ recurrence

Contents of
- Fibrofatty tissue
- L.N.
- Inf. hypogastric plexus
- Sup. Rectal artery

Remove mesorectum upto ⓓ colic artery

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

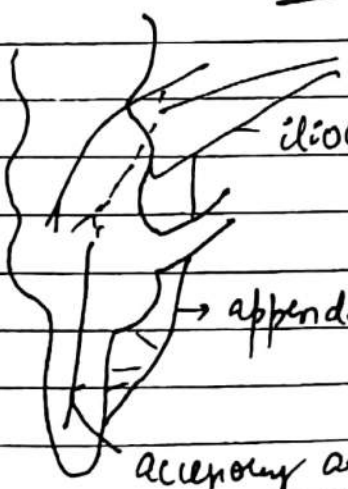
ANAL CANAL



T/t of SCC → GT → RT ← NIGRO's REGIME.
5 FU + Cisplatin (old terms - Mitomycin - C)

APPENDIX

M/c position - Retrocaecal
Recent → Post-ileal.



(artery of Sheshachalam)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Jackson membrane

Valve of Gerlach. → at the appendicular orifice. There is a mucosal fold

APPEDICITIS

M/cc of abd. emergency.
" " " " in ♂

Types
- Obstructive
- Catarrhal
  - visceral peritoneal T10

Murphy's Triad-
Pain → Umbilicus → mcburney's point
Vomiting ↳ parietal peritoneum
Temperature

Pain > vomiting

Mc Burney's Point
At the junc" of 2/3rd medial - 1/3rd lateral

Dieulafoy's Triad.
Guarding
Tenderness
Hyperasthesia
} RIF

Rovsing ~~Sing~~ Sign → Pain in RIF when pressure given at LIF

Cope
Psoas Sign
In retrocaecal appendix
Extension of hip joint causes pain

Obturator sign
internal Rotation of thigh causes pain

Dumphey
Cough causes pain

Aaron Test -
Press @ RIF causes pain in epigastrium

Ten Horn Test -
O', pull ® testis down causes Pain in RIF
Obsolete now.

Bastedo -
Insuflate colon ↑ air → causes pain.

Adler Test -
To differentiate

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Point of tenderness
↓
change position
↓
But no shift in tenderness in appendicitis

M/c D/D in children – Mesenteric Adenitis

Inv
TLC ↑
DLC – polymorphs ↑
CRP ↑ – 100% –ve predictive value

USG → IOC
tubular structure blind ending
non compressible
non peristaltic

length > 6cm, width > 6mm

Doppler → FLAME SIGN.

Prognostic Indicator
ALVARADO Score / MANTRELS Score

M	Migratory pain	-①	Total - 10
A	Anorexia	-①	if >7 ⇒ appendicitis
N	N, V	-①	5-7 ⇒ CECT.
T	Tenderness	-②	
R	Rebound tenderness	-①	
E	Elevated Temp.	-①	
L	Leucocytosis	-②②	
S	shift to left	-①	

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Tzanakis

Tenderness	-4	Total (15)
Rebound tenderness	-3	
Leucocytosis	-2	
USG +ve	-(6)	

RIPASA.

AIRS (appendicitis Inflammatory Reponse Scoring)

Iczbiki Score.

Rx appendicitis → appendicectomy

↓

Delay > 3-4 days.

↓

Appendicular Lump.

Conservative

OS (Ochsner Sherren Regimen)

↓

Pt. is stable

Discharge

↓

> 6wks → Interval Appendicectomy

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

APPENDICULAR ABCESS

1) Extraperitoneal drainage

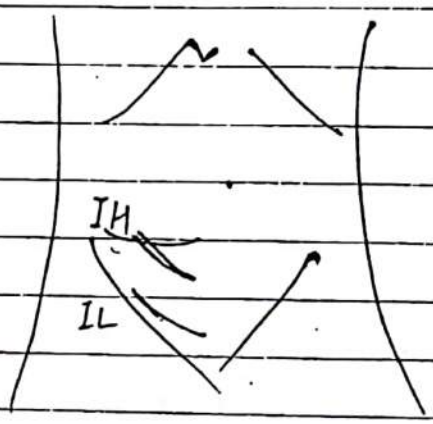
Perforated Appendix → Exploratory Laparotomy
Lavage

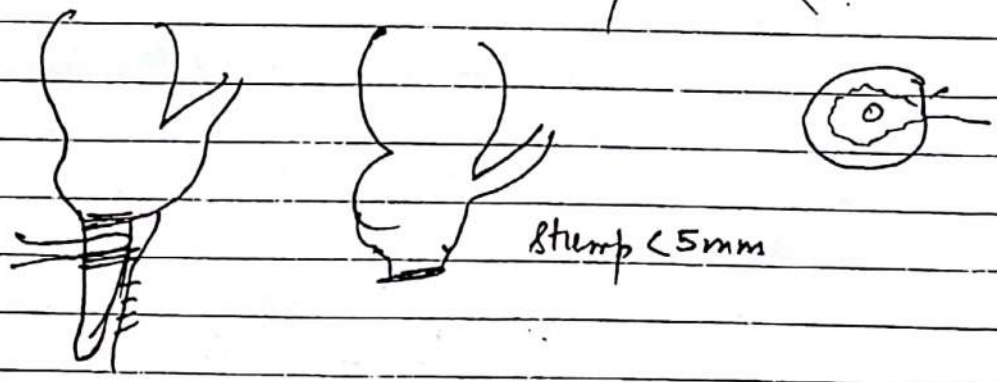
APPENDICECTOMY

1) McBurney's Incision
   ① muscle splitting → Grid Iron incision
   ② muscle cutting → Rutherford Morrison incision

Ilio-hypogastric n/v may get damaged

③ Long incision - Transverse incision





If base is gangrenous → don't crush the base
for ligation → absorbable suture used

In case of Crohn's Disease -
(N) → Leave
Appendicitis → Base involved → Leave
" free → Remove

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

MANEC tumour (Mixed adenoca + neuroendocrine).

Adenocarcinoma + neuroendocrine
>30% >30%
↓
Synaptophysin.
Chromogranin.

VOLVULUS.

Sigmoid → old age. counter clockwise

Caecal young age anter clockwise

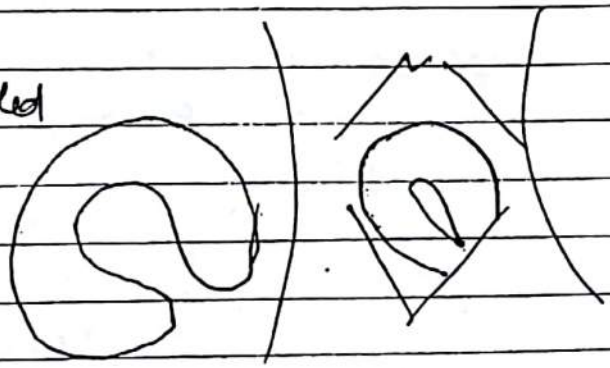
narrow pedicle, long ~~Base~~ Mesentry

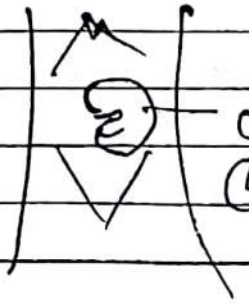
Presentation-
- Pain
- Distension
- Complete obstruction
- Recurrence

Hyper-resonant

Gangrene → Peritonitis

X-Ray- OMEGA SIGN → (R) sided
COFFEE BEAN





Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Ba

- Bird on Prey Sign

Flatus tube / Sigmoidoscope

↓

Try to derotate

↓

Exploratory Laparotomy > Manual Derotation

↓

Sigmoidomesopexy

Gangrene → Resection + Hartman's procedure.

↓

>6wks

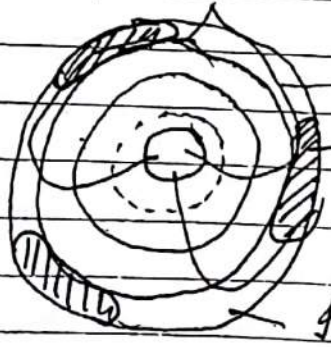
↓

Hartman's closure after bowel preparation.

DIVERTICULOSIS

- Colon > Sigmoid

- Longitudinal muscle in colon is pattern of 3, not all around.

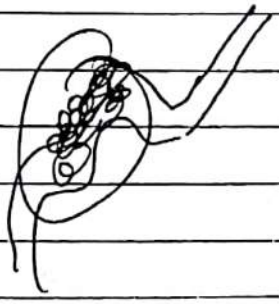


Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

SMA → artery ⊆ bleeds in Diverticulosis

- Diverticulum comes out from inter-tenia area.
- Diverticulosis >50yr.
  ↓
  presents ⊆ Bleeding

M/cc colonic Bleeding / → Diverticulosis
" Massive colonic Bleeding → Diverticulosis
M/cc Bleeding PR in India → Haemorrhoids.



Diverticulitis → Pain/Temp. → ⊕ Iliac fossa
abscess
Perforation
int. fistula → M/c of fistula
ext.

M/c of fistula in young (<50) → Crohn's
" " old (>50yr) → ~~Diverticulitis~~ Diverticulitis.

Inv
1) Barium Enema IOC
   ↳ Saw Tooth Appearance

Diverticulitis → CT Scan - Best Inv

HIENCHEY CLASSIFICATION

I - Localized abscess
II - Distant "
III - Purulent Peritonitis
IV - Feculent "

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Rx- O/I → Drain abscess → Manage Infection
↓
Discharge after recovery
↓
>6 weeks → Resect disease part
↓
Bowel Preparation
↓
Anastomosis.

II / III / IV → Laprotomy → Resect disease
↓
Hartmann's procedure
↓
Reversal after 6 wks after Bowel preparation

ANGIODYSPLASIA (Image)

- Degenerative Cond^{n}
- Involves (R) colon > Ileum
- Mucosal submucosal (vessel) → Bleed
  ↑ dilated / tortuous.

2nd MCC of colonic Bleed

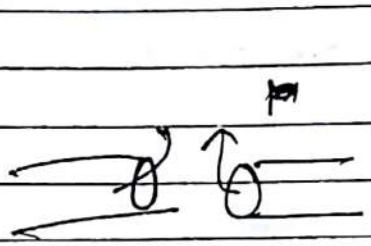
- May be associated c AS - HAYDE SYNDROME

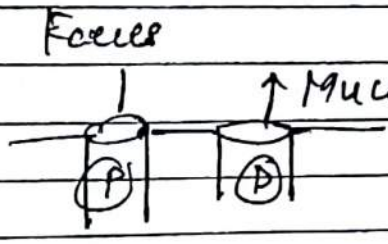
Efficiency of vWF Def^{n}
ADAMTS 13 → ↓ destroy vWF factor

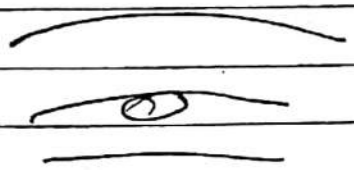
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

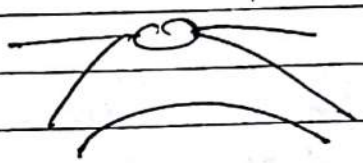
Dx
Colonoscopy -

Rx - Colonoscopic coagulation.



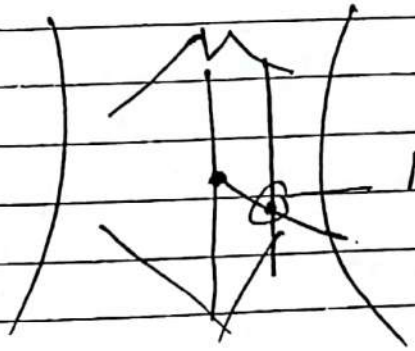






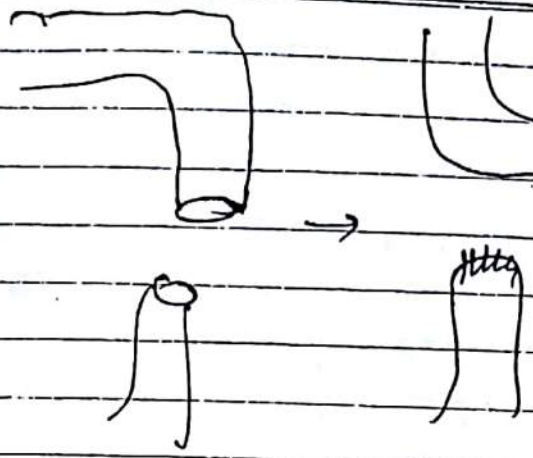
- C is the earliest comp" of Ileostomy = ISCHAEMIA
- " " commonest " " " = Skin Excoriation
- " " " " " Colostomy = Parastomal Hernia
  ↓
  Mucosal prolapse

Parastomal Hernia is the M/c seen in Loop colostomy



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Hartmann's Procedure



No Mucous Fistula

↓

Reversible process

>6 wks

↓

anastomosis

in (L) Colon → 1° closure not done

In case of if 1° closure is done

↓

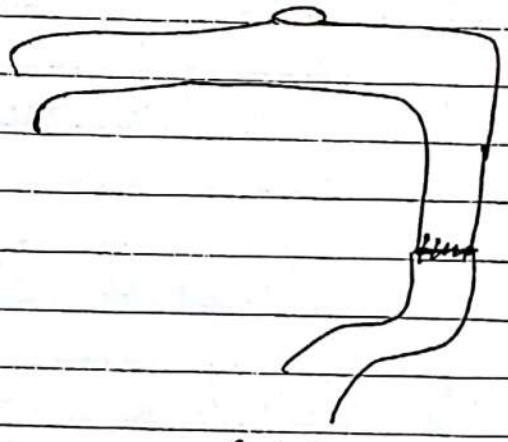
Defunctioning colostomy done

↓

≥6 wks

↓

Reversal



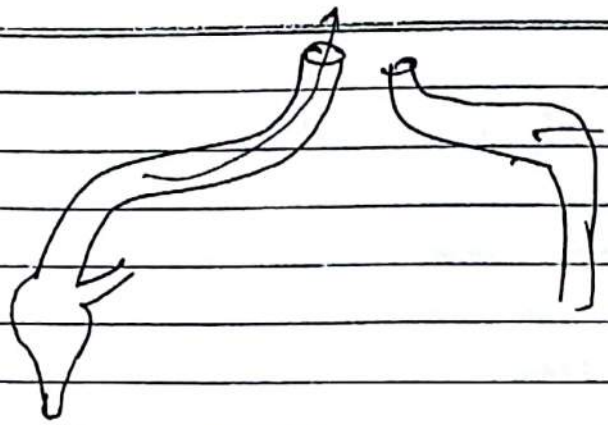
Diversion Colitis

Small intestine → glutamine is req. for mucosa

Large Bowel → Bacteria is req for viability

Carbohydrate in food —Bacteria→ Short chain FA (Butyrate)

Mucosal atrophy of Bowel distal to colostomy/ileostomy



Rx - Butyrate enema
Mesalazine
Steroid enema

NEUTROPENIC ENTEROCOLITIS (typhilitis)
On Chemotherapy

TLC < 1000
(N) < 500
Ileo-caecal junc" →

Inflammatory mucosa → Transmural
↓
gangrene

CT Scan — thickening of caecum
Fat stranding

PNEUMATOSIS INTESTINALIS

1° ↙ ↘ 2°

Submucosal
15%

Require Rx

Subserosal
85%
COPD & connective tissue disorder
CT.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

HIRSCHSPRUNG's DISEASE

Cong. Megacolon

- Aganglionosis
- ♂
- ganglion absent → Submucosal
  → Muscle
- involves Rectosigmoid
- Familial
  Down's syndrome
  MEN 2 - Chr 10 - RET.
  Piebaldism → pigmentation.
  Central Hypo ventilation Syndrome

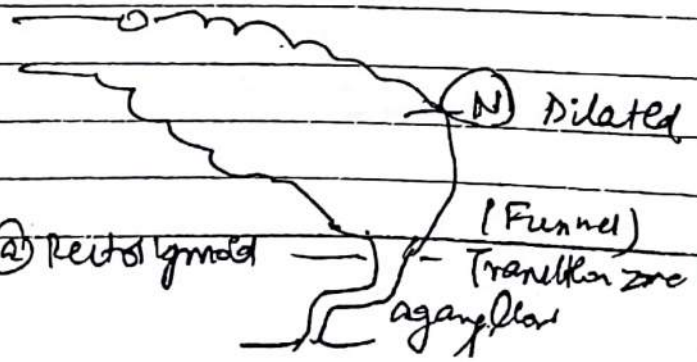
At Birth - Unable to pass meconium.
- Delayed passage of "

PR Exam" → Collapsed Rectum
No rectal ampulla
Rectum grips finger

There can be delayed presentation
No faecal soiling
Distended abdomen
Tense shiny skin.
Dilated veins

Inv - Ba study

Transverse Colostomy



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

② Manometry →
Rectal pressure > Sigmoidal Pressure

③ Gold std – Biopsy
↳ full thickness
1.5 cm above dentate line

Suction Biopsy
→ absence of ganglion
elongated n/v
Hypertrophied n/v
↑ AchE

℞ – ① Swenson
Resection + anastomosis
② Duhamel
③ Soave
④ Georgeson – lap. ~~assisted~~ assisted

RECTAL PROLAPSE

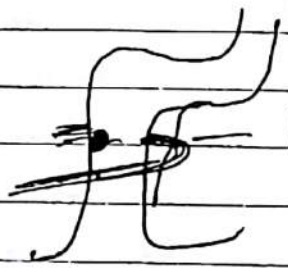
Partial	Complete
< 4cm	> 4cm
Mucosa	Full thickness
Folds, Radial	Circular
young/old.	
℞	
Rule out constipation straining	* Perineal approach
& Mucosal Reposition.	Delorme
Laxative	Altemier
Mucosal excision.	
Goldieu's ligature	
Thiersch wiring.	

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Rectopexy
↳ Litho tomy

By Lap.
Rectopexy
least recurrence
→ ant - (Ripstein) - In India
↳ post - Well's
↳ Lat - Orr - Loygoe

SRUS → Solitary Rectal Ulcer Syndrome



If no relaxation of muscle
↓
mucosal prolapse
↓
ulcer on ant. wall

- ♀
- middle age
- ulcerated lesion on ant. wall
- 5-8 cm. above anal verge
- due to non-relaxation of Pubo-rectalis during defaecation
↓
leading to ant. wall prolapse through puborectalis (int. intussusception)

Presentation -
- Off & on Bleeding P/R
- Mucosa in stool
- incomplete defaecation

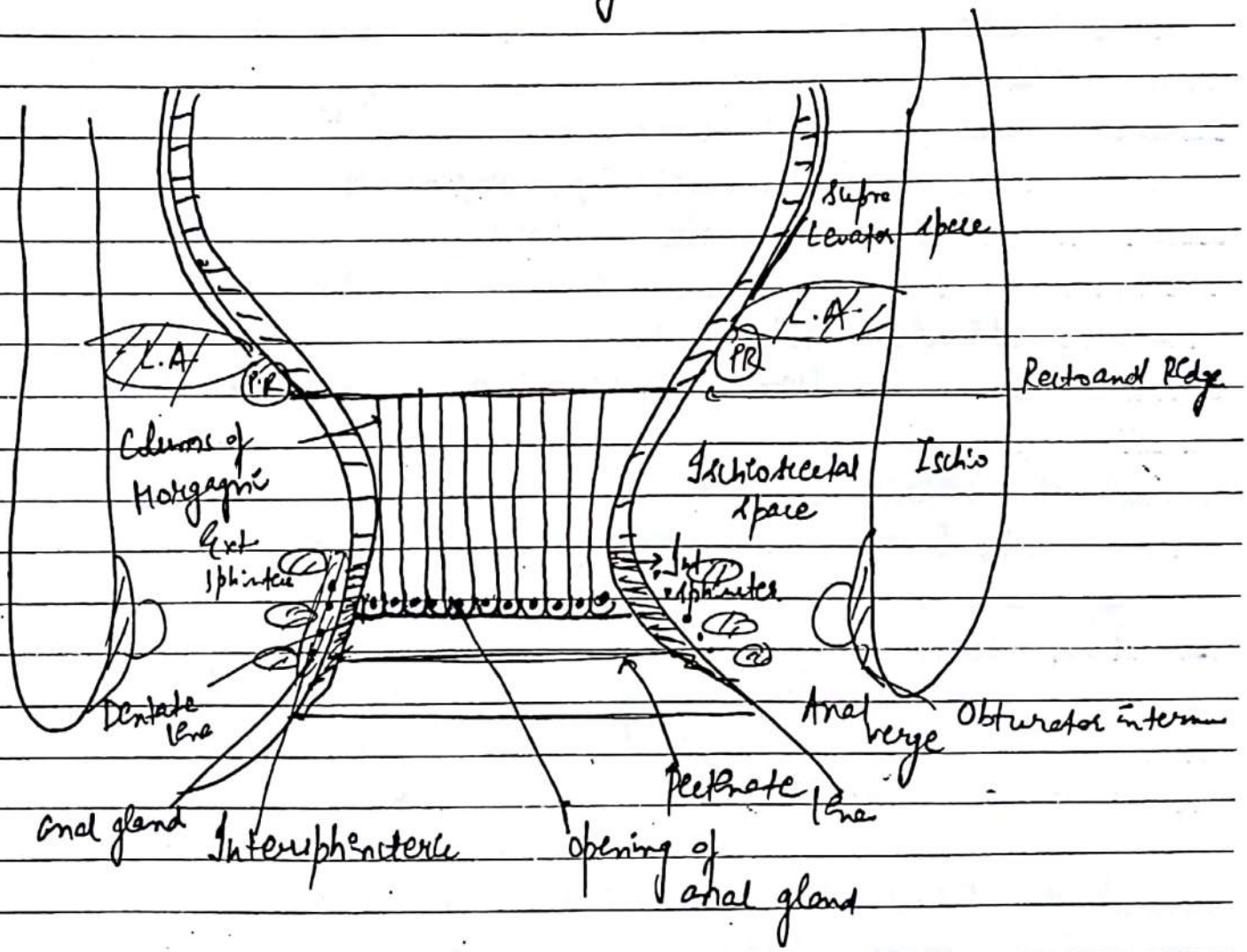
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Inv

4 Sigmoidoscopy

4 Defaecography

3) Biopsy → • Collagen in submucosa
• Colitis cystica profunda
• muscle of muscularis mucosae disorganised.
glandular crypt abnormality



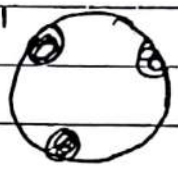
HAEMORRHOIDS

Submucosal bunch of vessel

Internal — Above Dentate line

External — Below Dentate Line

3 1° Pile → 3, 7, 4° clock



Grade

I → Sessile

II → ~~Read~~ Pedunculated
Come out during defecation
go back spontaneously

III → ~~Read~~ Pedunculated
Manual Reposition Required

IV → Bleeding
Thrombosed ~~leaf~~ pile → pain.

Dignosis
- By Proctoscopy

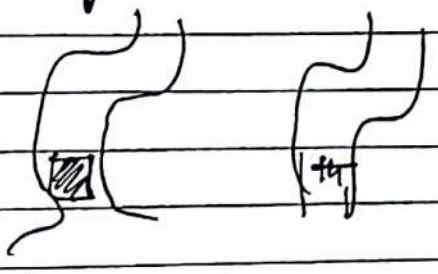
I → Conservative

II → Band ligation. → Barron Band.
Sclerotherapy ↓
Gr II internal

III → ① Haemorrhoidectomy
Open → Milligh Morgan
Closed → Ferguson.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

② Stapled haemorrhoidectomy
Longo's
↓
1.5cm above dentate line

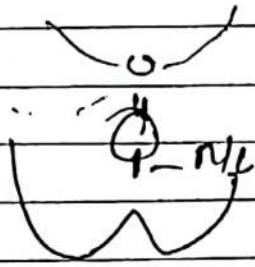


③ Cryo
liq N_2 → freeze → D/c

④ DUHAL (Doppler guided Haemorrhoidal ~~ster~~ arterial ligation)
or HALO
+
Recto-anal Repair

FISSURE - IN - ANO

- Pain - M/c
- Site → 6 o' clock
- Linear Ulcer at ~~middle~~ mucocutaneous junction



Rx - ND P/R or proctoscopy
↓ sitz Bath
Laxative
Analgesic
ointment.
Botox injection

Chr. fissure → skin tag → sentinal piles
fibrous base
↓
Rx - Excision
Sphincterotomy → Lord's dilatation
Lat. sphincterotomy

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

FISTULA

M/c abscess → Peri-anal abscess.

Fistula → abscess ruptured to form fistula.

Intersphincteric fistula → M/c type

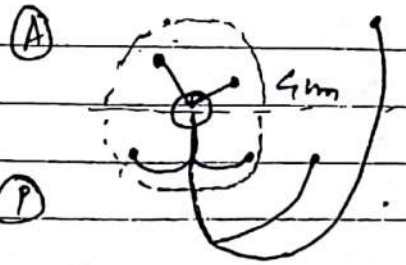
Low lying → below LA.
High " → ~~Hig~~ Above LA.

D_x –
Best → MRI.

Multiple → Crohn's
Colloid Ca
TB
~~LG~~ LGV

R_x – Low – fistulectomy
High – Seton ~~uring~~

Goodsall's Rule



Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

DR. ROHAN

GENERAL SURGERY

SIRS (Systemic Inflammatory Response Syndrome)
It is the bodies response to infection.
Coined for Pancreatitis but used for all
Mediated by (IL-1), (IL-6), (TNF-α).

TLC [< 4000] or [> 12000]
or > 10% Band forms in the smear.

RR [> 20/min]

pCO_2 [< 32 mm Hg]

Temp [< 34°C] or [> 36°C]

PR [> 90/min] [c out the effect of β blockers or inotropes]

Any 2 criteria out of 4 met ⇒ SIRS

SEPSIS
Defined as [SIRS + known foci of infn.]
Severe Sepsis = when sepsis ⟶ hypotension.
but it responds to fluids.

SEPTIC SHOCK - when sepsis ⟶ hypotension
but doesn't respond to fluids

MODS (Multiple Organ Dysfunction Syndrome)
Defined as failure of ≥ 2 organ systems.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

CAUSES OF POST OPERATIVE FEVER :-

Post-OP Day I -1) M/c - Atelectasis - collapse of alveoli

2) incentive spirometer is given to pt.

Day II or III

1) M/c acquired Hospital Infection ⇒ UTI

2) Thrombophlebitis (superficial)
M/c cause → I.V. line insertion.

3) Pneumonia

Day IV or V

1) M/c c of hospital acquired infection in a Surgical pt is SSI (surgical site infection)

↓

2) It is defined as infn at the operated site & can occur in 30 days of surgery.
In case an implant ~~the~~ be is placed,
any infn & occurs in 1yr of surgery is considered SSI

2) DVT
Pneumatic compression Stocking is used for prevention.

Day VI 6th Day - Burst Abdomen or Abdominal Wound Dehiscence can occur.

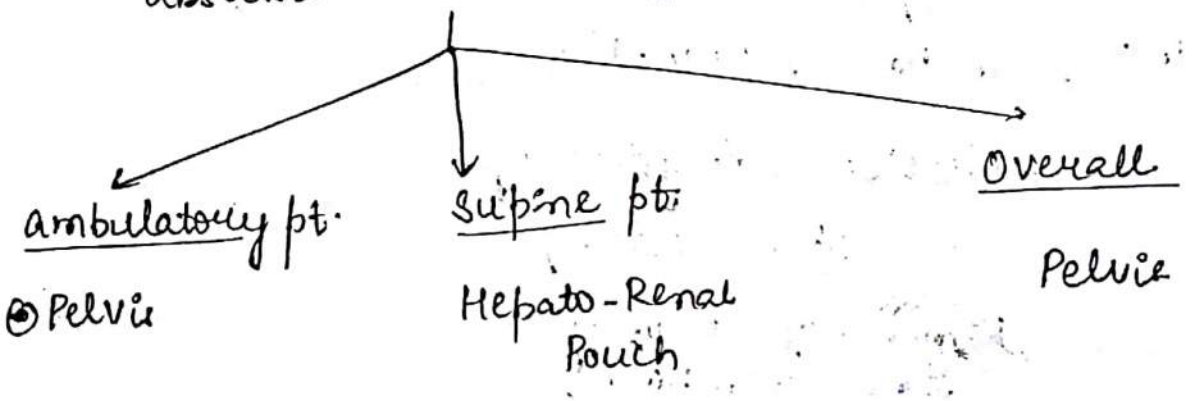
Serous fluid Sign or Salmon Sign

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Emergency Management
↳ Urobag Laparostomy or Bogota Bag Laparotomy.
↓
Urobag placed on the wound, sutured c skin.

Definitive Management
↳ Re-suture the Rectus Sheath.

≥ VII Day
1) Intra-abdominal Collec" or intra-abdominal abscesses.



IOC → CECT

Management → Pigtail Catheter Insertion.
↓
can be used in Liver Abscess also.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

TYPES OF WOUND

Type	Example	% SSI
① CLEAN	Clean incised wound Knee replacement Uncomplicated Hernia Breast Sx except abscess Thyroid Sx CABG	< 2%
② CLEAN CONTAMINATED	GI/GUS when there is no inflammation - elective cholecystectomy - " appendicectomy - Removal of urinary stone when no UTI - Bowel Sx in a prepared Bowel	2-10%
③ CONTAMINATED	GI/GUS when there is inflammation. - emergency appendicectomy - " cholecystectomy - Bowel Sx in unprepared Bowel - Removal of urinary stone when UTI ⊕	≥ 10%

④ DIRTY
- Peritonitis
- all abscesses
- Traumatic wound & has not been damaged > 6 hrs
↓
golden period for traumatic wound

>20%

SCORING SYSTEMS

ASEPSIS

SOUTHAMPTON

Clean case is always 1st case in elective OT List.

Wounds

1° intension
↓
Suture
Better scar
Less contracture

2° intension
↓
Open
more granulation tissue

3° intension / delayed 1° closure
↓
we initially leave the wound open due to infection
↓
once infection subsided in 2-3 days
↓
Re-suture the wound.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

To Reduce Incidence of SSI

1) Handwashing (M/I)
   - For 1st case of Day - 3-5 minutes.
   - For every subsequent case - 2 mins is enough.
   - 3 areas where contamination is missed.
     - Thumb
     - Tips of finger
     - Interdigital cleft.

2) Best way to remove hair from an operative side is (Intraoperative Clipping of Hair.)
   Shaving or de-epilatory cream are associated c a higher wound infn rate as compared to clipping.

3) Prophylactic Antibiotics.
   Best time - (30 min to 1 hour before Sx).
   When do we repeat the dose in case of prolonged Sx - [4hrs]

4) Ideal O.T. Parameters.

4 Zones

PROTECTIVE - change rooms
Transfer bay
Pre & post op rooms
ICU / PACU

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

CLEAN - connects protective zone to aseptic zone
equipment store room
maintenance workshop

ASEPTIC - OT

DISPOSAL - where u dispose all waste.

---

a) Proper zoning

b) Min 10-15 air changes in a hour. Out of ≤ at least 4 should be fresh air changes.

c) 50-60% relative humidity

d) Temp - 21-23°C.

e) Inside theatre, we need to have positive pressure (2 mm Hg above atmospheric pressure).

f) air should flow from ⊛ sterile to less sterile area

PATIENT SAFETY

1) Communication error is the cause of wrong side Sx

WHO surgical safety checklist

Sign-In
- Ward → OT
① Name
② MRD
③ Consent written
④ Site marking ⊕⊖

Time-Out
Before starting Procedure
1) Identify themselves
2) Nurse
Name
MRD No

Sign Out
Before skin closure
1) Nurse
Instrument
Gauze
(radio-opaque lines)

⑤ Prophylactic antibiotic given or not

⑥ Known allergies

③ Surgeon
- surgery
- Expected time
- anticipated blood loss
- any non-routine steps.

② Surgeon
- actual Sx 10
- non-routine step
- equipment failure

④ Anaesthetist
- prophylactic antibiotic
- any allergy
- any non-routine step for concern

③ Anaesthetist
- actual blood loss
- any concerns

ESTIMATED BLOOD LOSS

One fist full of clots → 500 cc
Completely soaked mope → 500 cc

Subtract the amount used for irrigation.

SURGICAL BLADES

No. 11

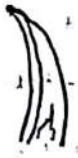
Stab Blade
- To drain an abscess.

15, 20, 21 No.

For skin incision.

Belly of blade → sharpest portion of blade

12 No



For suture removale

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

IV LINES

OGG P:B 24

Orange 14

Grey 16

Green 18

Pink 20

Blue. 22

Yellow 24

Earlier ATLS guideline -② 16 gauge cannula in Trauma pt

Latest ATLS guideline → ② 18 gauge cannula are sufficient

COMMON SURGICAL POSITIONS

1) SUPINE → Mic position - Laprotomy, thyroid, Breast

2) Lithotomy → gynaeco + obs.
Haemorrhoid
Fissure
TURP

If proper padding is not provided
↓
Common peroneal n/v can be injured.

3) Lateral position / Kidney Position.
Thoracotomy
Pilolithotomy [removing stone from pelvis]
Nephrolithotomy

Excessive abduction of arm → Brachial Plexus Injury

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

4) Jack Knife - Knee - elbow position

Because of positional asphyxia. this position is no longer used.

earlier used for haemorrhoid fenure

5) Prone

for spinal Sx

6) Fowler's / Sitting

- Best position for CNS Sx.
- Better exposure especially for posterior fossa
- Blood less field due to gravity
- chances of air embolism is higher due to -ve pressure.
- Can also be used for Breast reconstruction.

7) Neutral Position

Head end ——— Foot end

8) Trendelenberg Position

used for operating Pelvis.

9) Reverse Trendelenberg (RT)

used in lap. cholecystectomy

↳ RT + (R) side Up.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Drawback -

accumulation of gas beneath the ® dome of diaphragm

↓

irritate the diaphragm

↓

® shoulder tip pain → M/c complication following lap chole.

ENERGY SOURCES

Unipolar Cautery

① Machine —Current→ TIP (BOVIE)

↓

Body (cut/coag)

↓

exit through cautery pad on thigh.

If pad is not placed → cautery will not work

② Improperly placed pad can lead to burns at the site of cautery pad

- [cautery pad should have wide area of contact + placed on well perfused area]

③ C/I in Pt. c pacemaker. becoz it. pass through entire body, can interfere c conduction.

Bipolar Cautery

① Circuit is completed bet" 2 paddles.

↓

Cautery pad not required

② safe to use when there are vital n/vs

③ only coagulation can be done

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

④ Becoz there is lateral dissipation of current in unipolar cautery

↓

there can be thermal damage to nearby n/v.

↓

So use Bipolar cautery in such cases.

Yellow → cutting

Low voltage, continuous current

Blue → coagulation.

: high voltage, alternating current

Blend mode-

Combination of both type of currents.

LIGASURE

Uses Heat + Pressure ⇒ Coagulation.

Can coagulate vessels upto 7mm diameter

1st Gen → only coag

2nd Gen → coag followed by cutting

HARMONIC SCALPEL (Image)

1) Oscillatory Blade working on ultrasonic

↳ 50,000 Hz.

↓

Oscillatory movement cause protein denaturation.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

- coagulation can occur ē out heat production.
- can be used close to vital structure
- Precise cut
- ~~Cuts~~ & can cut through scarred tissue as well

PRINCIPLES OF MINIMALLY INVASIVE SURGERY

- CO_2 is the gas used for creating **Pneumoperitoneum**
- No O_2 ∴ air ⇒ they support combustion.
- Pressure to be maintained → 10-14mm Hg.

pneumoperitoneum

- OPEN (HASSON)
  Used in
  - Pregnant
  - Abdominal adhesions
- VERRES (Image)
  - Stopvalve tnt to regulate CO_2,
  - Blunt tip. normally.
  - But when u push it against hard surface, blunt tip retracts ∴ cutting tip
  - ↓
  - when it cuts through the abdomen, Blunt tip comes back so that Bowel doesn't damage.
  - ↓
  - Spring loaded ~~began~~ needle

- To confirm whether
  (i) Inject 5-10cc of saline through needle.
  ↓
  Saline should go on freely ∴ if u try to aspirate → nothing

② If u put a drop of saline
↓
It gets sucked in peritoneum

Put In Trocar.
↓
Through Trocar instruments are put

* If Bowel ~~Abdominal~~ Injury due to Trocar.
↓
Convert into open surgery
but keep Trocar in position.

* Laproscopic instruments → Black throughout except tip
⇓
for insulation & ensures current only acts at tip.

* If there is break in insulation
↓
Current leak out through Trocar
↓
Burns abdominal Wall.

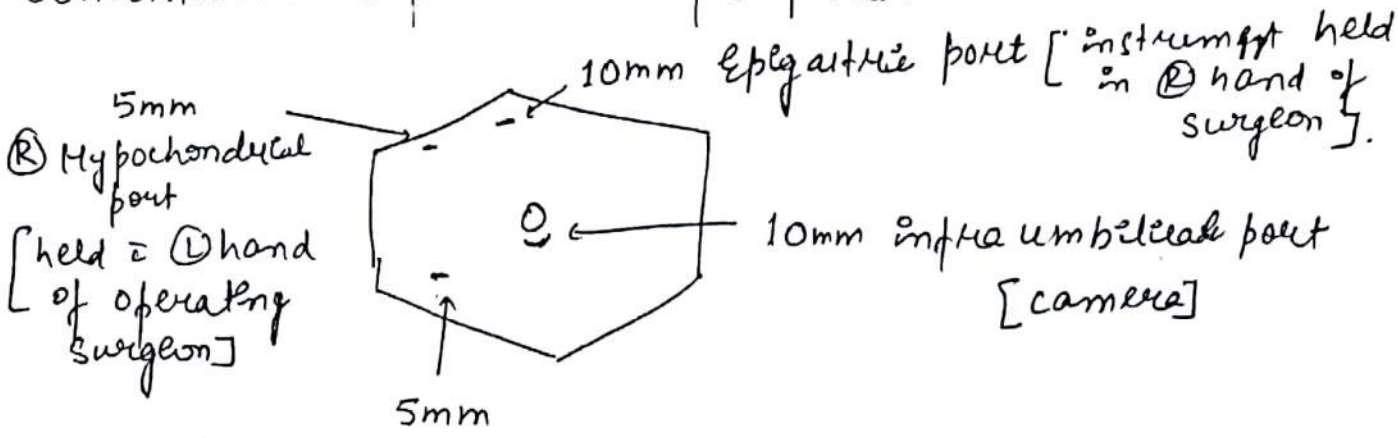
Capacitans
↓

How to prevent

① Maintain Proper Instillation
② Use Plastic Trocar.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Conventional Lap → multiple ports.



During lap chole, Surgeon, Person holding camera → Both stand on Ⓛ side.

SILS (Single incision laparoscopic Sx)

we use SILS port

↓

multiple openings in it

15mm infra-umbilical incision

↓

SILS Trocar is inserted

↓

All instruments through this

NOTES (Natural orifice Transluminal endoscopic Sx)

Through [uterus] → M/c orifice used.

Bladder

Oral cavity

Rectum

Umbilicus has no hole

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

ROBOTIC SURGERY

DA-VINCI Robotic Sx

Robotic Sx

Adv of Robotic Over Lap

1) 3D vision
2) More freedom of movement [7 degrees].
3) Better dissection
4) Faster recovery
5) TREMOR REDUCTION
6) Scaling of movement is possible
   ↳ ensures better dissec", suturing

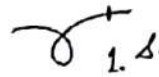
Disadvantages

1) Expensive
2) Longer ~~curve~~ learning curve.
3) Loss of tactile feedback.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

SUTURE

- 3 instruments req. for ~~suture~~ Skin Suturing
  - Needle Holder
  - Toothed Forceps
  - Plain scissors

- Square throw
  - If crossed once. —+—  1. square throw

- 2 square throw = Reef knot / Square knot
  - Secure knot
  - doesn't open up.

- Granny's knot / Slip knots
  - knot is made but sides are not crossed.
  - Insecure knots.
  - can open up

- Surgeon's knot square throw
  - crossed once & ~~2nd~~ again in 1 go
  - crossed once in 2nd go. (Square throw)

- Secure knot

Skin suturing — Bowel ~~suturing~~

- everted edges
- Mattress sutures required.
  (when ends get inverted)

Horizontal	Vertical
↓ same depth, adjacent side. ↓↓ everted + Haemostatic [Least cut through rate]	go deep to other side come back on same line superficially

- **Subcuticular Suture**

Skin has no marks.
Sutures are made from inside the edge
Best suture material → MONOCRYL

- **Aberdeen's ~~Suture~~ knot / Cobbler's Knot**

- correct way of tieing a continous suture
- Start ☜ 1 thread.
  ↓
  left ☜ 1 thread

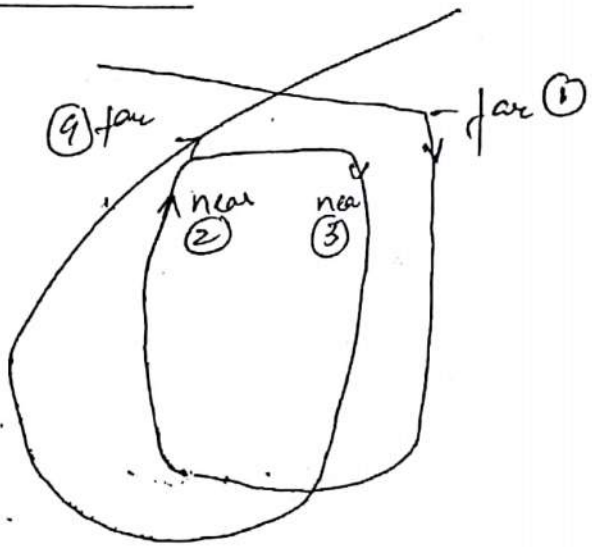
↓
take 1 finger + pull out multiple times.

- **Running - locked suture**

Advantage → Better approximation.
" Haemostasis

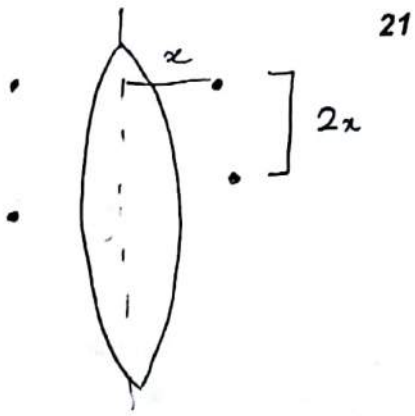
- **Far - near - near - Far suture**

- approximation
- Filling of dead space
- Tension is adequately distributed



Q. Lacerated wound,

Depth . x cm.



Ideal distance bet^n 2 sutures. = 2x.

Ideal distance bet^n bite & lacerated end = x

SUTURE MATERIAL

MONOFILAMENT

- Single
- Stronger memory as compared to braided.

[Memory = tendency of suture to resist a knot]

- Open up easily
- So multiple ~~sature~~ knots to ensure doesn't open-up

Monocryl
Nylon
PDS [Poly Dixol].

BRAIDED

multiple threads intertwined

- Higher wound infect^n rate due to crevices.

Vicryl
Silk.

ABSORBABLE SUTURE MATERIALS

Natural

Catgut → derived from gut of sheep of [submucosa]
undergoes proteolytic degradation
hold the tissue for 3-5 days.
(tensile strength)

Chromic catgut
hold tissue for 7-10 days
Rate of catgut in Sx ↓
↓
use only for approximation of subcutaneous.
Catgut is originally 1:1 layer in 2 layer Bowel anastomosis
But now replaced by vicryl

Synthetic

Monocryl
- Best for subcuticular
- Simple

Vicryl / Polyglactan
- Purple
- Braided
- Dissolves in 60-90 days

Vicryl Rapide
↓
dissolves in 10-12 days

Vicryl (+)
↓
Antibiotic coated vicryl

USES of Vicryl

1) S/c tissue
2) Bowel anast } → knot should be outside.
3) CBD
4) Bladder

PDS / Polydioxone

- Dissolves in 180 Days
- Monofilament
- use → same as vicryl

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

NON-ABSORBABLE SUTURE

NATURAL

SILK

Braided

Uses
- Skin
- 2nd Layer of 2 layer Bowel anastomosis

COTTON

SYNTHETIC

I) **PROLENE / POLYPROPELENE**

1. Mesh
2. Rectus Sheath closure [Jenkins theory of mass closure]

Ideal length of suture required = 4 times the length of wound

3. Vascular anastomosis or Vascular repair.

II) **POLYESTER / ETHIBOND**

III) **NYLON (ETHILON).**

Monofilament suture used for skin suturing

Natural suture material have antigen → so more inflammation.

So, most inert → **Synthetic Non-absorbable**

Barbed Veryl - No need to tie a knot as spikes are ⊕ on it

Drawback - Painful
" If it migrates, tissue will open up

STEEL SUTURES

- To Close sternotomy incision.
- Shoulder Repair → originally steel sutures were used.

SUTURE THICKNESS

No. 1 → Thickest → To hold drains, Silk is used

1-0

2-0

3-0

4-0 → for skin., Monocryl is used

9-0 → Microscopic Sx like microvascular anastomose.

10-0 Prolene is used.

11-0 → Finest

For Rectus sheath → No. 1 Prolene

Bladder - 1st layer - vicryl

2nd - Silk

Tendon - Nylon.

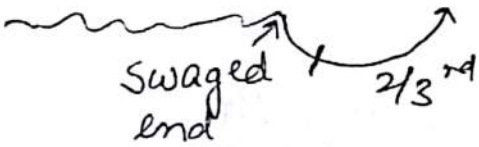
Cataract - 10-0 silk.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

SUTURE REMOVAL

1. Scalp → 7-9 days
2. Face → 3-5 days
3. Neck → 5-7 days
4. Thorax → 10-12 days
5. Abd → 12-14 days
6. Perineum → Men 14 days

NEEDLE



Where thread is attached.

Ideal place to hold needle- 1/3rd from swaged end
2/3rd from pointed end.

NEEDLE

CUTTING / REV CUTTING

Triangular
Apex → inward of concavity

Used for tough str. like skin.

Apex - outward to concavity

ROUND BODY

Rounded cross-section.

Atraumatic

Used for Delicate str
1) Bowel
2) CBD
3) Ureter.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Q. Pt. has undergon Burst Abdomen.

↓

Pt is planning Urobag / Bogota Laparostomy

↓

c suture to be used

3-0 round Body Silk	2-0 Round Body Nylon
2-0 cutting Nylon	3-0 cutting Vicryl

PRINCIPLES OF PLASTIC SURGERY

Langers → Parallel to the action of m/s
Incision along this line → good scar
But this was found wrong later becoz he described this in cadaver.

KRAISSL → Relaxed tension lines.
⊥ᵣ to M/s action

BORGES → For incision over the face

SKIN GRAFTING

GRAFT

Any piece of tissue that doesn't have its own blood supply

FLAP

It has its own blood supply

SPLIT THICKNESS SKIN / THIERSCH GRAFTS

THIERSCH — Thin

DONOR

1) M/c Donor Site
   → Thigh → followed by Buttocks

2) Larger Donor area

3) Can be raised using a HUMBY's knife or electric Dermatome
   ↓
   Petechial haemorrhages are seen as graft is raised [it means right thickness]

4) Require just dressing

5) Donor site can be re-used for grafting

6) Max. duration for storage in Skin Banks.
   2 weeks at 4°C

WOLFE's GRAFT (full thickness)

M/c site - Post-auricular skin
Supra or infra clavicular fossa

can be raised through blade

require suturing

can't be used again.

*) Meshing is done
  ↓
- ↑ surface area by 1.5 time
- prevent fluid accumulation beneath graft

RECIPIENT

① Better survival rate

① More resistant to trauma

② cosmetically better
Better colour matching

Skin Graft Survive by 3 method

① Imbibition → last for 24 hour.

② Inosculation → for 1-3 days

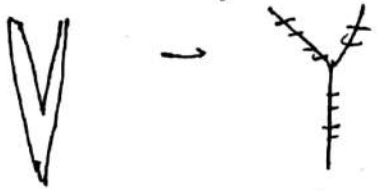
③ Neovascularization → beyond 3 days.

FLAPS

*RANDOM FLAP

- Flap is not based on named blood vessel
- Failure chances are high

1) V-Y Plasty



incision → suturing

it causes elongation of wound
So, it is used for Post burn Contractures

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

2) Z Plasty -

incision.

- Transposition of 2 flaps
  ↓
  causes elongation of wound
- Ideal ∠ is 60° → 1.7 times elongated of wound.

3) Rhomboid flap / Lindberg -
used for Pilonidal sinus surgery

* AXIAL FLAP

Rotated but based on a named BV.

M/c used flap for Head & Neck. → Pectoralis Major Myocutaneous flap (PMMC)

Based on Pectoral branch of thoraco-acromial Vx.

Deltopectoral Flap
Based on 2nd - 4th perforator of internal mammary artery
Rotated laterally

- Abbey Estlander
  used for reconstruction of upper lip . angle of mouth.
  Based on labial vessels.
- Lattissimus Dorsi Flap → elliptical incision.
  - used for Breast reconstruction ↓ swing forward.
  - Based on thoraco-dorsal vessels

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

TRAM FLAP

↳ Transverse Rectus Abdominis Myocutaneous Flap

Used for Breast Reconstruction.

elliptical incision following rectus M/s & rotate upwards cutting

Based on sup. epigastric (axial) or inf. epigastric (free)

↓

If both vessels used

↓

Super charged Tram

Disadvantage → chances of abd. wall hernia ↑

* FREE FLAP

When we disconnect tissue from Donor Site & carry out microvascular anastomosis at the recipient side → k/n/a free flap

↓

Prolene is used

eg. for mandibular reconstruction → free fibular graft

↓

Based on Peroneal vessels.

Belt Flap for ANDY GUMP DEFORMITY

↓

floor of mouth hangs when ant part of mand'ble resected

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Forearm Flap → Based on Radial artery

DIEP Flap Best Flap for Breast Reconstruction

↳ Deep Inf. epigastric artery Perforator

Elliptical Incision
↓
Only taking fat no muscle
↓
Reduced incidence of hernia +
fat reduced from abdomen.

* Best way of monitoring perfusion of flap
↳ Trans-cutaneous Doppler

SIGNS OF FLAP COMPROMISE

Arterial Block	Venous Block
Temp - cold	Warm
Colour - Pale	congested
Capillary Refill - Delayed	Quickly
Pin Prick ↓ blood flow	↑ blood flow

In Both Cond" → Flap appears oedematous

SURGICAL NUTRITION

BASAL ENERGY EXPENDITURE (BEE)

(1) Mild Trauma / (N) → (1) 20 kcal / kg / day

(2) Mod. Trauma / Sepsis → (1.4)

(3) Sev. Sepsis → (1.8)

(4) Sev. Burn → (2) 40 kcal / kg / day

NUTRITION

Enteral >> Parenteral

Going through gut — through vessels

(1) Physiological

(2) Cheap

(3) maintain entero hepatic circulation
↓
prevents cholestasis

(4) Keep intestinal microvilli patent

(5) *Prevents translocation of gut bacteria

ENTERAL NUTRITION

Mouth

If unable to eat
- < 2-4 wks. → NG Tube / NJ tube
  - good gastric emptying → NG.
  - poor gastric emptying → NJ
- > 4 wks. or unable to insert NG / NJ tube → Feeding gastrostomy or feeding jejunostomy
  - ↑ risk of aspiration

STAM
- ↓
- Stab incision on bowel ī tube
- ↓
- Disad - ↑ peridroin leakage

WITZEL
- ↓
- Keep tube on surface & create a tunnel & then insert into bowel
- ↓
- Less leakage

PEG + Tracheostomy (Sick Pt.)
- ↓
- only for gastro-ostomy
- Percut. endoscopic gastrostomy
- ↓
- upper GI endoscopy
- Put it under ant. surface.
- ↓
- incise ~~Hernia~~ at Rt side
- Push / Pull / Introducer

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Comp^{n} of enteral feeding

(1) Osmotic Diarrhoea Mc

(2) Tube related complication

a) Block

b) Migrate

c) Peridrain leakage

PARENTERAL NUTRITION

Indication -

1) High output Faecal fistula
>200 cc / 24 hr.

2) Acute episode of IBD

3) Prolonged paralytic ileus

4) Initial Phase of acute sev. Pancreatitis

5) Short Bowel Syndrome

Def^{n}

Adults

<100 cm of CI in the presence of ICJ^{n}

<150 cm of SI in the absence of ICJ

Children

<~~150~~ 40 cm of SI in the presence of ICJ

<60 cm of SI in ~~presence~~ absence of ICJ

Management -

(1) Long term TPN
or

(2) SI Transplant
or

③ Surgery

BIANCHI

Open Bowel
↓
Split it into 2
↓
Roll over & anastomose
↓
Double the length

Disadvantage

1) Luminal compromise
2) Blood supply compromise

STEP

Serial Transverse entero plasty

↓

Transit time ↑
↓
So more absorption.

Disadvantage

① Luminal compromise
② Blood supply compromise.

TPN

IV
(Peripheral)

Central Vein
Subclavian - M/C

- 1-2 Lts/24 hrs
- Rest of the fluid Req - DNS/RL
- 40-50% → Carb.
  30-35% → FAT
  15-20% → Proteins

Trace elements + Vitamins also present.

On the basis of Carb. content

→ Low-osmolar
Preferred in Pulmonary failure pt.
(less CO_2 formed from carb. metabolism)

→ High osmolar
Resp. Quotient > 1

↑ risk of venous thrombosis

Comp" of TPN :-

→ Central Regime

1) Pneumothorax
2) arrhythmia
3) air embolism.
4) Thrombosis

M/C → CIS / CRS
(Catheter induced / related sepsis)

→ Feeding Regime

M/C overall → Hyperglycemia
1) Trace element Def"
2) Vitamine Def"
3) Biliary stasis
Cholestasis is imp. reason to hold TPN

Refeeding Syndrome

Chronic malnourished pt. [catabolic] → Large quantity of TPN → Re-feeding syndrome

↓
anabolism starts

Mg^{2+}, PO_4^{3-} → Required inside cell → cell

energy ← insulin → K↓

↓

This leads to
Hypomagnesemia
" phosphatemia
" kalemia
Fluid overload

Associated ē arrhythmia & congestive heart failure

SHOCK & TRAUMA

HYPOVOLEMIC SHOCK

CLASSES	I	II (Compensated)	III (Decompensated)	IV
% Blood vol Lost	0-15%	15-30%	30-40%	>40%
Amount of Blood lost	400-500cc	1L	1.5L	>2L
PR	(N)	↑	↑	Not Recordable
SBP		(N)	↓	
DBP		↑	↓	
PP		Narrow.	narrow.	
UO		(N) or ↓	↓	Anuria
RR		↑	↑	↑↑
Mental Status		Thirsty.	Confused.	Comatose
Management	oral liq.	IV crystalloids. [NS or (RL) ↓ if trauma not mentioned]	IV crystalloid + colloid in 3:1 ratio.	Control loss + Massive BT.

Blood Loss → Sympathetic system → Adrenaline → ↑ PR
Nor-ad

↳ Peripheral vasoconstriction

SBP (N) ← adequate cardiac output ← ↑ venous return ← cold extremities.

↑ Peripheral vascular resistance

↳ DBP ↑

Warm ext. → ↓ resistance

Cold ext → ↑ resistance

⇓

Compensated Shock

Non-pneumatic anti shock Garment

1-6 no.

Reduces peripheral ~~loss~~ perfusion

* shifts blood toward Heart

Best ~~Rest~~ Indicator of fluid resuscitation in shock

↳ Urine output

Best Indicator to determine amount of blood required for resuscitation → CVP.

SHOCK INDEX

HR/SBP

if >0.9 → higher mortality

Best MODIFIED SHOCK INDEX

Q. HR/MAP.

Better indicator

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

ROPE

HR/PR

If >3 ⇒ ~~Pt going into~~ More chance of pt. going into decompensated shock

MASSIVE BLOOD TRANSFUSION

>10 units of Blood /24hrs

or

Replace the entire circulating Blood vol in 24hours.

Comp^{n} :- 1) Hyperkalemia → RBC lyse to release K^+

2) Hypothermia.

3) Hypocalcemia

Becoz citrate (anticoagulant) chelates Ca.

4) Coagulopathy

as platelets ↓ & clotting factors ↓

Leading cause of death in pt. ☆ massive blood Transfusion.

Q PRBC : FFP : Platelets = **1 : 1 : 1**

CONTROL BLEEDING

① Pressure

② Patience

③ Packing

	Hypovolemic	Cardiogenic	Neurogenic [spinal cord Transection]
PP	↑	↑/↓	↓
CO	↓	↓	↓
SBP	↓	↓	↓
PVR	↑	↑	↓
JVP	↓	↑	↓

Cardiogenic

Heart not working → ↓ CO → ↓ SBP

↓

Less Blood in periphery → Cold extremities

↓

PVR ↑

JVP ↑ due to backlog

Neurogenic

Sympathetic system inhibited

↓ PR ↓

↘ Vasodilation

↓

Pooling of blood

↓

warm

↓

PVR ↓

↓

↓ Venous Return

↓

↓ JVP

↓

↓ CO

↓ SBP

Anaphylactic shock

↑
↓
↓
↓
↓

eg Mismatch B.T.

Anaphylaxis

Histamine

↓

Vasodilation.

Sympathetic system intact

↓

PR ↑

Septic Shock

Warm

↑
↕
↑
↓

(N)

Hyperdynamic circulation

PR ↑

CO ↑

Cold

↑
↓
↓
↑
↑

In late phases of sepsis, bacterial Toxins suppress the myocardium.

↓

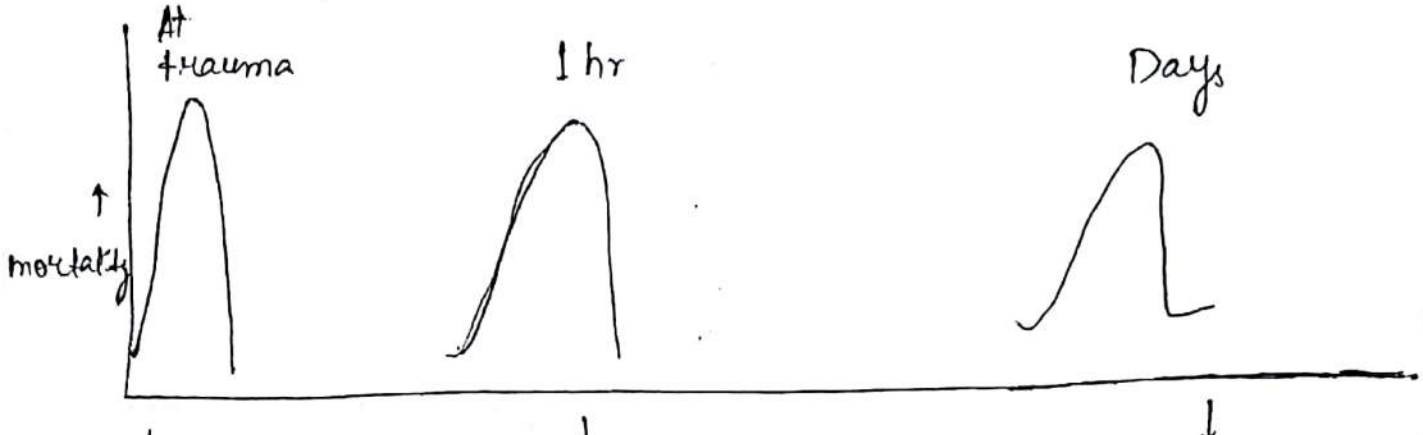
Cardiotoxic

↓

(Same as cardiogenic)

TRAUMA

3 spikes of mortality



- massive head injury
- aortic transection.

Cardiac Tamponade
Tension pneumothorax
Haemothorax
Haemoperitoneum

Sepsis
Delayed head injury

1 hr → golden hour following trauma

TRIAGE

Done in case of mass casualty event

Red → Req. immediate intervention
- Active bleeding vessel
- Tension pneumothorax
- Cardiac tamponade
- Haemothorax
- Haemoperitoneum.

Yellow – Req. admission + stabilization.
But intervention can be done latter.

eg. # shaft of femur

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Green → Walking wounded pts.
minor laceration.
First aid + medicine

Black → Dead Bodies or Moribound

ATLS	BLS/ACLS
In Trauma	In Cardiac Pt.
ABCD	CAB

ATLS

1° Survey

ABCD +
Life threatening injuries
↳ Cardiac Tamponade
Pneumothorax
Haemo thorax
↳ peritoneum.

2° survey

Detailed survey
(look for all other injuries)

Back
LOG ROLL
Q. 5 people Required for effective log roll

AIRWAY
Cervical spine —F/B→ airway
*Danger Sign s/o Cervical spine injury
① comatose
② Head injury
③ Restricted neck movement
④ Bruising over C-spine.

Whenever in doubt → Put Cervical collar

* Indications to achieve airway :-

quickest way to ask airway → ask the name
↓
If speaks ⇒ airway fine

1) Comatose pt.
2) GCS ≤ 8
3) Unable to speak
4) Sev. maxillo-facial trauma
5)

Oro-tracheal Int
Common
But in pt ī sev maxillo facial injury, 1 attempt of Oro-tracheal Int fail. do not attempt again

naso-tracheal
C/I in ant. skull base # (cribriform plate)
↓ avoided in maxillo-facial injuries.

Sev. maxillo-facial Injury

Emergency
needle cricothyroidotomy
↓
- infiltrate local anaesthesia
- Stab cricothyroid memb. ī 11 no. needle
- Put tube

- 4-6 mm tube
- 20 mins [as CO_2 starts accumulating]

avoided in children < 12 yrs bcoz it can lead to subglottic stenosis

Definitive
↓
Tracheostomy

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

BREATHING

- Put pt on Ventilation.
- Identify → Tension pneumothorax
  Cardiac tamponade

CIRCULATION

② Large Bore IV line → 18 gauze.

In Trauma.

↓

IV crystalloid [NS preferred in Trauma]

Unable to insert IV line

- Emergency
  - ↓ Venous cut down
    ↓ great saphenous vein.
    (just ant. to medial malleolus)
  - Intraosseous Infusion
    ↓ Pierce tibia just below tibial tuberosity
    ↓ (fluids drugs)
    ↓ earlier children < 6yr age
    Latest → any group.
- Definitive
  ↓ central line
  H/c → IJV

DISABILITY

Pupillary Response

GCS
Min - 3,
Max - 15
Dead Body - 3

Eye opening

E_4 → spontaneous eye opening

E_3 → on verbal command

E_2 → painful stimulus [sternum or supra-orbital ridge]

E_1 - no eye opening

Verbal response

V_5 - normal speech

V_4 - confused

V_3 - inappropriate words

V_2 - incomprehensible sounds

V_1 - no speech.

V_T - $\bar{c}$ tube (1T)

Motor response

M_6 - (N)

M_5 - localizes pain

M_4 - $\bar{c}$ draws away from pain

M_3 - ab (N) flexion (decorticate rigidity)

M_2 - Ab (N) extension (decerebrate)

M_1 - NO

Q. 20yr old ♂, RTA., Intubated @ site the accident 2hrs later brought to emergency. Spontaneously opening & closing eyes. Moving all his limbs.

Max. → 11T [$E_4 + M_6 + 1T$].

* Same pt in emergency.
  (L) Hand localizes pain ←
  (R) " abn flexion
  Motor Score? → (5) → Highest motor response is noted

Mild - 13-15
Mod. - 9-12
Severe - <8

4/2/18

ABDOMINAL TRAUMA

1) M/c organ injured in Blunt abdominal Trauma = Spleen
2) M/c organ injured in penetrating " = LIVER > SI
3) " " " Gun shot wound = SI

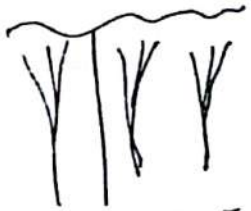
SEAT BELT SYNDROME -

Abdominal organs get compressed between vertebral column & seat belt
M/c organ injured = MESENTRY

DECELERATION Injury.

Mobile contents move foward, retroperitoneal organs stays there
↓
Tear @ Junction ⇒ DJ flexure.
>
Ileo caecal Junc^{n}

BOWEL INJURIES



Longitudinal ~~Injury~~ Tear/~~Injury~~

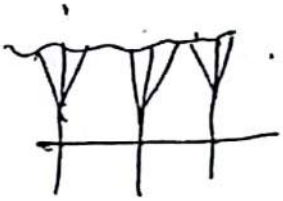
1 vessel gets injured
but adjacent vessel also
supplies the area

⇓

Hence no loss of vascularity

⇓

R_x - only repair the tear



Transverse ~~Injury~~ Tear/
Haematoma

vascularised in both

R_x - resection *
anastomosis

BLUNT ABDOMINAL TRAUMA

	Haemodynamically Stable	Haemodynamically unstable
First Inv	FAST	FAST
Ioc	CECT	

FAST - focused assesment sonogram in Trauma

Advantage → Saves time
2-4 min is required.

Probe - (4)

① epigastrium for cardiac tamponade

② ® Hypo Chondrium

③ (L) Hypo Chondrium

④ Suprapubic region

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

eFAST → Extended FAST

Probes – 4 + (2?)

↓

pleural cavities

BOAST (Bedside organ assessment Sonogram in Trauma)

same as eFAST.

FAST

↓

any collection on FAST. (FAST ⊕)

↓

Laparotomy [midline incision in Trauma]

PENETRATING ABDOMINAL TRAUMA

~~If wound is superficial to peritoneum.~~

wound – superficial to peritoneum

no peritonitis.

pt is stable

↓

Locally explore the wound & suture it

If peritoneal Breach ⊕

- Peritonitis
- Bile drenching of dressing
- omentum hanging out of wound
- Gunshot wound ± Breach

↓

Laparotomy.

SPLEEN

Splenic artery. → Br. of Coeliac Trunk

On ⊆ Ligament pedicle of spleen lies ⇒ Lienorenal

⊆ vessels are tnt in Gastrosplenic Ligament ⇒ Short gastric vessels

SPLENICULI – accessory splenic tissue

M/c site → Hilum of spleen

Importance →

If this splenicule is left behind when we are doing splenectomy for haematological cond^{n}

↓

It gives rise to recurrence.

M/c Benign Tumour → Haemangioma

M/c Malignant Tumour → Lymphoma

M/c True cyst → Hydatid Cyst

M/c Cystic lesion → Pseudocyst
(⊆ can occur after injury)

Min Platelet count required for Sx in a (N) pt
1 lakh

Min " " " " " in a pt. of I.T.P.
50,000

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

SPLENIC TRAUMA

Suspect Splenic Injury

- 9-11th Rib # on (L) side
- Bruising over (L) lower chest
- KEHR sign (+) (seen in splenic rupture)

If u raise (L) LL of pt.
- all the blood will accumulate below the (L) Dome of diaphragm
- ↓
- Pt will have (L) shoulder tip pain.

GRADES OF SPLENIC INJURY

(I) → Non expanding subcapsular (10% Haematoma
↳ Laceration < 1cm in Depth

(II) - Non-expanding subcapsular haematoma (10-50%)
Laceration 1-3cm in Depth

(III) Expanding haematoma & > 50%
Laceration > 3cm in Depth

(IV) Injury splenic Pedicle

(V) Shattered spleen

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

℞ Depends on Grade

I, II → Haemodynamic Stable → IOC → CECT. → Conservative

↳ Serial CECT (12-24 hrs) Monitor vitals

↓

If Grade of Inj ↑ on CECT

↓

angiographic embolisation.

↓

(1) If it fails or

(2) pt. becomes unstable or

(3) Contrast blush on CECT

⇓

Indications for Sx

Splenorrhaphy or splenic preservation

III — If stable → by Grade I + II

└ If unstable → by Grade III · IV

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

IV / V] unstable

↓

IOC - FAST

↓

Sx

Splenectomy

COMPLICATIONS FOLLOWING SPLENECTOMY :-

M/c

1) Atelectasis or (L) lower lung complications

2) Haemorrhage

3) Pancreatic Fistula

[pancreatic tail is associated ī hilum of spleen]

4) Haematological changes

Transient

upto 2 weeks

↑ WBC → can be confused ī infen

↑ RBC

↑ platelets

↳ if > 10 lakh

↓

Indication for starting pt on prophylactic aspirin.

Permanent

- Howell Jolly Bodies
- Basophilic stippling
- Reticulocytosis
- Hypersegmented Neutrophils

OPSI (opportunistic Post Splenectomy pts).

↳ causative → M/c Pneumococcus.

H. influenzae

Meningococci

Children > adults

- Usually occurs in 1st 2 yrs after splenectomy
- More common when indication: haematological Cond" > Trauma
- ↑ mortality Rate
- Can be prevented by Vaccines.

VACCINE

ELECTIVE
2 weeks before

EMERGENCY
Post-Op Day 2 or 3

↑Ab titres achieved ↑ before Sx.

PANCREATICO-DUODENAL TRAUMA

Rare

Penetrating Injury > Blunt

Isolated Duodenal Injury

1. ↓ Duodenal Haematoma
   ↓
   Mx- conservative
2. Duodenal Perforation
   Mx- Omental Patch Repair
   or
   Graham's Patch Repair

Isolated Pancreatic Injury
↓
① Pancreatic Parenchymal Injury But no injury to duct
↓
Mx- Conservative.

Abd. Trauma is M/cc of pancreatitis in children.
adult - acute → alcohol
chronic → Gallstone

Combined

② Inj. to H & N of Pancreas, ± Duct Disruption

↓

BEGGER

Duodenal preserving pancreatic head resection.

③ Injury to distal pancreas ± duct disruption

↓

Mx - Distal Pancreatectomy.

Combined Pancreatic - Duodenal Injury

Injury to H & N of Pancreas + Duct + Duodenum

↓

Mx - whipple [Pancreatico-duodenectomy].

BOWEL / COLONIC INJURY

SI injury

If pt. presents early
↓ contamination
Stable
↓
Resection & anastomosis

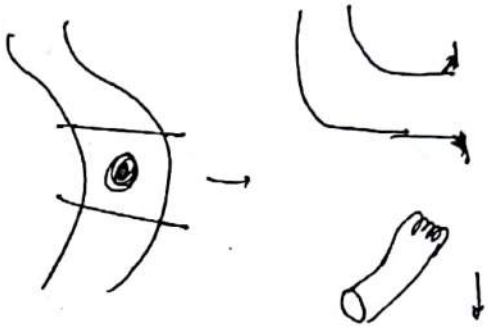
Late
↑ contamination
Unstable
↓
Ileostomy

Colonic Injury

Sigmoid colon.

If pt. trts early
↓ contamination
Stable
↓
Resection anastomosis

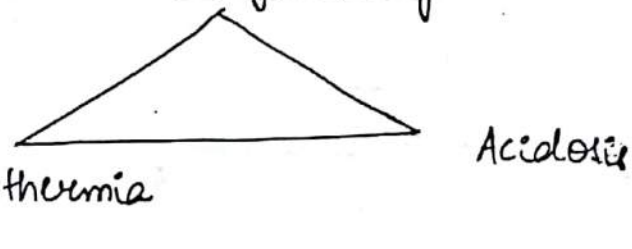
Late presentation
↑ contamination
Unstable
↓
HARTMANN's procedure



Once pt. stable
anastomose after ~6 wks.

DAMAGE CONTROL Sx / ABBREVIATED LAPROTOMY

Coagulopathy → Leading cause of death.



A trauma pt suffering from the triad
⇒ Damage control Sx

Phase I

Emergency Laparotomy
(IM)
1) Stop bleeding
2) prevent contamination.

Phase II

ICU care.
Temporary closure by Bogota bag
↓
(AIM) - correct the Triad.

Phase III

Re-exploration.
(AIM) - correct anatomy.

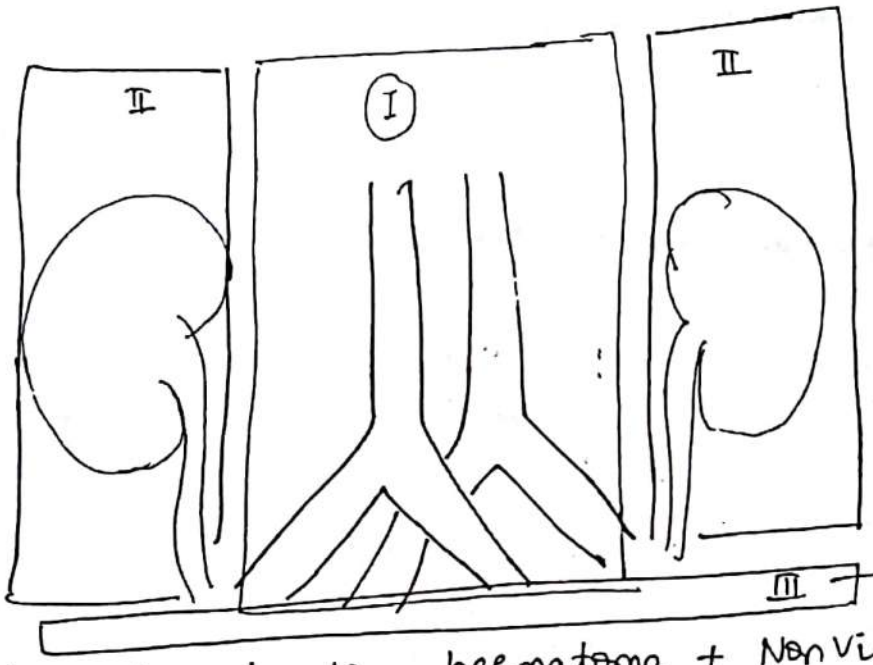
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

RETROPERITONEAL TRAUMA

Zone I → Includes Major Blood vessels
associated ↑ maximum mortality
all Stab injuries to zone I requires exploration.

Zone II → Includes Kidney & ureter.
Ioc - Single shot IVU

FAST not useful in retroperitoneal injuries



Pelvis, pelvic bone, Bladder

If there is expanding haematoma + Non visualization of kidney
⇓
Suspect Renal vessel Injury
↓
Do angiography then explore haematoma

Zone III - M/c ly injured zone
Majority can be managed conservatively

↳ Pelvis
Bladder
Bone

THORACIC TRAUMA

M/c cause of mortality

- Blunt
  - Tracheo Bronchial Injury
- Penetrating
  - Haemothorax
  - (2° Pulmonary Laceration)

RIB

Un common to have

- 1st Rib #
- 10^{th} – 12^{th} Rib #

This requires high velocity impact

Suspect injury of

1) Subclavian V/S
2) Brachial plexus
3) Apex of lung

- (R) Liver
- (L) Spleen

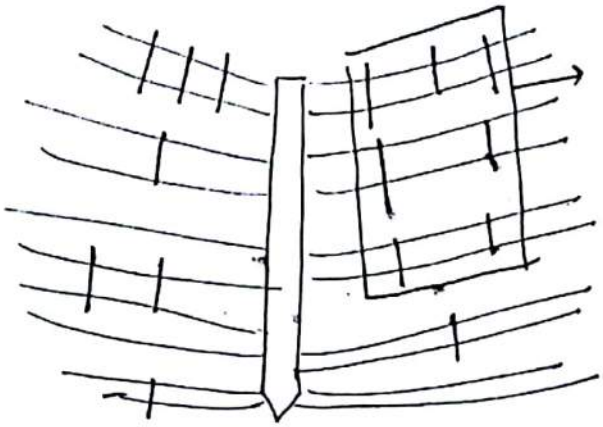
Simple Rib # – Mx adequate analgesia

M/c Ribs # while doing CPR – 4^{th} – 6^{th}.

FLAIL ℞ CHEST

- # of ⩾2 contiguous Rib at ⩾2 places.
- ℔ Segment breaks, hit lung ⇒ Underlying Pulmonary Contusion.
- Some pts have Paradoxical Chest wall movement

multiple Rib #



Flail chest

Leading cause of death → underlying Pulmonary Contusion
Not the paradoxical movement

Mx -

1) Adequate analgesia [Thoracic Epidural]
2) Despite - $pO_2 < 60$ mm Hg
RR > 20 /min.
↓
IPPV
↓
Despite - $pO_2 < 60$
RR > 20/min.
↓
Surgical fixation.

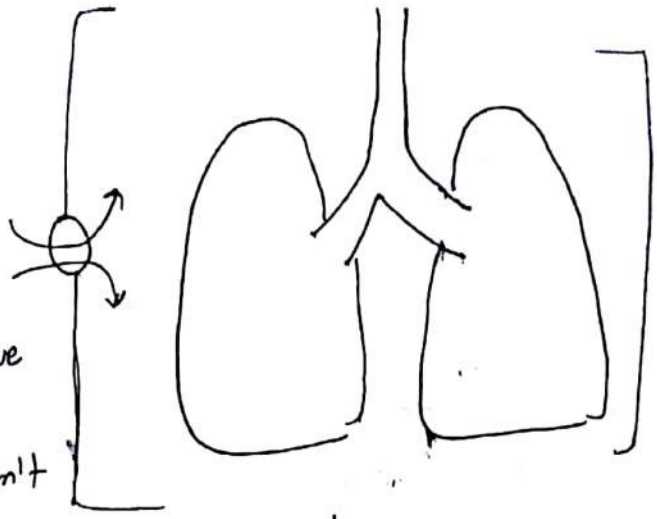
TENSION PNEUMOTHORAX

c Leads to rapid haemodynamic compromise

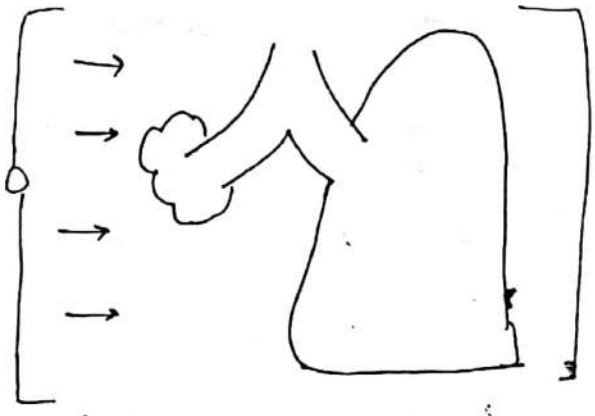
Can occur in 3 situations

1) Sucking wound in chest wall
2) Tracheobronchial Injury
3) Pulmonary Laceration c air leak.
IPPV is being given c out chest tube

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

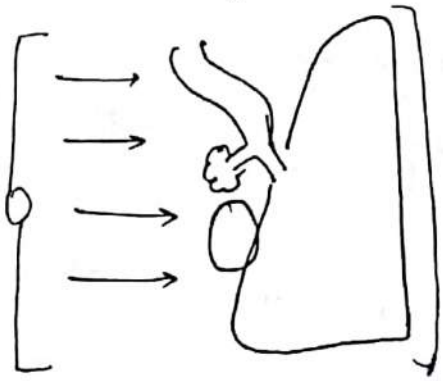


1 way valve
air just can entre but can't escape



collapsed lung

Hyperflated lung



Shifting of mediastinum

C/F →

1) RR ↑
2) CO ↓
3) SBP ↓
4) JVP ↑
5) PR ↑
6)

} same features are seen in cardiac tamponade.

Percussion ← Hyper-resonant
Breath sound ⊖
Tension Pneumothorax

FAST is also useful to differentiate

M_x

Emergency ← → Definitive

Needle thoracocentesis

Wide bore I/V Line in 2nd IC space in mid clavicular line

Tube thoracocentesis

ICT in Δ of safety.
we cover sucking wound ~ gauze & tape it on 3 sides.
↓
air can come out but can't enter.
[flow is reversed by putting tape of 3 sides]

SIMPLE PNEUMOTHORAX

Do not cause haemodynamic compromise

M_x - Put in chest tube directly

If pneumothorax in involving 1/3rd of thoracic cavity

HAEMOTHORAX

Accumulation of Blood in pleural space

Dull percussion note & absent Breath sound

eFAST is helpful modality

M_x - ICT insertion in Δ of safety

M/c site of aorta rupture in thoracic Trauma
↳ attachment of ligamentum arteriosum.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

INDICATION OF THORACOTOMY IN HAEMOTHORAX

1) >1L of blood loss at the time of insertion of ICT
2) >200 cc/HR for 3 consecutive hrs
3) unstable pt.

ICT

Δ of safety

ANT → ant axillary fold (P. Major)

POST → post " " (Latissimus Dorsi)

APEX → axilla

Base → 5th ICS

- Chest tube is inserted along the upper border of lower rib. due to fear of neurovascular plane of lower border
- chest tube is connected to under water seal

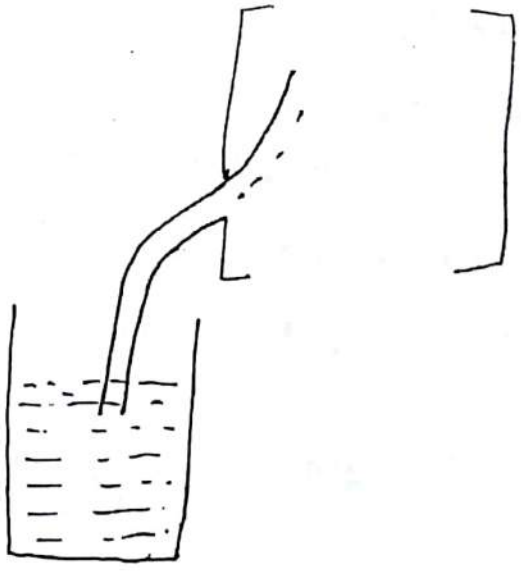
- Right Position

Water level rises & falls ∵ each breath.

↓

correct position.

1-0 silk. cutting needle.



Correctly placed tube

When all the holes/eyes of tube lies inside thoracic cavity [X-Ray]

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

When column stops moving

Block tube Displaced tube

Excessive bubbling in column ⇒ formation of Bronchopleural fistula.

Chest tube is removed when pt. is holding breath at Peak of inspiration.

Q. Pt undergoes thoracotomy
ICT is inserted after S_x
Serosanguinous fluid is coming out
When to remove → when output is < 50-75cc/24 hours
• if the lung is expanded

CARDIAC TAMPONADE

- Occurs 2° to penetrating injury
≥50cc blood → Cardiac tamponade.

Rapid accumulation of blood
↓
Puts pressure of heart
↓
Heart can't relax
↓
Diastole is not proper
↓
↓SV → ↓CO → HR↑ • SV↓

BECK'S TRIAD – ① Hypotension
② ↑ JVP
③ Muffled Heart Sounds.

Dx → By FAST.

Mx

Emergency

Needle Pericardiocentesis

Needle in subxyphoid area
45° to skin directed toward
(L) shoulder tip.
↓
Done under ECG + Echo. control
↓
Loss of resistance ⇒ Pericardial space
↓
aspirate blood.

H/c Comp' - arrhythmia

Definitive

Thoracotomy
↓
Create Pericardial Window

STERNAL

Uncommon
Requires High Velocity impact
If occurs → give rise to cardiac contusion
↓
Monitor by 12 Lead ECG + Cardiac enzymes period

DIAPHRAGMATIC INJURY

- Occurs 2° to blunt abdominal Trauma
- L > R [protected by liver]
- Delayed Presentation
  Breathlessness
  O/E - Bowel sounds (+) in thoracic cavity.
  Dx - X-Ray
  If u put Ryle's tube → end of ryle's tube will be in thorax

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

My - Sx

↙ By abdominal route

→ By thoracic route

Involves reducing content & repairing diaphragm c prolene mesh.

NECK TRAUMA

3 ZONES

Zone I - Thoracic inlet to upper Border of cricoid

Zone II - Cricoid to ∠ of ~~angle~~ mandible

Zone III - ∠ of mandible to base of skull

I → Trachea + Major Vessels + Oesophagus
associated c Max. mortality.

II → Most exposed zone
M/c ly injured zone.
Most surgically accessible

III → Carotid vessels ⊕

Zone II Penetrating Injury

↙ Majority
Superficial
Stable
⇓
Local exploration & suturing

↘ 10-15%
Deep to Platysma
Unstable
⇓
Formal neck exploration

* All gun shot wound to neck require formal neck exploration

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

HEAD TRAUMA

Layers

S - Skin

C - connective tissue → fibrous tissue septae. Blood vessels are adhered to this

A - aponeurosis

L - Loose areolar tissue (Black Eye [emissary vein]

P - Periosteum.

- Scalp Laceration bleed profusely as they can't vasoconstrict due to adherence
- Control Bleeding - ① Pressure
  ② Evert the edges
- Cutting needle / ~~so~~ 1-0 / 2-0 - silk nylon. mattress suture
- If there is bleeding below aponeurosis → Black Eye
- Emissary vein carries retrograde infn & lead to cavernous sinus infection

Skull #

← Non-Depressed → Nothing to be done

→ Depressed → Treat like open # Surgical elevation is required if focal neurological signs are present.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Skull Base

① Ant Skull # cribriform plate

c/F - ① CSF rhinorrhoea
② Epistaxis

β_2 - transferrin ④ in CSF

Halo sign

③ Black eyes / RACCOON EYES

Black eyes are associated ī Subconjunctival haemorrhage
↳ we cannot reach the posterosup. limit of "
⇓
~~Subcon~~ due to ant skull #

④ Anosmia
⑤ Frontal Lobe contusions

② Middle Cranial fossa #
petrous part of temporal Bone

YF
① CSF otorrhoea
② Haemotympanum
③ BATTLE SIGN - discolouration over mastoid process seen 24-48 hrs after middle cranial fossa #.

④ 7th N/v injury
⑤ Temporal lobe contusions
⑥ Paradoxical rhinorrhoea
↳ collect in ME cavity through ET & causes rhinorrhoea.

Post. Cranial Fossa #
Occipital Bone

CF ① Visual disturbance
② 6th N/v Injury
③ Occipital contusion
④ VERNET Sx → Jugular Foramen Sx
① (9th, 10th, 11th C.N.)
② Basilar or vertebral artery rupture

NICE Guidelines
(National Institute of Clinical Excellence)

1) Cervical spine injury should be suspected in all pts. c head injury

2) GCS
1st ~~[illegible]~~ 2 hrs → every 30 mins.
Next 4hrs → every hour
After 6hrs → every 2 hours

3) Indications for involving neuro Sx

a> GCS ≤8
b> Fall in GCS after admission
c> Unexplained confusion > 4 HRS

d> focal neurological signs
e> seizures
f> 1 episode of vomiting
g> Loss of consciousness
h> ENT Bleeding
i> Penetrating CNS injury

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

4) Indication to do NCCT Head

↳ ① ~~Brain~~ Head injury
② Salivary Gland stone
③ Renal Stone

a) GCS < 13
b) If GCS fail to reach 15 ~~min~~ in 2 hours of admission.

. Others are common.

BRAIN INJURY

1° BRAIN INJURY — due to Impact

2° BRAIN INJURY — due to TICT

Mildest type → concussion. No intervention Required.

Severe → Diffuse axonal Injury
↓
shearing force bet^n Grey matter & white matter

Pt is comatose
NCCT is (N)
IOC → MRI
↓
Punctate Haemorrhages at the Grey & white matter Junc^n.

Worst Prognosis amongst head injuries

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

INTRACRANIAL H'GE

1) Contusion [Intraparenchymal] → No Sx intervention required 70
2) EDH
3) SDH
4) SAH.

M/c Traumatic Intracranial bleed → Contusion

M/c Intracranial Bleed → SAH

Traumatic SAH → rarely requires Sx. intervention.

Spontaneous SAH → require Sx

EDH

arterial
Middle Meningeal artery
young pt
High velocity impact

C/F - Lucid Interval - Period of (N) consciousness between 2 episodes of unconsciousness.

↓

Common in EDH but not exclusive to EDH.

IOC → NCCT → Biconvex H'ge.

[Bet^n Periosteum & dura]

Mx - BURR HOLE

close to Pterion → H-shaped area where frontal, temporal, parietal sutures meet

↓

... in temporal region.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Burr hole is made on side of pupillary dilatation if CT is not available

If Burr hole not sufficient → craniotomy done to evacuate H'ge

SDH

- Acute (hrs)
- Subacute (days)
- Chronic (week)
  - elderly pts.
  - Trivial Trauma
  - Bridging Veins

Fall —(weeks)→ gradual decline in mental sensorium.

IOC – NCCT → Concavoconvex H'ge/ Crescenteric. Bet^n Dura & Arachnoid.

There can be midline shift present as well

Mx - creation of Burr-Hole

If not sufficient → Craniotomy

2° BRAIN INJURY

↑ ICT

CPP = MAP - ICP

Ideal CPP → 60-70 mm Hg.

In Head Injury ICT ↑↑

So, to maintain CPP → MAP should be ↑

MAP↑ → SBP ↑ → CO ↑ → HR×SV

Hence HR↑ will lead to LCO after some extent

So, SV need to ↑ → EDV ↑

↓

↑ Diastolic Interval

HR ↓

Cushing's Reflex → Bradycardia
HTN
altered Respiration

↓

Variant of Cushing's Reflex ⇒ Hypotension is found instead of HTN.

Cushing's ulcer → Stress ulcers seen in Head injury pts.
M/c site → Acid Producing area of Stomach.

Curling's ulcer are Stress ulcers seen in burn pts.
M/c site → 1st part of Duodenum.

HOW TO ↓ raised ICT in Head Injury

① Nurse pt. in 30° head up position
② Maintain perfusion.
③ " O_2
④ avoid dextrose containing fluids.
↳ hypotonic ⇒ worsen cerebral edema.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

⑤ Mannitol (IV)

⑥ Hyperventilation

⑦ STEROIDS → No role in raised ICT due to trauma

But DOC in Vasogenic Cerebral Oedema

15 Days

① Notes x4.
1st reading → 3 days.
② CRS questions
③ Last 5 yr questions
④ Images
⑤ Schwartz Absite Review.

BURNS

Refer ⟶ Burns unit

1) any 3° or 4° Burn
2) Burns involving face, genitalia, palm, sole
3) airway burns
4) any burn pt. requiring IV fluid
5) chemical & electrical Burn

Mx - ABCDE, exposure. → Cause of Burn
% of Burn.

AIRWAY

Danger Signs →

1) Carbonaceous deposit on sputum
2) Singed / Burned nasal hair
3) Burn in closed room
4) Burns involving neck or face
5) Hoarseness of voice.

⇓

Indication for Intubation.

BREATHING

If Breathing is compromised → Ventilator

CIRCULATION

Burnt areas
↓
release cytokines
[locally / systemic]

→ **Vasodilation**

↑ Evaporation

Vessels become leaky [upto 24 hrs after Burn]
↓
Albumins leak to Extra vascular space
↓
more fluid into EVS
↓
3rd space Loss. seen in BURNS

Do not use colloid for resuscitation in 1st 24 hrs. in BURN pt.

Dehydration.

Fluid of Choice → (RL)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

If child > 10% BSA
adult > 15% BSA
→ circulatory shock.

PARKLAND FORMULA

= 4 × BW (in kg) × TBSA Burnt

↓

Amount of fluid in mL required in 1st 24 hrs of Burns.

↓

① 1st & ~~2nd~~ Degree Burns are excluded from the calculation.

② Max. value we use in this formula is 50%.

↓

otherwise fluid overload.

③ Time starts when the pt gets Burnt not when he comes to the hospital.

Total amount

½ → 1st 8 hrs → 2 × BW × TBSA

½ → next 16 hrs → 2 × BW × TBSA

Best Indicator of fluid resuscitation → UO.

In adults. UO > 0.5-1 mL/kg/hr

child UO > 1-1.5 mL/kg/hr

in BURNS *

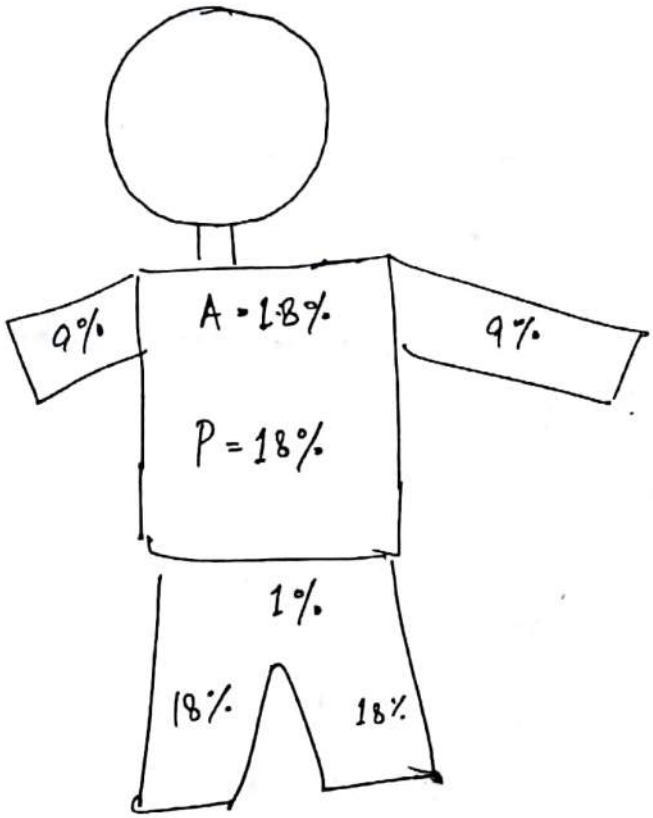
* Calculation of BSA Burnt:

① PALM - 1%

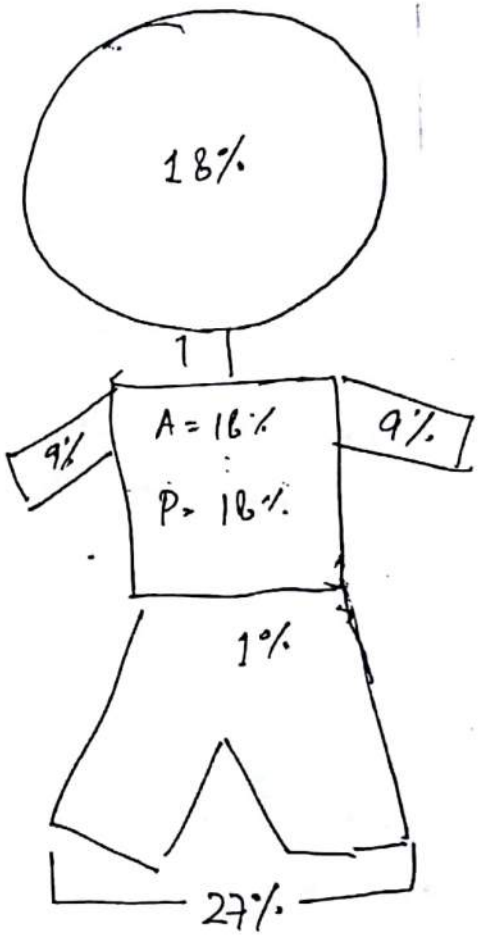
This method is simple but crude method to calculate patchy Burns.

② Wallace Rule of 9

ADULTS



CHILDREN



③ LUND - BROWDER CHART

↳ Best Method.

even for children → Best

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

ZONES

① zone of Coagulation
Max. Injured zone
Irreversible damage to this area.

② zone of stasis
Injured or Necrosed tissue
If properly managed → can be recovered
If it becomes infected → it can proceed to zone of coagulation

③ zone of hyperemia
Becoz of vasodilation
This zone usually recovers

DEGREE OF BURN

1st D → involve Epidermis
Burnt area red, tender
Complete Blanching occurs on pressure
Healed without scarring in 3-5 days.

2nd D →

Superficial
involves epidermis + Papillary dermis

① RED
② Tender
③ Blanching
BLISTER FORMATION
forms in hours (1-2)
SCALD

Deep
E + entire Dermis [Papillary + Reticular]

① Red
② ↓ Tender
③ Some areas of fixed capillary staining

2° Burns heal by Hypertrophic Scar & Keloid Formation.

Mx → ① Dressing using special materials.

M/c used → i) Silver sulphadiazine
↳ gud action against Pseudomonas.
But doesn't penetrate Eschar.

2) Silver Nitrate
frequent applications are required
stains everything Black.

3) Mafenide Acetate
can penetrate eschar
application is painful
in some pts, can ↓ metabolic acidosis.

4) Best Agent → Cerium Nitrate
↓
Immunomodulatory action
Can penetrate eschar
expensive

3° & 4° Degree Burns
↓ ↳ M/s
S/c tissue

Burnt area - Black
Charred
No Blanching
Painless → Becoz n/vs get burned.

Mx- Early excision followed by split thickness skin grafting

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

M/cc of Death in Burn

1) Immediate → Asphyxia
2) Early (1-4 days) → Hypovolemic shock
3) Late (>4-5 days) → Septic shock
4) OVERALL → Septic shock

M/c organism ⊆ infects Burn pt → Pseudomonas.

Circumferential Burn

Circumferential eschar
↓
fibrotic
↓
COMPARTMENT SYNDROME.

Mx - escharotomy ↔ fasciotomy
[upto Deep fascia]

Electrical Burns - AC output

High Degree Burns
Burns due to AC → induce ~~Tetony~~ Tetany
↓
Difficult for pt. to leave the source
↓
Give rise to
1) arrhythmia → leading cause of death.

- Look for entry & exit Burns.

Chemical Burns

Either Brush off compound or wash the area ⊆ water
never try to neutralise chemical Burn.
↳ exothermic reaction → worsen Burn

VASCULAR SURGERY

Virchow HES triad.

DVT

occurs 2° Virchow's Triad
- Stasis
- Hypercoagulate state
- endothelial injury

R/F

1. Prolong immobilisation
2. Previous H/o DVT
3. Trauma
4. any Sx lasting for >1 HR c/b → LL
   Pelvis
   Gynaec
   Urological
5. ♀
6. Malignancy
7. Protein C + S deficiency
8. May THURNER SYNDROME - Iliac artery crosses over iliac vein
   ↓
   Leads to iliac vein thrombosis

Phlegmasia Cerulea Dolens - Painful Blue limb.
All major axial veins of ll thrombosed but collaterals are spared

Phlegmasia Alba Dolens :-
Painful White limb
If all major axial veins + collateral involved

Usually seen during ♀.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

C/F -

1) M/c feature - Limb edema

2) Earliest - Pain

3) Signs → HOMANS → If Dorsiflexion of foot ↓ Pain

Only theoretical → MOSES (mausi k paon dbao) → Squeezing of calf ↓ Pain.

IOC - Colour Doppler or Duplex Scan. { acute - anechoic, chronic - echogenic

M/C veins affected by DVT → Calf or Soleal veins.

M/C veins from ⊆ DVT can give rise to Pulmonary embolism → Ileofemoral veins.

Mx -

① Anticoagulation.

1st 5 days → Heparin + Warfarin

After 5 day → Warfarin

1st episode of DVT → 3 months. warfarin

Recurrent DVT → Lifelong warfarin.

(INR) → $\frac{PT_{pt}}{PT_{control}}$ → Target INR - 2-3 for DVT [for Mech. Heart Valve 2.5-3.5]

Max. possible INR at ⊆ Sx can be done ⊂ Out Risk of excessive Bleeding → (1.4)

(H) → 1-2 . if ∴ INR > 1.4 ⇒ Risk of excessive Bleeding ↓ give FFP before Sx.

Indications of IVC filter in DVT

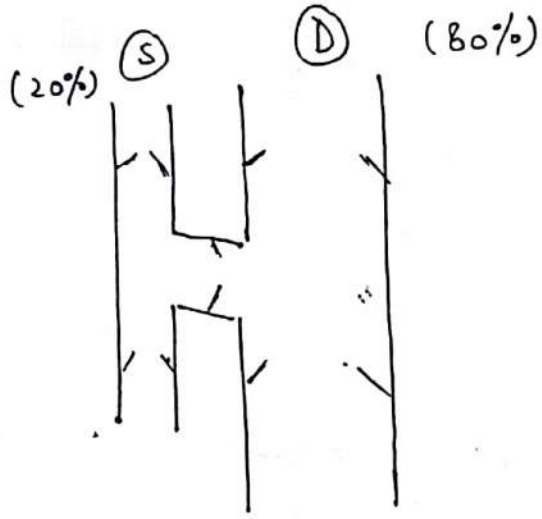
① Pt. c DVT but c/I for anticoagulant

② Recurrent PE despite anticoagulation.

Green field filter.

VARICOSE VEIN

- Dilated, Tortuous Vein c Defective Valves



Valves ensure unidirectional flow of blood

GSV

Medial end of dorsal V. arch.

↓

Ant. to MM

↓

Medial aspect of knee.

↓

Sapheno femoral J"

[4cm below & Lateral to pubic tubercle] Constant

SSV

Lateral end of dorsal v. arch

↓

Sapheno-popliteal J' (variable)

all along its course, associated c Sural n/v

↓

No stripping of short saphenous vein!

Below knee jt. it is associated c saphenous n/v

↳ So not stripping in this area

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Both systems are connected by Perforators (100-150)

↓

Direction from S → D.

① Largest Perforator → **Saphenofemoral J"**

② Thigh → **HUNTERIAN**

③ Below knee → **BOYD**

④ 3 cockett perforator → 5, 10, 15 — cm above MM.

⑤ At ankle → **May / KUSTER perforator**

C/F -

1) Dilated tortuous vein

2) O/E → if diameter of vein **> 4mm** ⇒ Varicose Vein

1-4mm ⇒ Reticular Vein

< 1mm ⇒ Thread vein or Dermal flares.

Test.

1) Trendelenburg — if SFJ is incompetent or not — if perforator competent of not

2) Fegan method → site of incompetent perforator

3) Mod. Perthe's → if DVT is present of not

DVT is C/I for Varicose Vein. Sx.

All clinical Tests have low sensitivity

So, Ioc ⇒ Duplex Scan.

Mx-

Great Saphenous Vein + SFJ incompetence

Traditional
↳ Trendelenburg
(Flush Ligation of SFJ)

3 tributaries
① Sup Circumflex iliac
② Sup. ext. pudendal
③ Sup. epigastric
→ Tie these 3 vessels
otherwise recurrence

Only Ligation
NO STRIPPING

Stripping is additional procedure
can be done upto knee

Latest
EVLT (Endovenous Laser Therapy)
or Radio-frequency ablation.

SSV or SPJ

Traditional
↳ Flush Ligation of SPJ

Latest-
EVLT or RFA

Perforator Incompetence

Traditional
↳ DODD + COCKETT
(Multiple subfascial ligation)
↓
Not cosmetically good
↓
SEPS
(subfacial endoscopic perforator Sx)
↓
Less incision
cosmetical

Latest- EVLT
RFA

TRIVEX

Subcutaneous illuminator
Dilated veins become visible
Hook out the veins + ligate

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

FOAM Sclerotherapy
Use for thread veins or dermal flares

Sclerosing Agents

1) Polydiconol
2) Ethanolamine oleate
3) Sodium tetradecyl SO_4
4) Sodium Morrhuate

⇒ Can also be used for Oesophageal Varices or Haemorrhoids.

PESS or TESS

3 : 1. ⇒ Tessari's technique
Air Sclerosant

COMPLICATIONS OF SURGERY

1) H/C - Bruising
2) Haemorrhage
3) Femoral vein damage
4) " artery damage

COMPLICATIONS OF VARICOSE VEIN

1) Bleeding
2) Calcification
3) Pigmentation - due to haemosiderin pigmentation
4) Lipodermatosclerosis → fat goes away
skin → shiny or thickened
Inverted Champagne Bottle appearance
5) Varicose ulcer
↳ medial malleolus
Gaiter area of leg
Venous ulcer is shallow
sloping edges
Pale granulation tissue @ floor

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Pigmented margins

Most acceptable theory behind development of venous ulcer - Ambulatory venous HTN theory

Fibrin cuff
Leucocyte sequestration] - No longer applicable theories

Mx of venous ulcer is using Bigard Regime

- Education
- Elevation of limb
- Plastic compression stocking
  - ↳ Grade III → pressure - 30-40mmHg
- Regular dressing
- Sx

Sx for varicose vein prevent recurrence of ulcer

Long standing venous ulcer ⇒ **Malignant change** [Marjolin's ulcer]

↓

SCC

ACUTE ARTERIAL OCCLUSION

- Due to **embolus**
- Since it is acute phenomena, there is no time for formation of collateral.
- Pt. presents with 6 P - Pain
  Pallor
  Pulselessness
  Paraesthesia

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Pulselessness
Poikilothermia

E→F

IOC - Colour Doppler / Duplex Scan

Mx If pt presents early [6-8hrs] → carry out
EMBOLECTOMY
↓
Fogarty's Balloon used.

If pt presents late when gangrene has set in
↓
amputation

CHRONIC ARTERIAL OCCLUSION

- 2° Thrombus

- Gradual process
- Hence, formation of collateral takes place ↓
contribute to distal run-off seen in chr. arterial occlusion.
↓
portion distal to obstruction survives.

When pt walks → experiences Pain of Claudication
↓
depends upon site of occlusion
not always calf

As the thrombus ↑ in size, Distance of claudication ↓
⇓
Gradually pt develops Rest Pain.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Leriche Syndrome

Thrombus @ Bifurcation of aorta

- gluteal claudication
- Impotence in ♂

IOC → Colour Doppler / Duplex Scan.

ABPI (ankle Brachial Pressure Index)

Ankle S.B.P.
Brachial SBP

> 1.1 ⇒ calcified vessels [CKD, DM].

(N) → 1 - 1.1

< 0.9 - s/o Intermittent claudication

< 0.4 - Critical Limb ischaemia

↓

below this, gangrene develops.

BUERGER or Thromboangiitis obliterans	ATHEROSCLEROSIS
- 3rd	5th
- ♂ > ♀	♂ = ♀
- Smoking - R/F	
- Involves AVN ↓	arteries predominantly
- Distal to proximal spread	Proximal to Distal spread
- Small to medium vessels	Large to medium vessels
- Becoz side of vessel is narrow ↳ Bypass Grafting & Stenting can't be done.	Mx - Bypass Grafting & Stenting
- Mx - conservative amputation.	BEST NATURAL GRAFT → Reversed Saphenous Vein
	BEST SYNTHETIC → DACRON

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Lumbar Sympathectomy

can provide symptomatic relief from pain for few months but it should only be done when there is REST PAIN

↓

c/I in Intermittent claudication

Precaution

When doing B/L Lumbar Sympathectomy

Save L1 ganglion

should be saved on 1 side otherwise pt. will have problem in ejaculation.

Lumbar sympathetic chain can be confused w/ Genitofemoral n/v.

M/c vessel involved in Mycotic aneurysm
↓ L Femoral artery
due to Staph. Aureus.

ANEURYSMS

M/c vessel → **CIRCE OF WILLIS**

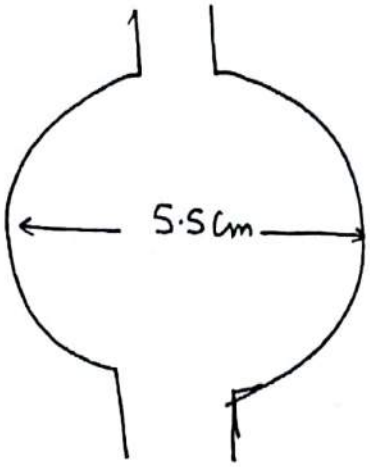
M/c Extracranial V → **Infrarenal abdominal aorta**

M/c ~~Popliteal~~ Peripheral V → **Popliteal**

AORTIC ANEURYSM AIIMS

- M/c RF → Atherosclerosis
- M/c site - Infrarenal abd. aorta

SCREENING → USG Abd



Critical Diameter.

If > 5.5cm diameter ⇒ chance of rupture ↑

% asymptomatic abd. aorta aneurysm need to be operated.

Critical Diameter

Asc. → 5.5

Desc → 6.5

C/F →

1) Abd. Pain

2) Pulsatile

3) Complications – rupture
embolic to LL

IOC → CT Angiography

Management → SURGERY

all symptomatic

asymptomatic > 5.5cm

DACRON GRAFT REPAIR

Open

EVAR
(endovascular aneurysm repair)

(L) Medial Visceral rotation
↳ mobilize (L) colon medially
MATTOX PROCEDURE

aorta → mat

IVC → cat

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

(R) Medial Visceral rotation
↓
expose IVC. CATTLEBRASCH Manoeuvre

Mobilisation of duodenum ⇒ KOCHERISATION

Complications of Sx

① H'ge ② M/c cause of mortality.
↓
CVS

③ Renal failure

④ Colonic ischaemia → (L) side of colon

⑤ Paraparesis → due to involvement of ADAMKIWICZ a.
↓
supplies Ant. Spinal Artery

It typically arises from (L) post. IC artery. & branches from aorta & supplies the lower 2/3rd of spinal cord via ant. spinal artery ↑

⑥ Mortality

ELECTIVE → Mortality is <2%

RUPTURED ANEURYSM " " >50%.

AORTIC DISSECTION

M/c site → Lateral wall of Asc. thoracic aorta

M/c R/F → HTN

C/F-

① Earliest → Chest Pain radiating to back [interscapular region]

② Once it occurs → hypotension occurs

③ If coronary sinus is involved ⇒ MI can occur

IOC in stable Pt. → CT Angio

Unstable Pt → TE Echo.

Mx- DACRON GRAFT REPAIR.

Classification

De Bakey		Stanford
I (M/C)	A+D	A
II	only Asc	A
-	only Desc	B

RAYNAUD'S PHENOMENA

Occurs due to Vasospasm

Phase I → A+V spasm ⇒ WHITE

Phase II → artery relaxes ⇒ BLUE
vein spasm painful

Phase III → artery, vein ⇒ RED
both relax

DOC - CCB

A-V FISTULA

CONGENITAL - Klippel Trenaunay Syndrome
- AV fistula
- Varicose vein
- Haemangioma
- absence of deep venous system
- Limb hypertrophy

Iatrogenic - M/c →
↳ for Dialysis - Cimmino

Traumatic -

Cong AV fistula are high output state

If tnt in a limb ⇒ lead to Hypertrophy of Limb

Branham/Nicoladni Sign

↳ Press feeding vessel of fistula

↓

Size of fistula ↓

↓

PR ↓

CO ↓

SBP ↓

Thrill over fistula ↓

Ioc - CT Angio

Mx - only Symptomatic require

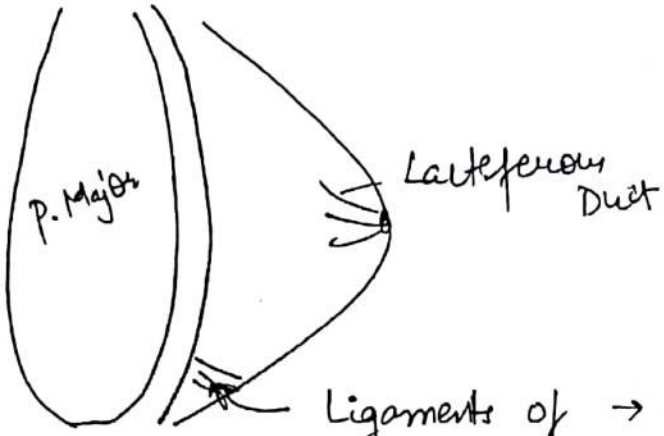
EMBOLISATION

or

LIGATION

BREAST

- Lie over Pectoralis Major
- Modified ~~Sebac~~ Sweat Gland



Ligaments of Cooper → arise from Pectoral fascia attach to skin of breast superficially

15-20 Lactiferous duct open at nipple

If ~~Lactiferous~~

If Ligament of Cooper involved ⇒ Puckering / Dimpling

If Lactiferous Duct " ⇒ Retraction.

If Dimpling + Retraction +nt ⇒ Do not signify skin involved.

Retraction

- Circumferential → Malignancy
- Slit like → Duct Ectasia

Peau D Orange → Occurs due to involvement of Subdermal Lymphatics

↓

It signifies skin involvement

Lymphatic Drainage

90% → Axillary

10% → Internal mammary

3 Levels surgically

P. Minor Divides axilla

I — Lateral | II | III — Medial

Rotter's L.N ⇒ Interpectoral L.N.
Lie in level II

TRIPLE ASSESMENT

- History & PE
- Radiological [Initial] — 1st Inv.
  - < 40yrs → USG → Dense Breast tissue
  - >40yrs → Mammograms
- HPE
  - FNAC
  - True-cut Biopsy / core needle Biopsy
  - Excisional Biopsy

In Dense Breast tissue → mammogram is not sensitive.

Mammography

Screening

Best

>45yrs

↓ mortality due to Breast Ca

4 cancers screening ↓ mortality

1) Breast
2) Cervical
3) Prostate
4) Colon.

Diagnostic

Mammography is usually done in 1st half of menstrual cycle so that it won't to effect the embryo if the pt. is ♀

Cluster microcalcifications in mammography indicates maximum risk of malignancy

2 views

Cranio caudal

Medio lateral.

Radiation exposure - 0.1 - 0.2 cGy

Latest technique ⇒ Tomosynthesis / 3D mammography

BIRADS Scoring (Breast Imaging Reporting & Data System)

- for mammography & USG
- Std. way

LIRADS - Liver.

~~B~~IRADS - prostate

TIRADS - thyroid

Type

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Type	Interpretation	Mx / Follow up
0	Incomplete	get alternate imaging test
1	Negative	1yr for annual test
2	Benign	1yr follow up
3 [<2% Risk for Ca]	Probably Benign	short term follow up. come back after 6months.
4	Suspicious	Biopsy.
	A - Low risk	2-10% risk
	B - Mod.	10-50% "
	C - High	50-90% "
5	Probably Malignant (>95% risk)	Biopsy
6	Biopsy Proven Malignancy	

Micro calcification s/o - Malignancy

USG

No radiation exposure

IOC in ♀

Best Inv. to Differentiate Solid Vs Cystic Lesions

P Malignant Breast Lump appears Hypo echoic on USG

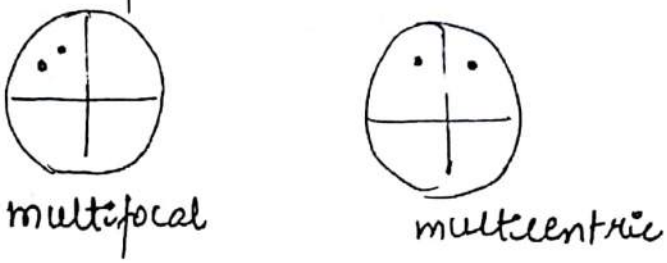
Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

MRI

Indications

1) Breast Implants
   Linguini Sign → Intracapsular rupture of implant

2) To identify multifocal & multicentric breast lumps - IOC



multifocal multicentric

3) approved as a screening modality in young & high risk pts. → ⊕ family H/o BRCA mutation

4)

4) Sensitive Inv. to detect scar recurrence after mastectomy or Breast Conservative Sx

5) Most sensitive Inv for DCIS

6) In a pt. c suspected Ductal Lesion where USG is inconclusive.

HPE

FNAC

Size of needle = 23-30 gauge needle.

In Breast Lesions, → it can't Diff bet^n In situ & Invasive Cancer.
Receptors can't be done

IOC ⇒ True-cut Biopsy or Core Needle Biopsy [Image]
Size of needle → 8-18 Gauge
└ 16 G → Best Biopsy for Breast

Incisional Biopsy

Excisional Biopsy → Gold std. Technique.

BREAST CANCER

M/C cancer in Indian ♀ & all over in World

Stat in India - 1 in 26

World - 1 in 8

R/F -

Hormone Driven cancer

1) ↑ age
2) early menarche
3) late menopause
4) Obesity [peripheral conversion]
5) alcohol consumption.
6) Smoking → associated c premenopausal Ca
7) ⊕ve Family History
   - Both maternal & paternal Family History is important
8) HRT → ↑ risk of Br Ca. [<u>low dose</u> OCP doesn't ↑ risk]
9) Nulliparity
10) Age at 1st Live Birth
    - if maternal age < 20yrs → protective.
    - if " " > 30yrs → ↑ risk of Breast Cancer
11) Breast feeding is protective
    - provided cumulative duration of Breast feeding > 1yr

M/c Gene mutated in Br. Ca → p53

M/c Gene " " Familial Br. Ca → BRCA.I.

85-90% Br. Ca is sporadic . gene mutated is p53.

BRCA mutation

↓

HBOC Syndrome

BRCA II

Chr. (17)

Predisposes to
- Breast
- Ovarian
- 1° peritoneal
- Colorectal
- Pancreatic
- Male Br. Cancer.

[II > I]

Basal Subtype

Aggressive

↓↓

Poor Prognosis

M/c histopathological type of BRCA I ⇒ Medullary

BRCA 22

(13)

Predispose to
- Breast
- Ovarian
- 1° peretoneal
- Colorectal
- Male Br. Cancer
- [Prostate Ca]

Luminal subtype

Better prognosis

HBOC Syndrome

↓↓

Genetic counseling

↓

Genetic Test (BRCA)

↓

Mutation (+)

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Lifestyle changes -
- Wt. reduc^{n}
- Regular exercise
- Give up alcohol & smoking
- MRI screening

↓

Risk Reduction Techniques

1) B/L prophylactic mastectomy [↓95%) - BRCA
OVCA - ↓0%.]

2) B/L Salpingo-oophorectomy [OVCA - ↓90%]
↓
fallopian T. stump Ca.
[BRCA - ↓50%]

Ideal age →
after completion of family
< 40yrs of age

10%

3) Tamoxifen [SERM].
↓ BRCA by 44%

IHC (Immunohisto chemistry)

ER, PR

ALRED Score
0-8

Nucleus Brown → Nuclear (R)
↳ ER + PR+

Membrane stained Brown
↳ ~~Nucleus~~ ~~Red~~
membrane receptor
↓
HER2 neu

HER2NEU

0, 1+ - Negative
2+ - equivocal [FISH]
3+ - Positive

↓

flourescent In-situ Hybridization

amplified (+) — non-amplified (-)

Trastuzumab [Herceptin].

Molecular Subtypes of ♀ Br. Ca

Gene Expression Profiling

	ER	PR	HER2 neu	Ki 67 ↓ proleferation index marker
Luminal A	⊕	⊕	⊖	Low ↓ (<14%) how quickly
Luminal B	⊕	⊕	⊕	Low / High
Basal	⊖	⊖	⊖	High

↳ H/C, Best Prog

↳ young, african, american
Most aggressive
Worst prognosis
TNBC Paradox (Triple Neg. Br. Ca)
This tumour responds very well to Anthracycline Based Chemo.
↓
But after 1-5-2 yrs, tends to relapse.

HER2 Neu enriched	⊖	⊖	⊕	High.

Since development of Trastuzumab → prognosis of her 2 neu ⊕ ↑

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

IOC → True cut Biopsy

IOC for staging → PET scan.

C TNM → clinical

P TNM → pathological.

M TNM → multiple tumours

r TNM → recurrent tumours

y TNM - TNM staging done after neo-adjuvent therapy

Staging

Breast
Oral Cavity
RCC
Testicular Tumour
T Stage of Prostate
Bladder
GB
Duke - colo-rectal Ca

TNM

T0 - No tumour

Tis - In SITU cancer.

DCIS

Paget's Disease

AJCC - LCSI has been removed as insitu lesion.

T1 - ≤ 2cm

T2 - > 2cm but < 5cm

T3 - ≥ 5cm.

T4 -

(A)
Involvement of chest wall

Involvement of pectoral m/s → Not considered

1) Serratus Ant
2) I/C m/s
3) Ribs

(B)
Skin
- peu D'orange
- Ulceration
- Satellite nodules

(C)
Skin + chest wall

(D)
Inflammatory Br. Ca..

Worst Prognosis.

N_0 - No

N_1 - mobile ax L.N.

N_2 — A → fixed, matted L.N.
B → ↑nce of internal mammary L.N. in absence of axillary L.N.

N_3 — A → infraclavicular L.N.
B → internal mammary ⊕ Axillary L.N.
C → Supra clavicular LN.

M_0 – no met

M_1 – distant met

M/c site of distant met → Bones.
Vertebral Column.
↓ [BATSON · PLEXUS]
Lumbar
[osteolytic > osteoblastic]

Mx
Surgery Chemo RT HT

Sx
1° Tumour → LN
BCS
Mastectomy
Overall survival ← Same → NSABP, EORTC, MILAN
Locoregional recurrence
3-4% 1%

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

RT is mandatory in BCS. to ↓ recurrence.

BCS

Lumpectomy
Removing Tx c 1cm margin.

C/I for BCS

C/I for RT

1) ♀ (absolute)
2) Collagen vascular diseases
   eg. SLE
   Rheumatoid arthritis
   } Relative C/I
3) Prior RT to chest wall.

Technical C/I

1) multicentric (absolute)
2) multifocal (relative)
3) Lobular Ca c multicentric
4) Large Tx to Breast Ratio (relative)

Family H/o + (+ve) axillary L.N. is not a C/I.

Margin status

BCS - 1cm

2cm
Oral cavity
Penile
GIST
Carcinoid.
Rectum

5cm
Gastric adenocarcinoma (proximal margin)

10cm
Oesophagus.
Small intestinal adenocarcinoma

Mastectomy

Radical

Halsted

Removed

Breast
P. Major + Minor
Level I, II, III LN

Modified Radical Mastectomy

Incision. elliptical Stewart

Removed

① Breast
② Nipple areola complex
③ Pector fascia ± P. MINOR
④ Level I, II, III L.N.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

MRM

Auchinclaus → P. minor is retracted.

Patey's, Scanlon → P. Minor is cut

Boundaries of axillary Dissection

Sup → axillary vein

Lat → Thoracodorsal Pedicle

Inf → Angular vein

Medially → Halsted Ligament

Min. no. of L.N. to be removed = 10.

Complications of MRM

① M/C - SEROMA → collection of fluid below flap.
drains are put to ↓ seroma formation.
When to remove drain → output < 50 cc/day for 2 consecutive days

② H'age

③ Injury to n/v
- Long Thoracic [N to Serratus Ant].
↳ Br. from roots (C_5, C_6, C_7)
Inj to this n/v causes Winging of Scapula.
- Thoracodorsal → Latissimus dorsi
- Lat & Med Pectoral - Pectoralis major
- Intercosto brachial N/v
↳ altered sensation in inner aspect of arm.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

④ Lymphoedema

Post mastectomy Lymphoedema - M/c C/o UL lymphoedema

M/cc of LL lymphoedema ⇒ Filariasis

incidence 2-10%.

Long standing lymphoedema ⇒ Pt. can develop Angiosarcoma ⇓ Stewart Treves Syndrome

⑤ Local Recurrence

↙ ~~~→

Extensive Cancer En Cuirasse ↓ involves chest wall like an armour.

SENTINAL L.N. BIOPSY

1st draining L.N. from Cancer is sentinal L.N.

1st cancer in C this concept was designed → Penile

Surgeon – CABANA.

Other CA

① malignant melanoma
② Breast
③ Penile
④ Oral
⑤ endometrial

Indications in Br Ca

↳ Clinically N_0 axilla

While operating → found sentinal L.N.

↓

Send for Frozen section. analysis.

[in ½ hr → (+) for cancer, (−)]

(+) ↓ axillary L.N. dissec^{n}.

(−) ↓ no need to clear axilla

↓

Chances of lymphoedema ↓

Methods

Blue dye

Methylene Blue or

Isosulphan Blue

⇓

1-1.5cc of dye

in peri-areolar region

↓

Blue L.N. are sentinal

M/c Comp → Skin tattoing.

Radio-nucleotide

Inject Tc 99 tagged sulphur colloid.

↓

Using gamma camera found most Radioactive L.N.

↓

sentinal L.N. !

Best → combination of Both

Hot & Blue L.N. → Sentinal L.N.

M/c N/v Injured in Sentinal L.N. Biopsy ⇒ ICBN

Senti Mag Technique →

Inject Fe_2O_3 compound.

↓

use magnetic scanner

↓

detects sentenal L.N.

Advantage → no radiation exposure

CHEMOTHERAPY.

Indications -

1) TNBC (Triple Neg Br Ca)

2) HER 2 New ⊕ tumour

3) ⊕ L.N.

4) T_x > 1cm in size

↳ exception

5) T_1 / T_2 | N_0 | M_0 ⇒ Molecular Tests to determine whether chemo will be helpful or not

Done in ONCOTYPE Dx

T_1 / T_2 | N_0 | M_0 + ER / PR +ve

MAMMAPRINT

Done in.

T_1 / T_2 | N_0 | M_0 — ER + PR +

ER ⊖ PR

TAILOR x ⟵ Trial ⟶ MINDACT

21 gene assay — 70 gene assay

Recurrence Score.

<18 ⇒ Skip chemo

18-31 ⇒ equivocal

>31 ⇒ chemo should be given.

PAM 50 → 50 gene assay

ENDOPREDICT → 8 gene

If BR Ca pt > 70yrs ⇒ avoid Chemo.

Latest Chemo Regime

4AC F/B 4T

4 cycles of 3 weekly

adriamycin

Cyclophosphamide

↳ S/E
Haemorrhagic cystitis by metabolite - Acrolin.
↓
MESNA is used for prevention

S/E
Dilated Cardiomyopathy

4 cycles of 3 weekly

Paclitaxel.

↳ S/E - Peripheral neuropathy

Other → CAF

CMF — 5FU.
|
Methotrexate

Herceptin (Trastuzumab) → Her 2 Neu (+) for 1 yr

Palbociclib → ✓ CDK 4/6 $ (cyclin Dependent kinase)
✓ ER/PR (+)
✓ HER 2 Neu (−)
| Metastatic Breast cancers.

RT

Indications -

1) ⊕ L.N.
2) after BCS
3) LABC [locally advanced Br. Ca].
4)

] for 25 days. 54 Gy

↓

Reduces loco-regional spread.

HT

↓

ER/PR ⊕

Pre-menopausal

Tamoxifen

NSABP Syn

ATLAS 10 yrs.

M/c S/E → hot flushes

endometrial hyperplasia

DVT

Post-menopausal.

AI (aromatase inhibitor)

Anastrozole
Letrozole
Exemestane.

↳ S/E → osteoporosis

Early Br. Cancer →

T_1 / T_2	N_0 or N_1	M_0

Surgery → BCS + RT. [mandatory]

T_1 / T_2 | N_0 | M_0

↓

Molecular Testing

(N_1) +

Chemo

HER 2 New (+)

HERCEPTIN

ER / PR (+)

HT

Locally Advanced Br. Ca

Any T_4
any N_2
any N_3
| M_0 ⟶ $T_3 N_1 M_0$

NACT ⟶ MRM ⟶ RT ⟶ If ER, PR (+) HT

Metastatic Br. Ca

M_1

Only Palliative T/t

Most Imp. Prognostic factor → axillary L.N. status.

M/I Prog. factor in Metastatic Cancer → ER / PR (P) status

Special Situations

Male Breast Cancer

Incidence 1%

R/F BRCA II > I

Klinefelter's Syndrome

Liver Disease

Dx, M_x, Staging, Prognosis exactly same as female Breast Cancer

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Pregnancy associated Br. Ca

1 & $\underline{c}$ develops during ♀ or $\bar{c}$ in 1 yr of delivery

aggresive

poor prognosis

D_X – by True cut Biopsy

Imaging → USG.

S_X →

BCS & C/I ✓ → Matectomy

If pt is detected in IIIrd Trimester BCS can be done.

RT will be given after delivery

Chemo

Safest Trimester → IInd Trimester

RT + HT

C/I in all trimesters.

PATHOLOGY OF BREAST CANCER

M/c quadrant → Upper outer

Least common " → Inner Lower

M/c pathological Type → Infilterating Ductal Ca. not otherwise specified (IDC, NOS).

Special type of ICD

- Tubular — Best prognosis
- Medullary — BRCA I.
- Mucinous

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Infiltrating Lobular Ca

Single file/ Indian file pattern.

Q. C Mutatations to look at to differentiate IDC & ILC

E cadherin mutated in Lobular Cancer

DCIS

4 types

Papillary — Cribriform — Solid — Comedo

H/c → microcalcifications on mammogram

ER/PR (+)

Comedo

↓

c necrosis

- Most aggressive
- present as lump.

ER/PR (−)

D_X – True-cut Biopsy

M_X – Surgery

BCS + Sentinal L.N. Biopsy + RT (amandatory)

→ Simple Mastectomy + Sentinal L.N.B.

No Role of chemo in situ cancers.

HT → if pt. is ER/PR (+).

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

EIC → Extensive Intraductal Component

Invasive Tx → if > 25% is formed by DCIS ⇒ EIC

⇓

POOR PROGNOSTIC FEATURE

VAN NUYS SCORING for DCIS

- age
- Type
- Size
- Margin status

BENIGN BREAST CONDITIONS

BREAST ABSCESS

Lactating ♀

Causative → S. aureus.

Source - Oropharynx of baby

Dx ♀F - Pain
Fever
Lump

Dx - USG

Mx - atleast 2 attempts of USG guided aspiration

↓

if fail

↓

then I + D

D/D of non-healing Br. ulcer -

① Breast TB

② Inflammatory Br Ca

ANDI

15-25 yrs → Fibroadenoma

25-40 yrs → Fibroadenosis

>40 yrs → Fibroadenosis. > Duct Ectasia

FIBROADENOMA

→ H/C of Lump in Breast

→ 15-25 yrs

→ Pathology

Pericanalicular — HARD Type — pathhare

Intracanalicular — SOFT type

C/F → present i

firm
mobile
lump

] Breast Mouse.

Dx - Popcorn calcification in Mammogram

1-2% risk of malignancy

Indications for Sx

① Family History (+)

② Rapid ↑ in size

③ Pt. having pain. or
④ cosmetic indications.

Giant fibroadenoma ⇒ >5cm.

MASTALGIA

Cyclical

Fibroadenosis

- 25-40yrs
- Pain max. before period
- as period starts, pain ↓

D_x - USG

M_x - Lifestyle changes
avoid caffeine, chocolates
Vit E capsule
Primrose oil capsule

⇓

If pt. doesn't respond for 2 months.

↓

Low Dose TAMOXIFEN.

Non-cyclical

Musculo-skeletal causes.

① ~~Tiiz~~ **TIETZE Syndrome**

Costochondritis.

↓

M_x - intralesional Triamcinolone.

↓

also used in keloids
Oral submucous fibrosis

② **MONDOR Ds**

Sup. thrombophlebitis of chest veins
M/c vein → Lateral thoracic vein.

NIPPLE D/C

- Single duct
- Multiple
- ~~Multiple~~ Surface

Serous ← ♀, puberty, ca →

Surface: eczema, Paget's Disease

Milky ← Lactating, Prolactin ↑ →

Greenish — Duct ectasia.

Bloody — single - Duct Papilloma — M/c - Cancer.

DUCT PAPILLOMA

M/c c of Bloody D/c from single duct

10% → associated ~ DCIS

D_x - USG - Dilated duct ~ intraductal lesion

↓ if inconclusive

↓ MRI.

M_x - **microdochectomy** → removal of single duct + lump.

DUCT ECTASIA

→ Perimenopausal women

→ More common in smokers.

→ Ducts remain dilated.

↓ Stasis of secretions

↓ Periductal Mastitis. [ZUSKA's DISEASE]

Bluish / greenish Nipple D/C — Peri-areolar abscess or sinus formation.

Mx - antibiotics
Rule out cancer
Becoz multiple ducts are involved
⇓
HAD FIEDD's Cone Excision

PAGET's

- Eczema like Cond^n in ≤ there is destruc^n of nipple - areola complex
- usually U/L
- Dx - Punch Biopsy of nipple [Image].
  [Incisional Bx technique]
  ↓
- Paget cell in the epidermis.
- ↓ Large polygonal cells c a clear cytoplasm + Prominent nucleoli
- CEA (+)
  ↳ Colorectal ca
  Medullary thyroid.

70% → underlying lump
DCIS ← → Infiltrating ductal ca

ECZEMA

No Destruc^n of NAc.

B/L
No underlying lump.

TRANSPLANT

- Organ Has to be transported in UW (University of Wisconsin) solution → ALAG (4°C)

Constituents-

ADENOSINE → energy

LACTOBIONASE → stabilizer.

ALLOPURINOL, GLUTATHIONE — Free Radical scavanger.

Cold Ischaemia :- Max. Time for ⊂ Organ survives in solution.

Heart - 4 hrs

Lung - 6-8 hrs

SI - 8 hrs

Liver - 10-12 hrs

Kidney - 24-36hrs

RENAL TRANSPLANT

Indications

Adults

H/c - CKD

2° DM

Children

H/c- GN

DONOR

① Donor Kidney preferred becoz it has longer Vein.

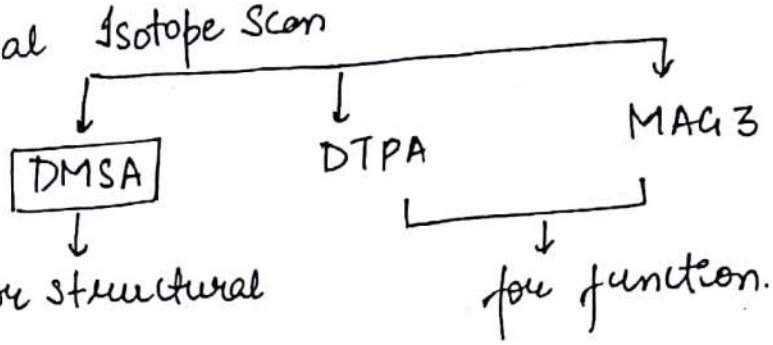
Tests ① ABO

② HLA — A / B — DR (most imp.)

③ KFT

④ USG KUB

⑤ Renal Isotope Scan



Total GFR = x

Differential GFR → (L) — x — (R)

Contribution of each kidney

EXPANDED DONOR CRITERIA

① Fit pt >60yrs can donate

② Age >50yrs + 2 or more of the following.

- H/o HTN
- S. creatinine >1.5
- death due to a stroke.

RECIPIENT

Kidney is kept in (E) iliac fossa.

3 Anastomosis

① Renal artery → iliac artery] Prolene

② " vein → iliac v.]

③ Ureter → Bladder : Vicryl or PDS.

COMPLICATIONS

1) Rejection

Hyperacute

- **on table**
- due to preformed ~~antibiotics~~ antibodies
- **Type II HSN Reac"**
  - occurs becoz of HLA antibodies.
- Can be ↓ by proper screening.

Acute

- **< in 1 yr.** of transplant
  - becoz of immunological cause
    - Can be ↓ by effective immunosuppression
      - >90% 1 yr. survival rate

Chronic

- Delayed Rejec"
  - Type IV HSN
- H/c type of rejection

2) ↑ risk of infection

3) • H/c organism - **CMV**

3) • H/c cancer in transplanted pt - **skin cancer**

4) • PTLD (post-Transplant lympho-proliferative Disorder)
   - due to **EBV**

5) • H/cc of mortality = **CVS** causes

LIVER TRANSPLANT

- **Orthotic**
  - ↓
  - Remove Ds Liver & place fresh Liver
- **Auxillary**
  - ↓
  - Ds Liver not removed but pt transplant right next to it
  - ⇓
  - for fulminant Liver Failure
- **Domino**
  - ↓
  - when liver is taken from pt. who is already suffering from a systemic disease
  - ⇓
  - Systemic Amyloidosis pt can act as DOMINO LIVER TRANSPLANT
- **Split**
  - ↓
  - when instead of taking entire liver, only a part of Liver is taken.

CHILD PUGH SCORE

(A)

↓

Compensated liver Disease

↓

Not candidate for Liver Transplant

(B) (C)

↓

Candidate for Renal Transplant

HLA matching is not Imp. for | Liver Transplant
Cornea "

COMPLICATIONS

(1) REJECTION

No hyperacute Rejn in Liver.

Acute Rejection can occur becoz of immunological cause

↳ suppress by Immunosuppressants

Chronic →

Biopsy → Vanishing Duct Syndrome

1) Infection
2) Malig
3) PTLD
5) H/c vascular Comp^{n} ⇒ Hepatic artery thrombosis

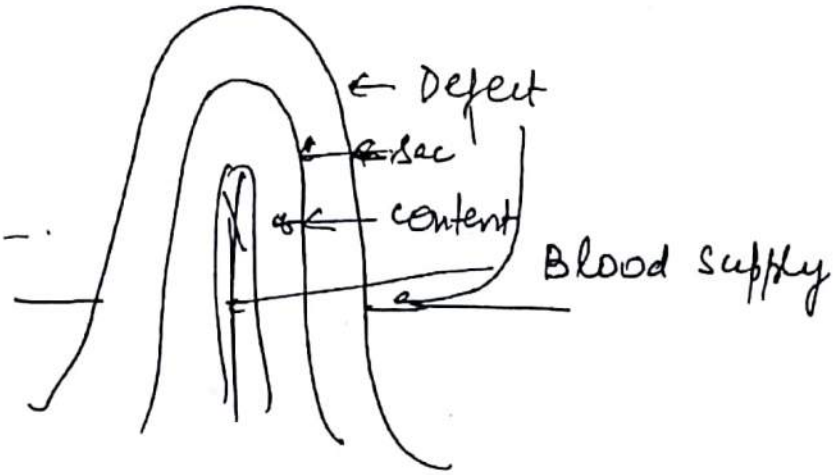
HCC is not a C/I for Liver Transplant
↓
can be transplanted provided he meets.

MILAN criteria

① Single Tx < 5cm] No Lympho vascular Invasion
② 1-3 Tx. < 3cm] No metastasis

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

HERNIA.



Uncomplicated Hernia → reducibility
Cough Impulse.

Obstructed Hernia → irreducible
No cough Impulse
Blood supply to the content is still Intact

Strangulated Hernia - obstructed + Compromised blood supply.

If Bowel is content → enterocele
if omentum " → omentocele
if Littre's " → Meckel's content

Amyand Hernia → appendix is content

INGUINAL HERNIA

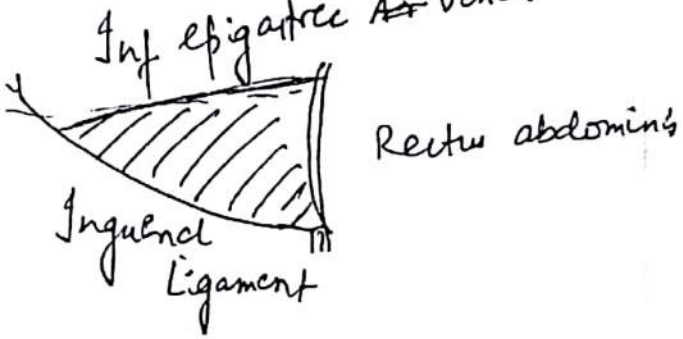
M/c Hernia - Indirect inguinal Hernia

↳ ♂

♀.

Femoral is more common in ♀.

Henelback's Δ -



Myopectineal Orifice of FRASCHAUD

Sup - arching fibres of Int. Oblique

Medial - outer border of rectus

Inf. - Pectineus / cooper

Lateral - Tendon of iliopsoas.

It covers defect of 3 Hernia.

inguinal
femoral
obturator

Covering it ∈ mesh. ⇒ 3 Hernia prevented.

Deep Ring Occlusion Test
Single Best test.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

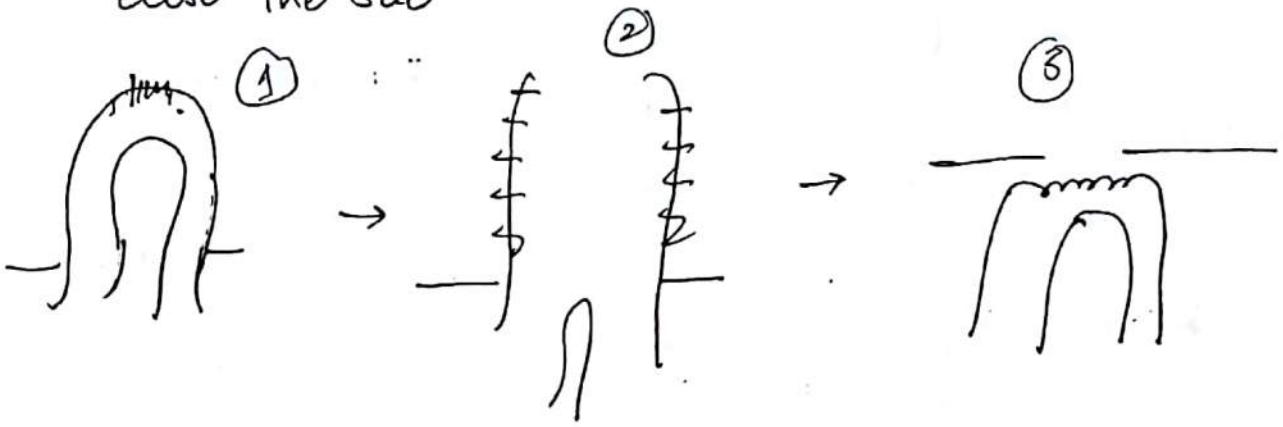
If Hernia is not palpable ⇒ USG.

Sportsman's Hernia ⇒ IOC - MRI.

Mx - Sx.

(1) Herniotomy

Identify the sac
open the sac
push the contents down
Cut the excess sac
Close the sac



Drawback → Highest Recurrence Rate

Sx of choice in inguinal hernia in children
Congenital inguinal Hernia
Hydrocele

(2) Herniorrhaphy

Perform (1), (2) + Suture the ends.

↑ Tension → Leading cause of failure of Herniorrhaphy

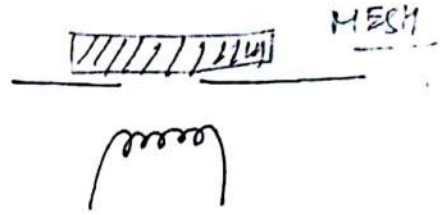
BASSINI — SHOULDICE

Sx oc → infected, strangulated Hernia.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Hernioplasty

Put Mesh over defect



~~Lichtes~~ ~~Lite~~

Lichtenstein Tension.
free.

⇓

Least Recurrence Rate

COMPLICATIONS OF OPEN INGUINAL HERNIA Sx—

① M/c N/v Injured → Ilio inguinal

2) M/c n/v entrapped in mesh → Ilio hypogastric

3) Injury to Vas.

4) Chronic Inguinal Pain → due to n/v entrapment

Laparoscopic inguinal Hernia Sx can also be done

① B/L

② Recurrent

TEP TAPP

Total Extraperitoneal Repair >> Transabdominal Pre-peritoneal Repair.

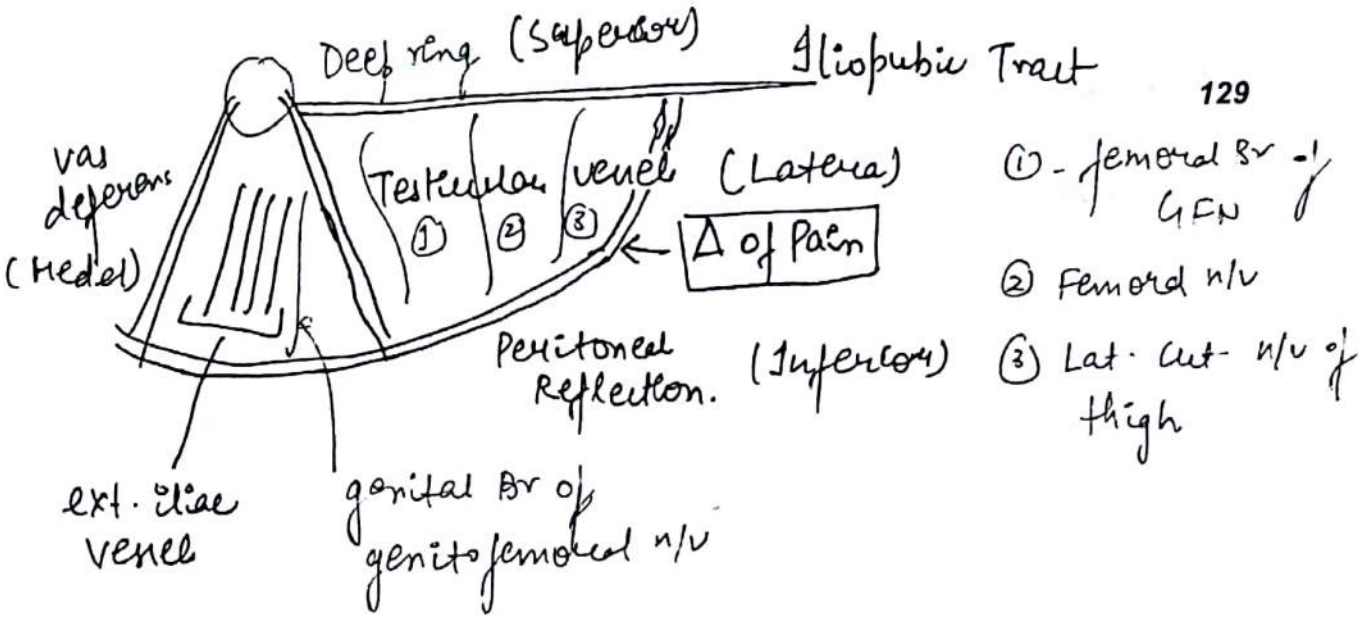
To keep Mesh in place, we use Stapler or Tackers.

* 2 Cond^n where stapler, Tackers are not used
area

① Triangle of Doom

↳ Bleeding

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp



② Δ of Pain.

M/c N/v entrapped → Lat. Cut n/v of thigh

⇓

Meralgia Paraesthetica.

Δ of Doom + Δ of Pain ⇒ Trapezoid of Disaster

Doom — Medial

Pain — Lateral.

NO STAPLER

FEMORAL HERNIA

Comes out through femoral Ring.

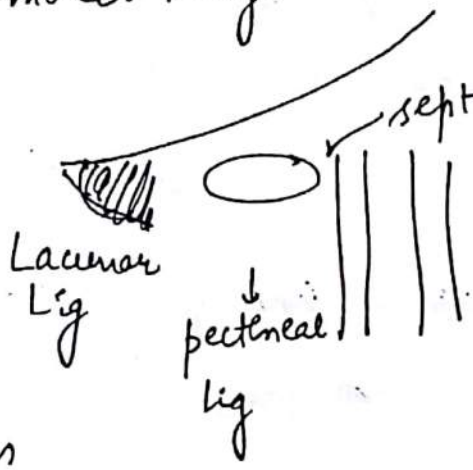
Femoral Ring is surrounded by lig. amentous str

↓

So can't dilate

⇓

Prone to Strangulation



Inguinal Hernia	Femoral
above & medial to pubic tubercle	Below & Lateral to pubic tubercle

Sx can be done by
Open / Laparoscopic

Special Types

1) Velpeau Hernia / Pre-vascular
   ↳ comes in front of femoral vessel

2) Serafini
   ↳ Retrovascular.

3) NARATH
   femoral hernia in a child = cong. dislocation of hip

4) Laugier Hernia -
   comes out through Lacunar Ligament

All special type have ↑ rate of strangulation

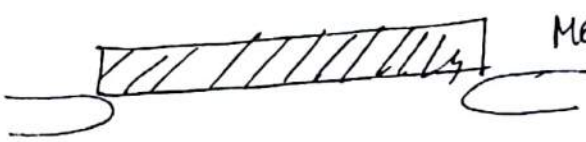
PARIETAL WALL HERINIAS

Incisional Hernia → M/c

Open / Laparoscopic

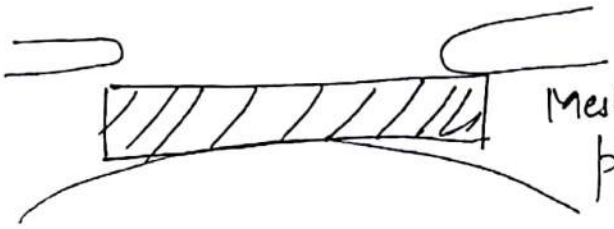
If Mesh is placed on Ant. Rectus Sheath ⇒ ONLAY
behind part " " ⇒ Sublay

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp



Mesh ⇒ ONLAY Repair

Rectus



Mesh ⇒ SUBLAY Repair.
peritoneum. earlier - inlay

Epigastric Hernia/ Fatty Hernia of Linea alba

Xiphisternum to Umbilicus.

Usually in midline

M/c structure ⊆ hernias out ⇒ Pre-peritoneal Fat

Pts ⊂ epigastric hernia can have pain similar to that of peptic ulcer.

Mx

open / Lap.

Umbilical

Through umbilical Ring

Umbilicus will be everted

Opening - Wide

Commonly seen in newborn children

Paraumbilical

- adjacent to umbilical Ring

Umbilicus is forming one of the boundaries.

narrow

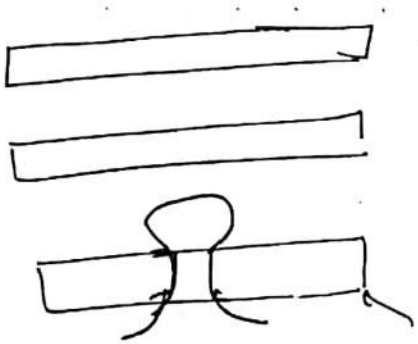
↑ rate of strangulation

All paraumbilical Hernia require Sx

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Conservative Mx is done
for 2-3 yrs
⇓
If Hernia persist
↓
Sx

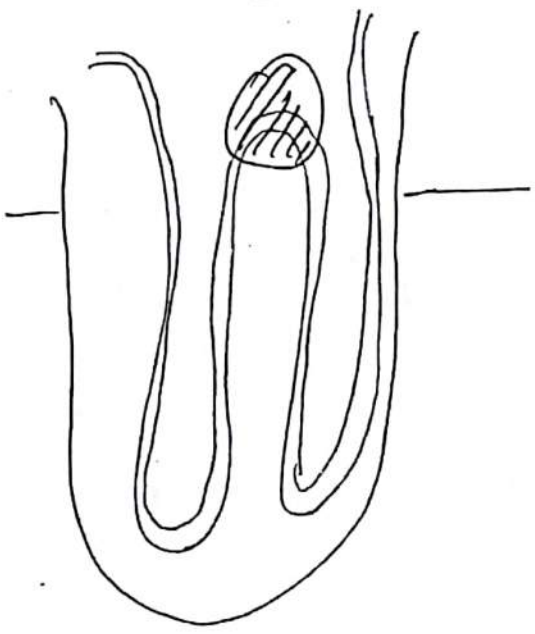
Spigelion Hernia / Intraparietal Hernia



Defect in Transverse
Sac remain in M/S layer

- We can know about it when strangulation occurs
- M/C site → outer border of rectus close to arcuate line [mid pt. between umbilicus & pubic symphysis]

- MAYDL HERNIA
- W shaped hernia
- If strangulation occurs
⇓
It occurs in part c in intraperitoneal



Significance → Strangulation can be missed because strangulated is intra peritoneal

RICHTER HERNIA

Narrow Defect

Strangulation

Femoral + paraumbilical Hernia

Usually detected late because initial features are those of gastroenteritis

Long. Diaphragmatic Hernia

Mx-Q circumferential incision is made over the defect while repairing the defect.

Special Types of Inguinal Hernia

① GIBBON → Ing. H + Hydrocele

② Pantaloon's → Direct + Indirect

③ Sliding → Inguinal H. in ⊆ the post. Boundary of sac is formed by a visceral str.

Significance- While dissecting the sac, we can injure str.

commonly seen in elderly

(L) > (R)

M/c str. involved is Sigmoid Colon.

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp

Sportsman's Hernia -

① Small inguinal Hernia ⊆ comes out through tear in post. wall M/s.

② Pt. present c inguinal pain
Not palpable since it is small

IOC → MRI

M_x → Laproscopic ⊟ Repair

Website: http://mbbshelp.com WhatsApp: http://mbbshelp.com/whatsapp